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KEY TO PRONUNCIATION.

ä	far, father
ā	fate, hate
a or ă	at, fat
ã	air, care
ạ	ado, sofa
â	all, fall
ch	choose, church
ē	eel, we
e or ĕ	bed, end
ė	her, over: also Fr. *e*, as in *de; eu*, as in *neuf;* and *oeu*, as in *boeuf, coeur;* Ger. *ö* (or *oe*), as in *ökonomie*
ẹ	befall, elope
ẽ	agent, trident
ff	off, trough
g	gas, get
gw	anguish, guava
h	hat, hot
h or H	Ger. *ch*, as in *nicht, wacht*
hw	what
ī	file, ice
i or ĭ	him, it
i	between e and i, mostly in Oriental final syllables, as, Ferid-ud-din
j	gem, genius
kw	quaint, quite
ṅ	Fr. nasal *m* or *n*, as in *embonpoint, Jean, temps*
ñ	Span. *ñ*, as in *cañon* (căn'yŏn), *piñon* (pēn'yŏn)
ng	mingle, singing
nk	bank, ink
ō	no, open
o or ŏ	not, on
ô	corn, nor
ȯ	atom, symbol
ọ	book, look
oi	oil, soil; also Ger. *eu*, as in *beutel*
ö or oo	fool, rule
ou or ow	allow, bowsprit
s	satisfy, sauce
sh	show, sure
th	thick, thin
ŧh	father, thither
ū	mute, use
u or ŭ	but, us
u̇	pull, put
ü	between u and e, as in Fr. *sur*, Ger. *Müller*
v	of, very
y	(consonantal) yes, young
z	pleasant, rose
zh	azure, pleasure

′ (prime), ″ (secondary) accents, to indicate syllabic stress

THE ENCYCLOPEDIA AMERICANA

Forcing, in gardening, is a term used to designate a process in which artificial heat is applied so that flowers, fruits, or other products of plants are obtained at a date or season other than that at which they may be had in the ordinary course of culture. Thus, for example, kinds of grapes which by the simple influence of the heat of the sun in a vinery do not ripen till September or October are induced by forcing to ripen in March or later, according to the period the process is commenced; and strawberries, which ripen from June to September, in the forcing-house yield their fruit from February onward. Conducted, as the system is, during the short days of the year, the chief obstacle the gardener has to contend with is diminished light. This in the case of forcing fruits taxes his skill to the utmost, because abundant light is essential both to the proper fertilizing of the flowers and to the perfecting of the fruit. Some vegetables and salads and many flowers are, however, more successfully forced in the dark than in light. Rhubarb, seakale, mushrooms, lily of the valley, lilac, are all forced in greater or less darkness.

Ford, Edward Onslow, English sculptor: b. London 1852; d. 1901. He studied in Antwerp and Munich, and was made a Royal Academician of London in 1859. His artistic faculty was displayed in felicitous portraiture, and he executed striking statues of many eminent contemporaries, including Gladstone and «Chinese» Gordon. The Marlowe Memorial at Canterbury and the Shelley Memorial at University College, Oxford, are also from his chisel. A monument to his memory was unveiled in Grove End Road, Saint John's Wood, London, 13 July 1903.

Ford, Henry Jones, American editor: b. Baltimore, Md., 25 Aug. 1851. He was graduated from the Baltimore City College in 1868, was connected with the *American* and *Sun* of Baltimore and the *Sun* of New York, and in 1901 became editorial manager of the Pittsburg *Commercial Gazette* and *Chronicle-Telegraph.* He published ‹The Rise and Growth of American Politics› (1898).

Ford, James Lauren, American journalist: b. St. Louis, Mo., 25 July 1854. He has written several volumes of short stories and essays, among which are: ‹Hypnotic Tales› (1891); ‹The Literary Shop› (1894); ‹Bohemia Invaded›; ‹Dolly Dillenback.› He is also the author of two books for young readers: ‹Dr. Dodd's School› (1892); and ‹The Third Alarm› (1893).

Ford, John, English dramatist: b. Devonshire 1586; d. after 1639. He printed his first tragedy of the ‹Lover's Melancholy› in 1629. This, however, was not his first play, as a comedy of his, entitled ‹A Bad Beginning has a Good End,› was acted in 1613. His genius is seen at its highest in the tragedy, ‹'Tis Pity Shee's a Whore› (1633), though the subject is repulsive. He wrote, or assisted to write, at least 11 dramas. Most of these were exclusively his own composition; but some of them were written in conjunction with Decker and others. Other plays by him are: ‹The Broken Heart› (1633); ‹Love's Sacrifice› (1633); ‹Perkin Warbeck› (1634); ‹The Fancies Chaste and Noble› (1638); and ‹The Ladies' Trial› (1638). Besides the works already mentioned, he wrote an able little manual, entitled ‹A Line of Life, pointing out the Immortalitie of a Vertuous Name› (1620).

Ford, Paul Leicester, American author: b. Brooklyn, N. Y., 23 March 1865; d. New York 8 May 1902. Besides numerous pamphlets relating to American historiography his works include: ‹The Honorable Peter Stirling› (1894), a novel of New York society; ‹The True George Washington› (1896); ‹Bibliotheca Hamiltonia›; ‹Franklin Bibliography›; and an edition of the works of Thomas Jefferson (1807), with notes, biographical introduction, etc.; ‹The Story of an Untold Love›; ‹Tattle Tales of Cupid›; ‹Short Stories›; ‹Janice Meredith› (1899); ‹Wanted — a Matchmaker›; etc.

Ford, Sallie Rochester, American story-writer: b. Rochester Springs, Boyle County, Ky., 1828; d. 1902. She married S. H. Ford in 1855, and with him edited the 'Christian Repository' and the 'Home Circle' for many years. Among her published works are: 'Grace Truman' (1857); 'Mary Bunyan' (1859); 'Morgan and His Men' (1864), and 'Ernest Quest' (1887); 'The Inebriates'; etc.

Ford, Washington Chauncey, American statistician: b. Brooklyn, N. Y., 16 Feb. 1858 He is a brother of P. L. Ford (q.v.). He was chief of the bureau of statistics, Department of State, 1885–9, and of the bureau of statistics in the Treasury Department in 1893–8; was connected with the Boston Public Library 1897–1902, and was chosen lecturer on statistics in the University of Chicago in 1901. He published: 'American Citizen's Manual'; 'The Standard Silver Dollar' (1884); 'George Washington' (1899)

Fordham, fôr'dam, a part of New York in the borough of Bronx. Prior to 1874 it was a village in Westchester County, N. Y Fordham was made a manor in 1671. St. John's College is located here. The poet E. A. Poe lived in Fordham for a number of years and wrote 'The Bells' and other pieces here.

Ford's Theatre, a Washington theatre in which President Lincoln was shot by the assassin, Booth, 14 April 1865. The United States government purchased the building in 1866, and it was at first used as the Army Medical Museum, but after 1887, as the Pension and Records Bureau of the War Department. It gradually fell into ruin, however, and suddenly collapsed with the loss of several lives, 9 June 1893.

Fordun, John of, known as the father of Scottish history: b. probably at Fordoun, Kincardineshire, about 1310; d. about 1386. He wrote the first five books of his 'Chronica Gentis Scotorum,' bringing the history down to the middle of the 12th century, and also a part of the sixth volume, which was completed by Walter Bower, abbot of the monastery of Inchcolm. He enlarged the first five books and added 11 new ones, bringing the history down to 1437. Several editions have been printed, the best probably being that of W. F. Skene (Edinburgh 1871–2).

Forearm. See ARM.

Forecasting the Weather. See METEOROLOGY.

Foreclosure is the right of a mortgagee, or of any one having interest in a mortgage, in the event of the conditions of the mortgage being violated, to compel the mortgagor to redeem the pledge or forfeit his right of redemption. This is done by filing a bill for foreclosure. The court may, on application of the mortgagee, mortgagor, or any incumbrancer of the mortgage, grant, under certain conditions, a sale of the subject instead of foreclosing the mortgage, the money raised by the sale being applied to the payment of the mortgage, any surplus being claimed by subsequent mortgages, or in the event of no other claim, being paid to the mortgagor.

Forefathers' Day, the day celebrated as the anniversary of the landing of the Pilgrims; first commemorated in 1769. Owing to a mistake in the change of Old Style (11 December) to New it was made 22 instead of 21 December.

Foreign Coins and Their American Equivalent. As the monetary value of national coins is subject to frequent change, it is impossible to prepare a statement which would correctly specify the value of any particular coin at any future time. As such changes are correspondingly slight, however, the following list of the coins of all nations will always be comparatively correct, the values in the moneys of account of the United States having been corrected to 1 April 1905 by the director of the mint, United States Treasury Department:

Argentine Republic.— Gold coins: argentine ($4.824) and half argentine; silver coins: peso ($0.965) and its divisions.

Austria-Hungary.— By a law passed 2 April 1892 the monetary system of Austria-Hungary was reformed on a gold basis, with the crown ($0.203) as a unit. The coins issued under the old system are still in circulation, however. They are, gold: eight florins ($3.858), 4 florins, ducat ($2.287), and 4 ducats; silver: florin ($0.5052) and 2 florins. The coins under the new system are, gold: twenty crowns ($4.052), 10 crowns, and 1 ducat ($2.287); silver: one crown ($0.203); nickel: twenty hellers ($0.0405) and 10 hellers; bronze: two hellers, or one kreutzer ($0.0040), and one heller.

Belgium.— Belgium being a member of the Latin Union, its monetary unit is the franc ($0.193), and its coins the gold 10 and 20 franc pieces and the silver 5 francs.

Bolivia.— The boliviano ($0.439) is the monetary unit of Bolivia. Its coins, all silver, are the boliviano, the 50, 20, 10, and 5 centavo ($0.0211) pieces.

Brazil.— The milreis ($0.546) is the monetary unit of Brazil. Its gold coins are 5, 10, and 20 milreis pieces; its silver coins, ½, 1, and 2 milreis.

Bulgaria.— The monetary unit is the lev ($0.185) which is supposed to correspond to the franc of other double standard countries. In fact, but few Bulgarian gold coins are in circulation, the necessary gold coins being supplied by foreign 10 and 20 franc pieces. The silver coins are the ½, 1, 2, and 5 leva pieces; the nickel coins are the 2½, 5, 10, and 20 stotinki ($0.0385), and there are copper coins of 1, 2, 5, and 10 stotinki.

Canada.— The gold dollar ($1) is the monetary unit. The silver coins are the 50, 25, 10, and 5 cent pieces. Some penny (2 cents) and half penny pieces are in circulation.

Chile.— The value of the peso, the monetary unit, is ($0.365). The gold coins of the country are the escudo ($1.825), doubloon ($3.65), and the condor ($7.30). The peso and its divisions are coined in silver.

China.— The monetary system of China is in an extremely chaotic condition. The unit and sole official coinage is the copper cash, 11 of which are equal to one cent. The silver tael, or liang, varies in value in different parts of the country, as follows:

THE CHINESE TAEL.

PLACE	Value	PLACE	Value
Amoy	$0.719	Nankin	$0.712
Canton	0.717	Ninchwang	0.674
Chefoo	0.688	Ningpo	0.691
Chin Kiang	0.703	Pekin	0.701
Fuchau	0.665	Shanghai	0.657
The Haikwan or customs tael	0.732	Swatow	0.664
		Takau	0.724
Hankow	0.673	Tientsin	0.697

In Hong Kong and Labuan, the "British Dollar" has the same legal value as the Mexican dollar.

Colombia.— The gold dollar ($1.) is the monetary unit. Other gold coins are the condor ($9.647) and the double condor. The silver peso ($0.9352) and its divisions are coined.

Costa Rica.— The gold colon ($0.465) is the unit of the country. Two, 5, 10, and 20 colon pieces are coined in gold; 5, 10, 25, and 50 centimor ($0.2326) pieces in silver.

Cuba.— As Cuba is a gold standard country, its monetary unit, the peso, is a gold coin valued at $0.91. The gold doubloon, valued at $5.017, and the Alphonse, valued at $4.823, are also used, as well as several foreign coins The silver coinage of Cuba is the peso ($0.455) and its divisions.

Denmark.— The monetary unit is the crown ($0.268) and gold 10 and 20 crown pieces are coined. The minor coinage, in silver and bronze, is represented by the 50 ore ($0.1247) and its divisions.

Ecuador.— The gold sucre ($0.487) is the unit, but the 10 sucrae piece is the only gold coin. The minor coinage, the 10 and 5 real ($0.0467) pieces, is of silver.

Egypt.— The gold pound, representing 100 piasters ($4.943) is the unit, and 50, 20, 10, and 5 piaster pieces are also coined in gold. The silver coinage is represented by the 1, 2, 5, 10, and 20 piaster pieces.

Finland.— The markkaa ($0.193) is the monetary unit, and the gold coins are 20 and 10 markkaa pieces. The 50 penni ($0.0794) and the 10 and 1 penni ($0.0019) pieces, in bronze, constitute the smaller coinage.

France.— The gold franc, valued at $0.193, is the unit of the country. Gold 5, 10, 20, 50, and 100 franc pieces, and silver 5 and single franc pieces are coined. The minor coinage is represented by the 50, 20, 10, and 1 centime ($0.0019) pieces.

German Empire.— The gold mark ($0.238) is the unit, and 5, 10, and 20 mark pieces are coined in gold. The 50 pfennigs ($0.1039) and the thaler ($0.6928) represent the silver, the 5 pfennigs, the nickel, and the single pfennig the bronze coinage.

Great Britain.— While the monetary unit for the colonies varies, that for Great Britain itself is the gold pound sterling ($4.8665). The pound sterling (the sovereign), and the half sovereign are coined in gold; the crown ($1.0872), half crown, florin ($0.4348), shilling ($0.2174), sixpence ($0.1017), four pence ($0.0724), three pence ($0.0543), and the two pence ($0.0362) in silver, with the penny ($0.02), half penny, and farthing ($0.005) in bronze.

Greece.— The drachma ($0.193) is the monetary unit. Five, 10, 20, 50, and 100 drachma pieces are coined in gold, 5 drachma pieces in silver, 20 and 5 lepta ($0.0096) in nickel, and 1 and 2 lepta pieces in bronze.

Guatemala.—The silver peso ($0.439) is the monetary unit and this coin and its divisions are coined in silver.

Haiti.— The gourde ($0.965) is the unit of the country; 1, 2, 5, and 10 gourde pieces are coined in gold, and the single gourde and its divisions in silver. The smaller coin is the bronze centime ($0.0096).

Hawaii.— Same as United States.

Honduras.— The peso ($0.439) is the monetary unit and this coin and its divisions are coined in silver.

India.— The pound sterling, or sovereign, is the standard coin of India, but the rupee ($0.324433) and its divisions is the money of account.

Italy.— The lire ($0.193) is the monetary unit. The 5, 10, 20, 50, and 100 lire pieces are coined in gold; 5 lire pieces in silver, while the 20, 10, and 1 centesimo ($0.0019) in nickel and bronze represent the minor coinage.

Japan.— The yen ($0.498) is the unit of the country. Gold 5, 10, and 20 yen pieces are coined; 10, 20, and 50 sen ($0.448) silver pieces, with 5 sen, 1 sen, and 5 rin ($0.0024) pieces in bronze.

Liberia.— The only official coin of Liberia is the gold dollar ($1.).

Mexico.— The silver dollar, valued at $0.458, has long been the monetary unit of Mexico, but a change to the gold standard, which is about to be established, will give the country a gold dollar of the value of about fifty cents. The several divisions and multiples of the dollar will also be coined.

Netherlands, The.— The gold florin ($0.402) is the monetary unit. Gold 10 florin pieces are coined as well as ½, 1, and 2½ florin pieces in silver. The cent ($0.004) is of bronze.

Newfoundland.— The gold dollar of Newfoundland is valued at $1.014.

Nicaragua.— The silver peso ($0.439) is the unit, and this coin and its divisions are coined in silver.

Norway.— Same as Sweden.

Panama.— The balboa, valued at $1. in gold, is the monetary unit. At present no gold is coined, the only coin being the silver dollar ($0.50) and its divisions.

Paraguay.— The country has no coinage, but the silver pesos of other South American republics circulate there at the same value as in the countries where they are issued.

Persia.— The silver kran ($0.078) is the monetary unit. Gold ½, 1, and 2 tomans ($3.408) pieces, and silver ¼, ½, 1, 2, and 5 krans are coined. The copper coins are the chai ($0.0085) and the abassi, valued at 4 chais.

Peru.— The sol ($0.487) is the monetary unit. Gold libra ($4.8665) are coined, as well as the silver sol and its divisions.

Philippine Islands.— By act of the 57th Congress the authorized coins of the Philippines are silver pesos of 10, 20, and 50 centavos (cents) value, and of copper ranging from ½ cent to 5 centavos in value.

Portugal.— The milreis ($1.08) is the monetary unit and 1, 2, 5, and 10 milreis pieces are coined in gold. The silver coins of this country are 1,000 reis ($0.9526) and 50 reis; the nickel coins, 100 reis and 50 reis, and the bronze coins, 20 and 5 reis.

Rumania.— The gold lei ($0.193), corresponding to the franc, is the monetary unit. Twenty and 10 leis pieces are coined in gold, 5 and single lei pieces in silver, and 10 and 1 bani ($0.0019) pieces in bronze.

Russia.— The ruble ($0.515) is the monetary unit. Gold imperials, valued at 15 rubles, and half imperials are coined. The ruble, as well as the 50 and 5 copeck ($0.0187) pieces, are of silver, while the single copeck and a 5 copeck piece are coined in copper.

Salvador.— The silver peso ($0.439) is the unit, and this coin and its divisions are coined in silver.

Servia.— The dinar ($0.173) is the monetary unit. The 20 and 10 dinar pieces are of gold, the 5 and 1 dinar pieces of silver, while the 20, 10 and one para ($0.0019) pieces, in nickel and bronze, represent the minor coinage.

Siam.— The monetary unit is the silver fical ($0.28). The other coins current are the salung (¼ fical) and the juang (⅛ fical).

Spain.— The peseta ($0.193) is the monetary unit. The several divisions and multiples of the peseta are coined in gold and silver, while the minor coinage, ranging from one centimo ($0.0019) to 50 centimos, are of silver or bronze.

Sweden and Norway.— The gold crown ($0.268) is the unit, and 10 and 20 crown pieces are coined in gold. The silver coinage includes the 2 crown piece, the single crown, and the 50 and 10 ore ($0.0241), while the single and the 5 ore pieces are of bronze.

Switzerland.— The gold franc, valued at $0.193, is the monetary unit. Gold 5, 10, 20, 50, and 100 franc pieces, and silver 5 and one franc pieces are coined. The minor coinage includes the 50, 20, 10, and single centimes ($0.0019).

Turkey.— The piaster ($0.044) is the monetary unit and the gold coins include the 25, 50, 100 (the lira), 250, and 500 piaster pieces. The ½ piaster, the single piaster, and the 20 piaster pieces are of silver, while a piaster and the para ($0.0001) are of copper.

Uruguay.— The peso ($1.034) is the only gold coin authorized in Uruguay, but the silver peso ($0.403) and its divisions are also coined.

Venezuela.— The bolivar ($0.193) is the monetary unit. Gold 5, 10, 20, 50, and 100 bolivar pieces are coined, while the silver coinage includes a 5 bolivar piece as well as the single bolivar and its divisions.

Foreign Exchange. Foreign Exchange is a name applied to that part of banking which deals with transactions between different countries. Since the earliest days of which we have authentic record of human achievements, different communities have traded commodities with each other. Originally the transactions were confined to barter, and the caravan or ship that carried goods to a foreign country traded them directly for goods of supposed equivalent value, which they took back with them to their own countries. The difficulty experienced in making even exchanges of mutually desirable articles led to the formation of banks (see BANKS AND BANKING) and finally to the development of the Foreign Exchange business in its present form.

Due to the fact that it was the first in the field in a scientific way, and also because of its world-wide political interests, Great Britain can truthfully claim that the bulk of the world's business is carried on in its currency — pounds sterling. See MONETARY SYSTEMS OF THE WORLD.

Foreign Exchange being the same in theory the world over and similar in practice, except where influenced by local conditions, we will consider it from the standpoint of the United States. The foreign exchange banker, whether running a separate institution or a department of a bank organized for the handling of both domestic and foreign business, finances the following propositions, which we will divide into two divisions, viz., Exports and Imports, as because of the effect upon exchange everything can be logically classed under these heads:

Exports.— (a) Merchandise; (b) Expenses of travelers to this country; (c) Securities (government, corporation, firms, or individuals, sold abroad); (d) Remittances to this country; (e) Precious metals.

Imports.— (a) Merchandise; (b) Expenses of travelers from this country; (c) Securities (government, corporation, firms, or individuals purchased abroad); (d) Remittances from this country; (e) Precious metals.

First, consider the exports. Different commodities because of their being perishable or otherwise, or because of the different methods of handling that hurry or retard their delivery, have to be financed according to their nature. Thus, for example, we find that meat, cotton, flour, and machinery are, as a rule, all financed on a different basis. Because of the time necessary to collect drafts against exports, only concerns of large free capital over and above the needs of their domestic business could sell their goods to foreign buyers, if it were not for the foreign exchange banks or departments that pay cash for the goods on delivery of documents. The transactions are consummated as follows: Bids are asked for on bills drawn against merchandise by telephone, telegraph, and over the bank's counter, and are accepted or rejected as they are in or out of line with bids of competitors, with the exception of bills that are placed for deposit regularly with some one concern, in which case rates are applied according to the market. In purchasing bills the following questions arise in the mind of the buyer: Is the responsibility of the seller of the exchange sufficient to warrant the purchase of the bill? If it is a long time bill is it drawn upon responsible banks or buyers? Is the market value of the goods covered by the shipment stable, and if not, is the value at the time of the offer low enough to warrant the purchase? These questions answered satisfactorily, next comes the point of rate to be paid, which is based upon the following conditions (in this country bills are ordinarily drawn in the currency of the country of the drawee). The laws and customs of the country upon which the bill is drawn concerning the class of exchange offered, for instance as to delivery of documents, stamp tax, days of grace, etc., the value of demand exchange in New York on day of purchase, the rate of New York exchange at interior points (when such points are the seat of purchase), the current rate of interest obtainable upon loans, the call money rate in New York, the bank and private discount rates in the country on which the bill is drawn, the market tendency in foreign exchange and the rates for other foreign exchanges, both in this country and in the country on which the draft is drawn.

The rate being made and accepted, the exporter obtains the necessary papers and delivers them to the foreign exchange banker, where he is either given a cashier's check or credit in account for the amount of the bill at the agreed rate, provided the documents are in order. Every piece of paper handled is carefully checked up as follows: To see that the conversion rate when applied to the bill equals the dollars paid the depositor; that bills of lading are drawn to the order of shipper and indorsed in blank; that all negotiable copies of the bill of lading are attached to the draft, which is in nearly all cases drawn in duplicate; that the goods covered by the bill of lading cover the draft at market rates; that the goods are insured while in transit and a certificate in proper order accompanies the draft; that invoices, and where necessary consular certificates, are attached, and that where a general hypothecation is not held, a special hypothecation covering the particular shipment accompanies the other papers. Documents, of course, vary somewhat from the above, but this covers the bulk of the business.

Travelers to this country ordinarily carry travelers' letters of credit, in order to provide for their expenses. Drafts drawn against such letters are cashed by the foreign exchange banker, which further increases his funds abroad. See CREDIT, LETTER OF.

The next division under exports is the handling of stocks, bonds, or other securities purchased from us by foreigners. In such cases drafts are drawn and the securities are attached or notice is sent to the effect that they are going forward under another cover, and where necessary, insurance is carried.

Remittances from foreign countries are also in effect exports, as the amount drawn by foreign bankers is either credited to the account of the payee bank or draft is drawn against balances in this country that were built up in a similar manner.

In all these divisions under exports the foreign exchange banker is in effect paying out funds in his city for which he receives or will receive foreign money at the point of destination for bills, securities, and drafts drawn against letters of credit, and in the case of remittances, at the points from which they originate.

Secondly, we will consider the imports. The importer causes the demand for the exchange that the exporter has made and is accommodated in two ways, either through the direct sale to him of demand or cable exchange and sometimes long bills, or through the issuance of commercial letters of credit. Merchandise, the first division under imports, is usually brought in under commercial letters of credit. In issuing such credits the banker is again confronted with the proposition of financial responsibility, this time of the importer, together with the marketable nature of the goods which he wishes to import, their prices, etc. If everything is satisfactory and the credit is granted, the foreign shipper is authorized by the bank to draw upon some convenient foreign correspondent for the value of the goods, the foreign banker being authorized to honor such draft upon delivery to him by the foreign seller of documents evidencing the shipment, etc., which correspond identically with those required in advancing money to an exporter whose credit is not sufficient without such assurance or where the standing of the purchaser of the goods is not high enough so that the exporter himself is willing to make the shipment without such a letter. The documents delivered to the foreign banker come forward to this country and are delivered to the customer against trust receipt before the draft for the goods matures, or are held for payment of the draft as special cases may require. Where letters of credit are drawn for 30, 60, 90 days, or other maturities, the actual money is not advanced as in the case of the exporter, but credit is extended through the acceptance by the foreign banker of the time bill against guarantee.

The American traveler in foreign countries is really an importer, for he buys in foreign lands amusement, experience, and other trifles to bring back to the United States either in memory or in bulk. See CREDIT, LETTER OF.

Securities imported are handled in the same manner as those exported, with the exception of the fact that more often payment is made out of balances of American banks in the foreign centres than by the foreign banker against his draft.

Remittances to foreign countries consist largely of money being returned by foreigners who are located here. This is ordinarily done by so-called postal remittances or drafts, and is in effect an import, as foreign balances are reduced in order to pay them, the same as if goods had been purchased abroad.

An item that enters largely into the foreign exchange business is the shipment of precious metals. In dealing with the Orient the price of silver enters largely into the price of exchange, as the old Mexican dollar is the accepted standard in Hong Kong, which is the business centre of the far East.

As gold is used more largely the world over for the purpose of settling so-called trade balances, we will consider the part it takes in foreign commerce more in detail. The various countries of the world have moneys of different denominations and values (see FOREIGN COINS AND THEIR AMERICAN EQUIVALENTS), and in order to get a common basis from which to figure values, the relations between the moneys are based upon the actual pure gold value in the principal coin of each country. For instance, in the case of Great Britain and the United States the pure gold in a pound sterling is found to be equivalent to the gold in 4.86656 American dollars, and this rate is called the mint par of exchange. When the exchange rate is enough higher than the par of exchange to make it profitable to ship gold abroad and sell exchange against balances so made, the export point is said to have been reached, and where the rate falls so low that exchange can be purchased and gold shipped in to replace the funds used for the purchase of the exchange, it is called the import point.

The theoretical export and import points are constant, but the actual points at which gold can be profitably shipped vary considerably, the difference between the actual and theoretical export and import points being made up of the following items: Boxing and cartage of the gold, freight to destination, insurance and loss of interest while the gold is in transit. (These costs vary somewhat, depending upon the arrangements different shippers are able to make.) The actual points are also dependent upon other exchanges; for instance, if sterling on London in Paris is abnormally low, gold can be shipped to Paris, and London exchange purchased with the balances so made at a profit, when the rate for drafts on London in this country would not of itself permit of such profit. The price of gold also has a bearing upon the rate, but where gold is exported from this country the cost of the gold is fixed, as the United States Government furnishes gold bars at the rate of four cents per $100, and gold coin can be obtained without premium by demanding same of the United States Government in exchange for gold notes. As this country exports a tremendous amount of cotton, wheat, corn, and other cereals after harvest in the fall, other things being equal, exchange would naturally be lower at this time of year. On the other hand, it would naturally be high during the early summer months, because of the fact that the imports are heavier in proportion at that time. (See EXPORTS AND IMPORTS). This natural condition has been offset largely through the interchange of securities, and also by so-called finance bills. The latter in effect carry over a debt of this country to foreign countries when issued at the time of high exchange to such time as the exports make enough exchange to carry the market down and allow cover at low rates. This often allows the borrowing of money at a very low interest rate, and is much resorted to when discounts abroad are lower than interest rates in the United States, or when exchange is at abnormally high rates without correspondingly divergent interest rates against the transactions. As the bulk of our foreign trade is carried in foreign bottoms, we are obliged to pay immense amounts for freight. Most of our marine insurance is also carried on the other side of the water. Both of these items must be added to the imports before the real balance of trade can be found, but as they can only be estimated and as finance bills are drawn and securities sold back and forth in unknown amounts, there is no time at which the real balance of trade is a known quantity. The demand and supply of exchange that causes fluctuations to reach the gold points is the only real guide to such balance, and even then finance bills in themselves may be sufficient to call forth shipments when the real balance if it were known might be the other way.

The foreign exchange banker in financing the foreign trade of the United States in addition to accepting the ordinary risks entailed in advancing credit to his customers is always at the mercy of the fluctuations in foreign exchange rates, and if it were not for the fact that the two gold points are separated from each other by under ordinary conditions not to exceed one per cent. and usually at a much less difference, it would be impossible for him to work upon the close margins that are now in vogue and that give the exporter and importer the best possible service at an infinitesimal cost. See COMMERCE AND COMMERCIAL TERMS.

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Foreign Judgment, in law, is the term applied to the judgment of a foreign tribunal. Such judgment is proved in common law by exemplifications certified under the great seal of the state or country where the judgment is recorded, or under the seal of the court where the judgment remains; the fulfillment of its conditions depends upon treaty stipulations or on international comity.

Foreign Laws, the laws of a foreign country. The courts do not judicially take notice of foreign laws; and they must, therefore, be proved as facts. Exemplified or sworn copies of written laws and other public documents must, as a general thing, be produced when they can be produced. The effect of foreign laws, when proved, is probably referable to the court; the object of the proof is to enable the court to instruct the jury what is, in point of law, the result from foreign laws to be applied to the matters in controversy before them. The court is, therefore, to decide which is the proper evidence of the laws of a foreign country, and when evidence is given of those laws, the court is to judge of their applicability to the matter in issue.

Foreign States. In law, every nation is foreign to all other nations; and the several States of the American union are foreign to each other, with respect to their municipal laws. The reciprocal relations between the national government and the several States, however, are considered not as foreign, but as domestic.

Foreign Trade. While political economists have engaged in fierce disputations over many economic theories regarding money, wages, distribution and similar subjects, they have allowed the theory of international trade, as it was set forth by John Stuart Mill, to remain unchallenged and unchanged. The principle involved is one of advantage. In general, a given nation will export those articles in the production of which it has an advantage over other nations and import such articles as can be produced cheaper by other nations. This advantage may be absolute, depending upon location, soil, climate, etc., or it be merely relative and artificial, depending, for instance, on a system of protective tariff.

Modern international trade, in all its vastness and complexity, is a comparatively recent development. It may be said to have first begun with the multiplication of steamships and the extension of railroads throughout the world. Among important recent changes affecting foreign trade, and destined to affect it even more in the future, may be mentioned: (1) The acquisition by the United States of Hawaii and the Philippine Islands; (2) the construction of the Trans-Siberian Railway; (3) the expansion of steam-carrying trade on the Pacific; (4) the opening of China; (5) the definite assurance of a Panama Canal by the United States. These changes mean new markets for us, with better and cheaper facilities of transportation. The location of Manila makes it the logical collecting point for all articles of trade in southern Asia except tea, and under American control, with changed conditions of shipping, this city is destined to become a great commercial emporium. The fact that our factories are located on the Atlantic coast has placed us at a disadvantage in the oriental trade. This condition will be greatly alleviated by the construction of the Panama Canal; not to mention the advantages we shall gain in our trade on the west coast of South America. Indeed, the trade of that group of countries lying south of us is important. They buy of us manufactures and food-products. Their principal employment being agriculture, they form one of the most important groups of those nations known to political economists as "neutral markets." In recent years special efforts have been made to cultivate the South American trade. Witness, for instance, the assembling of the International American Conference, under act of our Congress for the explicit purpose of extending inter-American trade; the completion by an American company of telegraphic communication with the southernmost cities of South America; the appointment of an inter-American commission to report on a route for an inter-continental railway; the establishment of the Bureau of American Republics for the publication of information for those engaged in American trade; the unification of customs regulations and the monetary conference to study plans for facilitating inter-American exchange; the unanimous recommendation of all the republics to establish an international American bank, with branches in every American republic; the celebration of treaties of reciprocity and the proposal to establish a permanent inter-American court of arbitration for the settlement of all American disputes; and finally, the opening of our great consuming market to our sister republics by continuing the free admission into the United States of coffee, rubber, nitrate of soda and other products, and by the removal of the duties on hides, sugar and wool. In addition to these means of promoting trade must be mentioned the activity and persistence of our American merchants and manufacturers in advertising their wares, and in this way stimulating the market for them.

Nor have our commercial leaders proved less equal to the demands of international trade in the widest sense. In the trade of the world the United States has taken an important place. In fact, the development of our foreign commerce has been almost phenomenal. It is interesting to examine the figures giving the total values of our imports and exports by decimal periods for the past fifty years, and to note the rate of increase:

Imports.

1855	$257,808,708
1865	238,745,580
1875	533,005,436
1885	577,527,329
1805	731,969,965
1905	1,117,512,029

Exports.

1855	$218,909,503
1865	166,029,303
1875	513,442,711
1885	742,189,755
1895	807,538,165
1905	1,518,561,740

With few exceptions the volume of our foreign trade has increased steadily year by year, the figures for the fiscal year 1905 showing the largest imports and exports. For the fiscal year 1904 the imports and exports were $991,087,371 and $1,460,827,271, respectively. The gain of $126,425,258 in imports alone almost equals the total volume of our foreign commerce in 1812, the year in which the United States first made a clear start in the race for recognition as a world power.

The gradual increase of exports over imports is noteworthy and important. Roughly, from 1855 to 1905 imports have increased fourfold, while exports have increased sevenfold. Whereas in 1855 there was a trade-balance of $40,000,000 against us, in 1905 there was a balance of $400,000,000 in our favor. It is further significant that about half of our imports are manufacturers' materials. See COMMERCE; COMMERCE, INTERSTATE; COMMERCIAL ORGANIZATIONS; COMMERCIAL TREATIES; EXPORTS AND IMPORTS, AMERICAN; EXPORTS AND IMPORTS OF THE LATIN-AMERICAN REPUBLICS; ALASKA, COMMERCIAL; CANADA, COMMERCE, TARIFFS AND TRANSPORTATION; UNITED STATES: FOREIGN COMMERCE OF; HISTORY OF THE TARIFF; RECIPROCITY; COMMERCIAL DEVELOPMENT; FINANCES OF THE, ETC.; FREE TRADE; BALANCE OF TRADE.

Foreign Wars, Military Order of, a national patriotic society founded in 1894 in New York, under the name of the Military and Naval Order of the United States, but known from 1895 by its present designation. The objects of this order are (1) to preserve and honor the memory of those who assisted in the maintenance of the government of the United States in the Revolution, the war with Tripoli, the War of 1812, the Mexican war, and the Spanish-American war; and (2) to collect all records and documents appertaining to the wars above mentioned. The order is sub-divided into 22 State commanderies, and includes in its membership commissioned officers of the army, navy, or marine corps who took part in any of these wars (Veteran Companions), and direct lineal descendants of commissioned officers in the main line (Hereditary Companions). The present membership (1903) exceeds 1,600.

Fore'lands, North and **South,** two headlands on the southeast coast of England, county of Kent. North Foreland projects into the sea in the form of a bastion, and consists of chalky cliffs nearly 200 feet high. South Foreland consists also of chalky cliffs, and has two lighthouses, with fixed lights, erected upon it.

Forensic Medicine. See MEDICAL JURISPRUDENCE.

Foreordination, or **Predestination,** a term appropriated by theology; in the Calvinistic system, the assignment of the Deity, at the time of creation, of some of his creatures to eternal life and happiness and others to eternal death or suffering. Of course the decree was not, as usually stated, irrespective of the spiritual merits of the subjects; but if human beings it was irrespective of their actual conduct on earth. This was supposed to be irrelevant, as through the fall of Adam they had lost all possibility of merit, and owed any escape they might have from utter destruction to God's grace and Christ's vicarious atonement, which restored some of them to moral health. As none of them deserved anything, there could be no injustice in leaving such as he chose to suffer the penalty assigned. The first noun or its verb is not taken from the Scriptures, which uses «ordain» instead (Acts xiii. 48; Jude iv. 13). It was not alone Adam's dereliction which had caused this liberty of choice, however, as angels were included: the Westminster Confession says, «By the decree of God, for the manifestation of his glory, some men and angels are predestinated unto everlasting life, and others foreordained to everlasting death.» This implies that no created being has any claim to other than destruction except by divine grace.

Foreshortening, in art, the method of drawing in strict accordance with the rules of perspective, by which objects are so represented as to convey to the observer an idea of their just length, although but a portion of that length is actually given. The method was known to the ancients, and in more recent times has been notably employed by Correggio.

Forest-fly, the British name for the minute parasitic, flea-like flies called bird-ticks, bat-ticks, and the like, in America; specifically *Hippobosca equina,* which is especially a torment to horses by thrusting its long beak through the skin and sucking the blood. See BIRD-TICK.

Foresters, Ancient Order of, a fraternal order founded 1745, at Yorkshire, England, with a membership 1903 of over 1,000,000, divided among 9,000 courts. The order was introduced into the United States in 1832, and despite the fact that over 175,000 members withdrew and organized the Foresters of America in 1895, the order in this country has a membership of 187,000.

Foresters of America, a fraternal, benevolent order known under this title since September 1895. Orignally the order was part of the Ancient Order of Foresters (1745), but freed itself from the High Court of England (1889), and became a separate order. There were 1,600 courts in 1902, with a membership of 195,200.

Foresters, The Independent Order of, was organized in 1874 in New Jersey. It was reorganized in Canada by the Hon. Dr. Oronhyatekha, a full-blooded Mohawk Indian of scholarly distinction, high character, and great ability, who was educated under the patronage of the present king of England, in 1881. In 1881 the society consisted of 369 members and was in debt. It now numbers 214,000 and has a surplus of $6,700,000 in its treasury, having already paid to widows and orphans of deceased brethren about $14,000,000. The membership extends throughout all of the provinces of Canada, nearly all of the States of the American Union, England, Ireland, Scotland, Wales, Norway, Denmark, France, Belgium, India, Newfoundland, and Australia. In 1902 it added to its membership 13,000, and for the first half of 1903 its net increase was about 9,000. During the year 1902 the number of members initiated was 100 per month greater than in 1901. The death rate of the year was 6.60 per 1,000 or a fraction less than the year before. The average age of its membership at the close of 1902 was a little over 36. The society rejects a large percentage of applicants, being very careful in the selection of its risks. Its accumulated funds increased during 1902 by $957,239. This meant a betterment in assets of 18.19 per cent. The increase in assurance at risk during the year was 4.52 per cent. The increase in the premium income of the order in 1902 was 8.37, while the demands upon that income for the purpose of meeting claims was only 1 per cent greater than in 1901. The order is governed by a supreme body, which meets once in three years. The local jurisdictions are governed by high courts of the various States and Provinces. The funds, however, are all forwarded to the head office, there being invested under the insurance law of Canada which prevents investment in anything except first-class gilt-edge securities. The last reports show that no losses have ever been made in investments. The head office of the order is in Toronto, Canada, the building being a magnificent structure known as the Temple Building, which was built and is owned by the order. In addition to the head office it contains a number of banks, loan companies, insurance companies, and is the headquarters of masonry for the city of Toronto. The order pays out daily (1903) $6,500 to widows and orphans. The rates of premium may be judged from the following: Age 35; amount $1,000; mortuary premium $1.38 (small court dues in addition). All premiums cease at 70 years of age, or at any time when the members become totally and permanently disabled, at which time they are allowed to take in cash one half of the amount of their policy, the balance to be paid to their heirs at death. After 70 years of age members are permitted to draw one tenth of their policy for each of 10 years if they live so long, the balance to go to their beneficiaries at death. The order also has a sick and funeral benefit division. It admits lady members, these being called companions, who are gathered in separate courts. Of its total membership of 214,000 about 17,000 are companion members. The growth and progress of the institution is the life work of Hon. Dr. Oronhyatekha. He has been supreme chief ranger for 22 years and is a man of wonderful strength and power. Associated with him are the following: Hon. Judge Wedderburn, Hampton, N. B.; J. D. Clark, Dayton, Ohio; John A. McGillivray, K. C., Toronto, Ont.; H. A. Collins, Toronto, Ont.; T. Millman, M.D., M.R.C.S., Toronto, Ont.; Hon. Elliot G. Stevenson, Detroit, Mich. Benj. Greer, London, Ont., and Charles A. Fitzgerald, Buffalo, N. Y., are the supreme auditors.

Forestry in the United States. Forestry is the art of using the forest continuously to meet the needs of men. In the United States forestry has to do principally with the supply of wood for various purposes, with the maintenance of waterflow in streams, with the prevention of floods, and with the supply of forage for grazing animals within the forest. Nowhere else are forest problems of more vital importance to the welfare of the people than here, and in no other country of similar civilization has so little progress been made in their solution. This condition follows naturally from the vast area of the United States, its comparatively sparse population per square mile, and from the nature, location, and extent of the forests themselves.

The forests of the United States occupy an area of approximately 1,100,000 square miles, or about 36 per cent of the total land surface. They may be divided into five principal regions.

(*a*) The *Northern Pine Forest* extends from western Minnesota east to the Atlantic Ocean and southward to middle Tennessee, northern Georgia, central Virginia, and northern Maryland. Its characteristic tree is the white pine (*Pinus strobus*, Linn.), a tree of the very first commercial importance, which has hitherto supplied much more of the lumber cut in the United States than any other tree. In its western and more important centre of distribution in Michigan, Wisconsin, and Minnesota, the white pine is found both in pure stands and associated with other, principally hardwood, trees. The cut of white pine in the northern pineries reached its maximum in 1890, when the production for Michigan, Wisconsin, and Minnesota was 8,597,623,000 feet. During the census year 1900 the cut had fallen to 5,419,333,000 feet. This reduction in the cut has been accompanied by so marked a fall in the quality of the lumber that at present very many mills are sawing logs of which 50 or 60 are required to produce 1,000 feet of lumber, while the former average of logs to the thousand was seven or less. In the eastern part of the Northern Pine Forest red spruce (*Picea rubens*, Sarg.) is now the principal lumber tree, since the majority of the merchantable pine has been removed. The spruce grows usually in mixture with hardwood trees such as birch, beech, and maple. Formerly used mainly for lumber, spruce is now cut principally for paper pulp. The production of spruce pulp wood in the census year 1900 was 1,160,118 cords, the majority of which was used for news and other coarse grades of paper. In its southern extension the white pine forest penetrates the extensive hardwood belt of the Southern Appalachians, into which it merges as the white pine and its associates cease to be the characteristic trees. In its northern portion the white pine forest is predominantly of value for the production of wood. Its use as a regulator of stream-flow, while very great, is there far less conspicuous than along its southward extension in the Appalachian Mountains, and in many other forest regions of the United States. The loss from floods in streams which head within this forest in the Southern Appalachian Mountains during a certain period of 12 months ending in 1902 was, according to official estimates, more than $18,000,000. Congress has been asked to undertake the control of these floods by the purchase of lands for a Southern Appalachian forest reserve, but the plan, although thoroughly good, has not yet been carried through.

(*b*) The *Interior Hardwood Forest* follows the southern boundary of the Northern Pine Forest from the edge of the treeless region eastward to the mountains of Virginia and southward along the Appalachian Mountains and the Piedmont region, skirting the northern boundary of the Southern Pine Forest until it meets the prairie in western Texas. Its principal trees are the oaks. It is in this forest that the black walnut, now almost exhausted as a timber tree, reached its best size and most important distribution.

(*c*) The *Southern Pine Forest* extends from northern Maryland south along the Atlantic and Gulf coasts and up the valleys of the principal rivers until it meets the open country in western Texas. Its most important and characteristic tree is the longleaf pine (*Pinus palustris*, Mill.), in many respects the most valuable and important timber pine of the globe. Frequently associated with the longleaf pine, and serving elsewhere to delimit the boundaries of the Southern Pine Forest, is the loblolly or rosemary pine (*Pinus taeda*, Linn.), a tree of rapid growth and great dimensions. Other characteristic trees are the shortleaf pine (*Pinus echinata*, Mill.), which occupies the higher ground back from salt water, and the bald cypress (*Taxodium* *distichum,* Linn.), a swamp and tideland tree of high commercial importance, whose wood, for many purposes, is taking the place of the white pine, as clear lumber from that tree becomes progressively scarcer and higher in price. The cut of pine in the Southern Pine Forest in 1900 was 8,523,000,000 feet, and it is increasing with great rapidity. The cut of cypress in 1900 was 495,000,000 feet. The naval stores produced from the longleaf pine in 1900 were valued at $20,344,888.

Along the western border of the Northern Pine Forest, the Interior Hardwood Forest and the Southern Pine Forest extend the region of the Great Plains, destitute of timber except along the margins of the streams and on occasional elevations. There is a strong probability (and in many places conclusive evidence) that great areas of this region at one time bore trees and are still capable of growing forests. The clothing of such areas again with trees is one of the most important problems to be attacked and solved by the American forester. Ultimate success, of which there is now no doubt, will be of enormous value to a region whose principal industries, agriculture and grazing, are both so dependent for their future development upon a cheap and accessible timber supply.

(*d*) To the west of the Plains region lies the *Rocky Mountain Forest,* occupying more or less isolated mountain chains or mountain masses separated by grazing lands, deserts, or cultivable valleys. The Rocky Mountain Forest has its eastern extensions far in the heart of the Plains country, as in the case of the Black Hills Forest in North Dakota. Its predominant characteristic at middle and lower elevations is semi-aridity, and its distribution is limited by a combination of forest fires and deficient rainfall. Its principal timber trees are the western yellow pine (*Pinus ponderosa,* Laws.), the Engelmann spruce (*Picea engelmanni,* Engel.), the red fir (*Pseudotsuga taxifolia,* Lam., Brit.), and the lodgepole pine (*Pinus murrayana,* "Oreg. com.") The principal products of the Rocky Mountain Forest are water, wood, and grass, in the order named. The chief industry of this region is, or is about to become, irrigated agriculture. Since the passage of the National Reclamation Act of 1902, which provides for the reclamation of vast areas of irrigable arid land under the auspices of the Federal government, the watersheds of the region have taken first place in its economic resources, for here water, not land, is the measure of value of the farm. All the industries of this region hang with peculiar dependence upon the forest. The distance from which supplies of timber for mining, for railroads, and for domestic purposes must come if the Rocky Mountain forests are once exhausted makes their preservation an imperative necessity on these accounts, while the existence of summer range in the forest for herds of cattle, sheep, and horses gives value to immense areas of winter range which without it would be of little use, and thus maintains one of the most important industries of the region. Because of the aridity of the country the forests of the Rock Mountain region are destroyed with peculiar facility by fire, by overgrazing, and by overcutting. The reproduction is less rapid and abundant than on either the eastern or western coast, while the preservation of the forest, of vast importance everywhere throughout the United States, is here more peculiarly and immediately essential to the well-being of the people than is the case elsewhere.

(*e*) West of the Rocky Mountain Forest stretches the *Pacific Coast Forest,* probably the most densely timbered and prolific forest region of the earth. In California the forest of the Sierras, characterized by the big tree (*Sequoia gigantea,* Decaisne), the sugar pine (*Pinus lambertiana,* Dougl.), and numerous magnificent firs, is perhaps the most beautiful and attractive in existence, while the forest of coast redwood (*Sequoia sempervirens,* Lamb., Endl.) has a larger stand of merchantable timber per acre than any similar area of which we have knowledge. In Oregon and Washington, the red fir (*Pseudotsuga taxifolia,* Lam., Brit.), the coast cedar (*Thuya gigantea,* Nutt.), and the tideland spruce (*Picea sitchensis,* Bong., Trautv. and Mayer) are lumber trees of the highest commercial value and the chief economic components of the forest, while the coast hemlock (*Tsuga mertensiana*), for the present less sought after than the fir, and the red fir itself alternate as the most numerous tree in the forest. Water is the most important product of the Sierra forest, wood of the redwood belt and of the coast forests of Washington and Oregon. The cut of redwood in 1900 was 360,000,000 feet, the lumber product of Oregon 740,000,000 feet, and that of Washington 2,300,000,000 feet. During the year 1902 the loss from fire in the State of Washington was said to be about twice the cut. Although it is true that wood is by far the most important product of the coast forests of Washington and Oregon, yet the prevention of floods from the heavy rainfall and snowfall of the coast is of critical importance to many agricultural valleys.

Forests of the Philippine Islands.— The forest lands of the Philippine Islands cover an area which certainly exceeds 40,000,000 acres. They are rich both in the number and in the value of their species, and their total stand of merchantable timber is exceedingly large. Except for occasional private or monastic holdings, they are entirely in the possession of the United States, and are being administered by an Insular Bureau of Forestry in competent and reliable hands. The development of practical and systematic forestry in the Philippines is likely to be even more rapid than in the United States, and the returns from the government forests there, already more than double the expense of administration, will form one of the most important sources of revenue from the islands.

Forest Protection.— The early settlers in New England and Pennsylvania, coming as they did from regions where forest protection was rigidly enforced for the sake of the game, brought with them the survival of their habits at home, and made provision among their earlier laws for the preservation of the forest. This transplanted care for the woodlands did not long survive either in legislative or in effective public desire. It was succeeded by a reasonable appreciation that the forest, in the early days on the Atlantic Coast, was the enemy of the settler. The state of mind which was thus produced survived in enmity to the forest long after the progress of civilization had converted it from an enemy of the settler to his best friend, and the eagerness for forest destruction which has characterized the great majority of frontier communities in the United States has, after the early days, had no more legitimate cause. Until the immense expansion of the railroads which followed the close of the Civil War, the demand for timber was comparatively local in character, and the great operations of destructive lumbering had not begun. Since that time forest destruction has increased progressively until the exhaustion of the timber supply has almost been accomplished in certain regions and is imminently threatening elsewhere. Even before the era of gigantic lumbering operations, organized bodies began to take action for the preservation of the forest, but it was not until the resolutions of the American Association for the Advancement of Science in 1873 that such action achieved results. These resolutions called upon the National government to investigate the forest situation of the United States and to move accordingly. In 1876 the Commissioner of Agriculture, through Dr. Franklin B. Hough, one of the most honored pioneers of forestry in this country, organized such an inquiry. The work which Dr. Hough then began developed into the Division of Forestry in the United States Department of Agriculture, which division was greatly enlarged and became the Bureau of Forestry in 1901.

The Bureau of Forestry.— The Bureau of Forestry is divided into six offices. The Office of Forest Management prepares working plans for conservative lumbering for the National forest reserves (see below) and for State and private forest holdings. Its practical assistance to the owners of timberlands is given on the ground, either without cost in the case of small areas, or at the cost to the owner of expenses only in the case of larger tracts. The area of private forest land for which applications for assistance had been made on 1 July 1903 was 5,650,171 acres, an area far larger than the force of the Office of Forest Management has been able to cover. The total area of private lands put under management at the same date was 679,194 acres. The Office of Forest Extension gives assistance in tree planting under conditions similar to those described for the Office of Forest Management, studies methods of re-establishing the forest on areas which it once occupied, and gives special attention to the study and prevention of forest fires. On 1 July 1903 the area for which planting plans had been made amounted to 10,807.47 acres. The Office of Forest Measurements calculates, drafts, and puts into final form the very extensive measurements and maps made in the field by the Offices of Forest Management and Forest Extension. The Office of Forest Products studies the uses of timber and other forest products, makes timber tests and chemical examinations of by-products of the forest, and gives special attention to the preservation of wood. The Office of Dendrology deals with the natural history and nomenclature of trees and forests, and has charge of the forest library and the collection of forest photographs of the United States. The Office of Records is charged with the routine and the business operations of the Bureau. The appropriation of the Bureau of Forestry for the year ending 30 June 1904 was $350,000. It will be evident from what has been said that the work of the Bureau is to forward both the study of the forests of the United States and the application of practical forestry upon them regardless of the character of their ownership.

National Forest Reserves.— Parallel with the development of the Bureau of Forestry, two other lines of National forest work have sprung up, one in the General Land Office, the other in the United States Geological Survey. To the General Land Office the custody and disposal of the lands of the public domain have been given, together with the care and management of the National forest reserves created from time to time by proclamation of the President of the United States under the Act of 3 March 1891. These reserves, situated in all the Western States and Territories except Nevada, occupied on 1 July 1903 an area of 62,343,645 acres. When the first reserves were created, it was natural that their administration should be placed in the hands of the Land Office, which had had charge of these lands before they were reserved, but the development of the other government forest work has made it evident that a change is required.

In 1895 the president of the National Academy of Sciences was requested by the secretary of the interior to appoint a committee to examine the forest lands of the public domain and report a policy for their management. Upon the recommendation of this committee, President Cleveland, on 22 Feb. 1897 created some 22,000,000 acres of forest reserves. The proclamation of these reserves was immediately followed by protests in the Western States and Territories so vigorous that Congress suspended the operation of the President's proclamation for a year in all the States affected except California, whose senators, recognizing the value of reserves to their State, protested against the suspension. At the expiration of the year of suspension the proclamation of President Cleveland became effective in spite of some opposition in the West, and the forest policy of the government has never been seriously threatened since that time. The law of 3 June 1897 conferred upon the secretary of the interior all necessary powers for the management of the forest reserves through the General Land Office, and gave to the director of the Geological Survey, who had been instrumental both in saving the reserves from permanent suspension and in procuring the passage of the law, certain duties in connection with them. He was charged with the survey and description of the reserves, with mapping their topography and timber, and with recommending to the secretary of the interior their proper boundaries and marking them permanently upon the ground. The duplication of work and the loss of energy involved in the dispersion of the National forest work under these three independent agencies has been called to the attention of the Congress by the President of the United States and is likely soon to come to an end.

State Forestry.— While the national government was making the progress described, various States were taking active measures in forestry. Among those Minnesota and Pennsylvania are conspicuous for the excellence of their fire laws, New York and Pennsylvania for their forest reserves, Michigan, California, and a few other States for peculiar excellencies of State organization or public sentiment on the forest question, but except in some of the States already named and a few others the state movements for forest protection have not usually been notable either for efficiency or good results.

Forest Schools.— Instruction in forestry began in this country under the mistaken impression that forestry differs but little from horticulture and botany. But the character of forest teaching has been revolutionized within the last few years, and at present opportunity for education in professional forestry is not wanting in the United States. One of the earliest practical courses of forestry, discontinued shortly after it began, was given in the State University at Bozeman, Montana, under Capt. George P. Ahern, U. S. A., now in charge of the Bureau of Forestry in the Philippine Islands, but the first effort toward the establishment of professional instruction was in the simultaneous opening in the autumn of 1898 of the Biltmore Forest School at Biltmore, North Carolina, and the New York State College of Forestry as a part of Cornell University. The former offered a one year course without entrance examination and is still continuing to do so. The Cornell School, which offered a four year undergraduate training in professional forestry and had begun to graduate students capable of passing the government examinations, was discontinued in 1903. The Yale Forest School, which offers a two year post graduate course to the holders of a bachelor's degree from any recognized institution of learning, was established in 1900. It has already graduated more professional foresters than all other schools combined. The University of Michigan has just instituted a two year post graduate course, the University of Nebraska has established a four year undergraduate course, the State Agricultural College of Minnesota has established a four year course; Harvard University offers some instruction in forestry in the Lawrence Scientific School, and many other institutions afford the opportunity for more or less complete and effective training in various branches of forestry.

American Forestry Association.— The American Forestry Association, organized in 1882 as the American Forestry Congress, has been one of the most effective agencies in the progress of forestry and forest preservation in the United States. Its influence upon legislation has of late years been a notable one, and its summer meetings, held in whatever portion of the country needs its influence most, have been exceedingly effective in educating public opinion. Its official organ, formerly 'The Forester,' now called 'Forestry and Irrigation' because it has become likewise the organ of the National Irrigation Association, is the best forest periodical in the United States and one of the best in existence. In the publicity which it gives to forestry, it has been of late most cordially and helpfully joined by the lumber journals and the daily press of the country. The newspaper press as a whole has been a most effective agent in the dissemination of right ideas of forestry and in bringing about in Congress, among lumbermen, and among the people at large the strong support of practical forestry which is now perhaps the most hopeful sign of the forest situation in the United States.

The Practice of Forestry.— The practice of forestry in the United States naturally falls under two heads: First, those forms of conservative lumbering which were practised by farmers, lumbermen, and others without the assistance of professional foresters. Second, those forms of conservative lumbering which have been introduced under the supervision of the latter. In both cases a factor of the utmost importance is found in the methods of logging adopted or devised by the American lumbermen in different parts of the country.

Destructive Lumbering.— The methods of felling timber, except for variations in the forms of axe and saw, are approximately similar throughout the world, but the methods of handling the felled timber vary greatly. In the United States the mechanical and inventive capacity of the people has led them to develop forms of logging cheaper and more effective than those in use elsewhere. These methods have become highly specialized in response to the requirements of the market, the topography, and the forest itself in the different forest regions. In the Northern Pine Forest the final operations of logging await the fall of sufficient snow to make possible the preparation of solid ice roads over which the logs can be hauled to the bank of a stream or to the railroad. In the Southern Pine Forest and throughout the larger part of the interior hardwood region snow is not a factor in the logging. Its place is taken to some degree by timber slides or by installations of wire rope cables which drag or carry the logs from the stump to a logging train. In the Rocky Mountain region the methods vary greatly, but on the whole they are less highly developed there than in the denser timber on the Pacific slope, where wire rope logging has reached a very high point of economy and efficiency. Here the logs are dragged over specially prepared skid roads by wire cables of great length attached to the drums of donkey engines, which transport themselves about the woods by their own power whenever change of location is required. Forestry being in many respects more closely akin to lumbering than to any other occupation, it is of first importance to the forester that effective and economic methods of logging should be employed. These methods hitherto have been wasteful and destructive both to an unnecessary and to an unprofitable degree, and the future of the forest has been needlessly sacrificed to the idea of immediate gain. Conservative lumbering harvests the present forest crop economically and profitably at the same time that it provides for future growth.

Forestry by Private Owners.— The idea of perpetuating the forest by wise use, which is the essence of forestry, had found hospitable lodgment in the minds of many Americans before forestry had become a recognized profession in the United States. Examples of the treatment of the forest from this point of view were more common in the northern spruce forests than elsewhere, and especially on the Androscoggin River in Maine, where great permanent value was given to very considerable tracts of spruce land by careful handling. Among the farmers of New England, New York, and New Jersey the harvesting of successive crops of hardwood sprouts for fuel, fencing, etc., was a common practice during the last century, but as a rule the methods used, like those for the spruce in Maine, were less effective than they might easily have been.

Beginnings of Professional Forestry.— In 1891 the first example of professional forest management in the United States was begun on the Biltmore estate near Asheville, North Carolina, in a mixed forest of hardwood and pines which had been severely damaged by the mismanagement of former owners. The object of the management was to secure what revenue was possible from the forest while conducting such operations as were required to put it in good condition. Even in the first year the forest work paid for itself, and it has been conducted successfully ever since. No further examples of professional forest management were created until, in the summer of 1898, practical forestry was introduced, under the care of the then Division of Forestry of the Department of Agriculture, on two tracts in the Adirondacks of a total area of more than 100,000 acres. Other instructive examples of co-operation in practical forestry between private owners and the government have been created in Maine, Tennessee, Georgia, Texas, and many other States and Territories, and the plan is still in increasingly effective operation. Under it the great majority of the conservative forest management now in existence in the United States has been brought about. The types of practical forestry which have been adopted or devised for application in these various cases include improvement cuttings of various degrees of refinement, several types of treatment of sprout lands, and a variety of forms of the high forest and selection systems, the most typically American of which is what is called localized selection. In all cases their application has been reduced to the utmost simplicity, and a definite effort has been made to limit interference with the ordinary methods of logging to the smallest possible amount. As a result they have not interfered as a rule with the profits of the forest, while the reproduction and perpetuation of the forest, the other principal object of the management, has been fully secured. Through the application of these simple and effective methods forms of forest management peculiarly adapted to American conditions are growing up. In the early practice of American foresters many of the important tenets of European forestry, such as the doctrine of the sustained annual yield, have wisely and necessarily been abandoned, and effort has been confined to insuring the profitable use of the forest and its continuance in productive condition, not seldom at the expense of a long hiatus in the yield, provided such a form of management was satisfactory to the owner. The conditions of the lumber trade here justify the transportation of forest products for longer distances than is possible in Europe, and localities are far less dependent in America upon the local supply than is the case abroad. A fundamental consideration in determining forms of management in the United States is the extremely moderate price of low grade forest products such as firewood and the cheaper kinds of lumber. This fact, together with the cost of transportation, decides what kinds and grades of timber can be profitably cut and how closely what is cut can be put to use. Logging under the conditions of which not more than 50 per cent of the growing tree ever reaches the market, is still practised in several parts of the United States. The duty of perpetuating the forest is not less imperative under such conditions than where the price of lumber is higher. The methods of the American forester, although they must be the product of ripe training and experience if they are to succeed, are often summary and rough. In every case they must pay and in every case they must insure the perpetuity of the forest. If they succeed in these two essentials, their roughness may be disregarded.

Principal Forest Problems.— The efforts of American foresters are at the present time largely grouped about a few principal forest problems which arise from the nature of the forest, from the dangers which threaten it, and from the economic conditions by which it is surrounded.

The National Forest Reserves.— Since it is the general experience of all countries that the only forests which are permanently safe are those in the hands of a permanent owner, namely the government, the United States has by the creation of forest reserves undertaken to set aside and hold in the public hands those areas within the public domain whose preservation is essential to the public welfare. The establishment of these forest reserves met at the beginning, and in certain instances continues still to meet, unthinking opposition in certain parts of the Western States where lie the 863,000,000 acres which remain of the public lands. But in each State public sentiment is crystallizing rapidly and effectively in favor of forest preservation. This trend of the public mind makes it continually easier for the national government to set aside and hold those forest lands which it should retain, and is rapidly making possible a better administration of the reserves themselves. The latter are located either at the headwaters of streams whose protection is essential to irrigated agriculture on the lands below them, or in more densely forested regions where the preservation of the timber supply is the first consideration. In either case their preservation alone can meet a critical public need. It is unfortunate that the personnel of forest supervisors and forest rangers available for their protection has remained far below their requirements. The natural result has been that the diminution of forest fires, although striking in amount, has been less than might have been accomplished, while the stock ranges have continued to suffer from overgrazing and the reserves have been injured to some extent by timber stealing and by minor depredations. They have nevertheless answered a most important and beneficent public purpose, and under the policy which controls their administration their value to the people will steadily increase. This policy briefly stated is the employment of all their resources for the good of the people, and thus, in the language of President Roosevelt, the making and maintaining of prosperous homes.

Forest Fires.— It is altogether probable that more timber has been destroyed in the United States since the landing of the Pilgrims by fire than by the axe. In every country where timber is plenty and settlers few, fire has been harmfully employed to assist the settler in his warfare against the forest. With the progress of civilization railroads have scattered along their rights of way fires which have destroyed thousands of square miles of timber. The transcontinental railroads are lined for hundreds of miles, where they traverse the forest regions, with the bleached fire-killed remnants of the former stand. Prospectors often set fires in heavily timbered countries to uncover the surface of the mineral soil, and campers, hunters, and others, either by the injudicious location of their fires or by neglect in leaving them unextinguished, have been responsible for much important loss. The use of steam machinery in logging and the supposed necessity for burning away the debris, as in the case of the coast redwood of California before skidding the logs, has been responsible for many fires. The loss from forest fires is confined to no section of the country and its percentage has diminished but little of late years, if at all, in proportion to the total stand of timber which remains. Although exact figures are not obtainable, it probably exceeds on the average a total of $50.000,000 a year. The Hinckley fire of 1894 in Minnesota destroyed property valued at $25,000,000 and cost the lives of 418 persons. For two weeks before the high wind which gave it its destructive power this fire was smoldering in the neighborhood of Hinckley and could have been extinguished easily and cheaply at any time. During the autumn of 1902 fires destroyed property valued at $13,000,000 in the States of Washington and Oregon, while in the spring of 1903 about 650,000 acres were burned over in the Adirondack Forest in New York. Such losses are as unnecessary as they are appalling, for a small fraction of the cost of these fires expended in preventive measures would have rendered their occurrence practically impossible. There is but one effective safeguard against fire in the woods, an enlightened public sentiment with regard to it. Such a sentiment is rapidly being created within and near the National forest reserves and in certain other portions of the country. While the effort to produce it is in progress the National Bureau of Forestry is studying the natural history of forest fires and devising the cheapest and most effective means for extinguishing them. It is studying likewise their effect upon the condition and production of the forest, and the amount of loss, as special means of awakening public opinion. In the dense and moist forests of the northern pine belt, forest fires of importance almost invariably originate in the debris of cut-over lands and not seldom are unable to penetrate the untouched virgin forest. In unusually dry seasons, however, fires may burn throughout any woodlands without distinction, and it is in such seasons that conflagrations like the Hinckley and the Peshtigo fires take place. Except under extraordinary conditions, fires in forests of this type are apt to move slowly, but they are difficult to extinguish because of the mass of inflammable material in the forest floor. Mature trees in the Interior Hardwood Forest and the Southern Pine Forest are seldom killed by fire if the bark is unbroken and sound. Fires in these regions usually travel along the ground with moderate speed and are seldom dangerous to human life. The damage they occasion is in the destruction of young growth and the unsoundness which they produce in trees of larger size. They are especially destructive in those portions of the Southern Pine Forest where the longleaf pine is boxed for the production of naval stores. Where a boxed tree catches fire it is lost for such production, and most often succumbs to the attack. In the Rocky Mountain Forest fires are less uniform in type. Where the timber is dense, and especially where it is composed of a thin-barked species such as the lodgepole pine, not infrequently vast areas of the forest are killed by a single fire. In such cases the trees are not consumed, but stand bleaching long after they have lost their bark, and finally fall in an almost impassable tangle of prostrate trunks, to be consumed later by another fire together with the young growth which has sprung up among them. In the more open forests of the western yellow pine, the damage is to the young growth and to the soundness of the old trees. In many regions it is practically impossible to find a tree of any size that does not bear the marks of fire. The most serious effect of fires in the coast redwood of California is to prevent the sprouting of the old stumps after logging, and thus to convert highly valuable timberland into indifferent pasture. In the fir forests of Oregon and Washington fires are common and difficult to extinguish, but usually slow-burning and not of great extent. It is only in seasons of exceptional dryness that losses of appalling magnitude are to be expected. The State of Washington has recently passed a forest fire law, the operation of which will be watched with peculiar interest.

Some Uses of Wood.— The yearly product of wood in the United States is about 35,000,000,000 feet. In 1900 the lumber industry employed 283,260 wage-earners, to whom it paid $104,640,591. The perpetuation of this industry is of vital concern to all the people. Its ramifications are as wide as the industrial life of the nation, and its perpetuation is a most pressing concern of the forester. The use of wood for the maintenance of railroad tracks, for example, rises to about 120,000,000 ties a year, together with vast amounts of bridge timber, piling, etc. Since the use of metal ties is believed to be impracticable by American railroad engineers, the maintenance of the supply of wooden ties is of vital importance to the railroads, and through them to the nation at large. In a similar way, the permanence and success of the mining industry is dependent upon cheap and accessible supplies of timber. In most portions of the West such supplies can be expected only from the national forest reserves. In the creation of the reserves, therefore, the special needs of mining and other industries have been kept carefully, and it is also believed successfully, in mind.

Summary.— The profession of forestry, which has already reached high standing on the continent of Europe, in British India, and elsewhere, is being born in the United States. Its establishment on a high plane is of the first importance to the solution of every problem of American forestry. The forest wealth of this country, although vastly diminished, is still very great, and the reproductive capacities of its forest are usually of the first grade. Wood is cheap and methods of the lumberman are wasteful. The low cost of transportation permits the movement of forest products from vast distances, so that local markets are supplied from distant points. In view of all these conditions, the task of the American forester is to secure the reproduction of the forest without materially impairing the profit of lumbering, and wherever possible to bring into public ownership whatever forest lands are required to supply in permanence the public need.

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Forests, Petrified, fossil remains of forest trees and plants found in the Potsdam sandstone formations in America and the Cambrian rocks of Europe. Large forest trees, fossilized and converted into stone are found in many sections of the United States, particularly west of the Mississippi River. Those of Arizona are well known. PALÆOBOTANY.

Forey, Elie Fréderic, ā-lē frā-dā-rik fō-rā, French military officer · b. Paris, France, 10 Jan. 1804; d. there 20 June 1872. He took part in several Algerian campaigns as well as in the Crimean and Sardinian wars, and when the expedition to Mexico was decided upon in 1861, Forey received the command of the French troops. After several sanguinary engagements, he attacked and stormed the strong post of Puebla, thereby throwing open the road to the city of Mexico. For this service he was made marshal of France.

Forfeiture, fôr'fit-ūre, a legal penalty, by which an owner is absolutely deprived of his property for crime or other unlawful act. This applies to personal as well as real property, and forfeiture may be a decree of civil as well as criminal courts. The penalty is of feudal origin. The lord owed protection to the life and property of the vassal; the latter owed fealty and service to his lord. When the vassal failed to yield these, he lost the shelter of the law, became an outlaw, and incapable of holding property. Loyalty to the feudal relation being the condition on which life and property were secured to him, when he failed in loyalty he had no longer any claim on life or property.

Treason was punished by forfeiture long before the Norman Conquest in 1066. After that period forfeiture became the ordinary penalty for felony, which was styled petty treason; while treason, or disloyalty in regard to the sovereign, was called high treason. Forfeiture was accompanied by what was styled corruption of blood. This was the sentence of legal bastardy passed on the offender so that he could neither inherit nor bequeath property.

Felony in the United States has never been considered ground for forfeiture. The Federal and State laws have modified all precedents in the matter of forfeiture, which they restrict within very narrow limitations. See ATTAINDER.

In England civil forfeiture may be incurred by tortious alienation, by wrongful disclaimer, by alienation in mortmain (see MORTMAIN), by breach of condition, and by the commission of waste (see WASTE). In Scotland civil forfeiture may arise either from statutory enactment, at common law, or by agreement. In the United States civil forfeiture is only imposed for acts of waste committed by tenants for life or years, or for breach of contract in violating the conditions on which lands were granted. Some States have abolished even this degree of forfeiture. By particular statutes enacted by Congress smuggling, or importing goods on fraudulent invoices involve confiscation, and forfeiture of the entire invoice (see INVOICE), or the balance wrongly imported. Piracy has always entailed confiscation or forfeiture of the piratical craft.

Forge, Forging, and Forging Machines. A forge is a furnace or open fireplace, having a forced draft, for heating metals, especially iron and steel, to be shaped by hammering or pressure. Previous to the 19th century, most iron work was forged by smiths on avils. Then came the period of cast iron, when everything that could be cast was made that way because it was cheaper, and during the last half of the century the use of forged iron and steel increased enormously owing to improved and cheapened methods of production. Now, in 1893, a vast quantity of steel for machine-made forgings finds its way into machines and structures, giving greatly increased strength and durability. A simple blacksmith's forge is a brick structure, with a chimney at one side. The coals and fire are located at the mouth of the chimney, and a bellows or rotary fan furnishes a blast of air which is driven from underneath through the mass of coal. This coal is usually soft, sometimes being termed blacksmith's coal. Portable forges are made for light work, and a common form of these has four legs made of iron tubing, a shallow bowl to hold the coal and contain the fire, and a hood above. At the rear is a small rotary fan; operable by a wheel-crank. As forges increase in size and capacity, they develop into what are more properly called furnaces, such as the immense heating furnace of a steel works. In forging iron by hand the smith thrusts the metal into the centre of his fire, and its color tells him when it is ready to be worked. As it heats, it becomes black red, then a low red, then bright red, then a white heat, and if the heating continues it next begins to burn. If the smith desires the iron to be very soft, that it may yield quickly to his blows, he lets it come to a white heat, then takes it with his tongs on to his anvil, and begins to hammer it rapidly into the desired shape. Often a helper stands by to strike blows alternately with the smith, in order that as much hammering as possible may be done before the iron cools to a point where it requires reheating. Long practice makes very expert smiths, and many of them will shape a bar of iron into intricate form in a surprisingly short space of time. When the smith desires to weld together two pieces of iron, he must heat both pieces at the same time to a uniform white heat. As the iron approaches a white heat he throws sand on it, which, if done at the proper temperature, adheres and melts, forming a liquid glass-like fluid that flows over the surface of the iron and keeps the air from it, thus preventing its burning. If the ends of two bars are to be welded, each is first brought to a flat point, so that there will be considerable surface to weld together. After the surfaces adhere, the weld may be reduced by reheating and hammering down to the size of the other portions of the bars. When pieces are joined end to end, this is termed a butt-weld, which is not apt to be as strong as a lap-weld. Where forgings are so large that a smith and helper cannot work them satisfactorily, because there is too much and too heavy hammering to be accomplished in the short time the metal retains its great heat, the machine hammer is resorted to. This was made in various forms, and was an important tool during the early part of the 19th century, finding its culmination in the great steam-hammer of Neysmith, which was devised especially for such large forgings as the shafts of paddle-wheel steamships, then coming into use. The trip-hammer and the steam-hammer were the chief tools used for large forgings until about 1890 when the hydraulic press began to supersede the hammer for large work. About 1884, when the United States government began to seriously take up the rebuilding of the navy, and the construction of steel battleships and cruisers, there came a demand to American manufacturers for very large forgings, which had not previously been produced here. The forges of that date were equipped with power hammers, of a capacity suited to welding wrought iron into forgings of moderate size. The introduction of steel rails taught American iron manufacturers that steel forgings were desirable in all classes of machinery, as greatly reducing the size of the parts, because of the increased strength.

The hydraulic compression system of forging, which was introduced in America when our steel plants were called upon to provide the large forgings for the navy, has met with general approval, and is steadily increasing in use. It has been demonstrated that forgings made by hammering were subject to all sorts of internal strains due to differences in compression and differences in cooling. When such a forging is cut, as for making a keyseat, a distortion of form follows as the result of certain strains that have been relieved. A large forging requires a pressure great enough to penetrate to every part of the mass of metal, so that the flow of metal resulting shall take place uniformly throughout. Such a flow requires time and a pressure that can not be obtained by a quick hammer blow, and a series of blows does not produce the same effect as does the persistent pressure of the hydraulic forging machine. Fluid steel begins to crystallize at the point where the degree of heat is reduced so that it solidifies (about 2,600° F.), and the more slowly it is cooled from this point downward, the larger will be the crystals of the ingot. Forging during the cooling tends to check crystallization, just as stirring water at a temperature below the freezing point would check the formation of ice crystals. The more irregular the method of forging is, as in the case of hammer blows, the more it interferes with an even crystallization. The pressure system not only interferes much less than hammering, but forgings are farther improved in modern practice, by reheating above the recalescent point, which is between 1,200 and 1,300° F., depending on the percentage of carbon and annealing to secure a new crystallization, and oil tempering.

An examination of the grain or fibre of hydraulic forgings shows that the steel tends to arrange itself in layers following the outer contour of the piece of metal, thus securing the most strength. A sharp angle in the pattern will tend to cut off the flow of metal, and if such is required, the method is to round out the place in the forging, to secure the best flow of metal, and then machine off the surplus later.

To avoid internal strains as much as possible such large forgings as steamship shafts are preferably made hollow. That is to say, the cylindrical ingot from the furnace after cooling is bored through the centre, mounted on a steel mandrel, heated and forged by compression. Ingots produced with fluid compression are well adapted to being bored and hollow-forged, and this method produces the most perfect forgings. These large forgings are subjected to a hydraulic pressure of about 7,000 pounds to the square inch, which pressure is maintained while the mass slowly cools. Shafts of more than a foot diameter are best bored, as the bore hole not only assists uniform heating, but gives opportunity for inspection.

Small forgings of iron, steel and other metals are now most commonly produced by the method known as drop-forging. A press containing a top and bottom pattern (die and counter) receives the roughly shaped hot metal, and at a single blow brings it to the desired shape. Parts of machines that were formerly made of cast iron or steel are now drop-forged at moderate cost, and the metal is so much stronger that they can be lightened materially in weight, thus sometimes actually reducing the cost, while increasing the durability. See BELLOWS; FURNACE; HAMMER; IRON; PRESS; STEEL; WELDING.

CHARLES H. COCHRANE.

Forgery, the fraudulent making or alteration of a writing to the prejudice of another man's rights, or making of any written instrument for the purpose of fraud and deceit; the word *making,* in this last definition, being considered as including every alteration of or addition to a true instrument. The offense of forgery may be complete though there be no publication or uttering of the forged instrument; for the very making with a fraudulent intention, and without lawful authority, of any instrument which, at common law or by statute, is the subject of forgery, is of itself a sufficient completion of the offense before publication. Most of the statutes, however, which relate to forgery make the publication of the forged instrument, with knowledge of the fact, a substantive offense. A deed forged in the name of a person who never had existence is forgery at law. A writing is forged when a person drawing up a will for an invalid, inserts legacies therein falsely. It is not material whether a forged instrument be drawn in such manner that if it were in truth that which it counterfeits it would be valid. The punishment of forgery at common law is, as for a misdemeanor, by fine, imprisonment, and such other corporeal punishment as the court in its discretion might award. The penalty varies in different States, in some the statutes having been much enlarged to include acts which were not punishable formerly as forgery. The punishments ordained for the offense by the statute law in England were once, with scarcely an exception, capital.

Forli, Melozzo da, mā lōts'ō dä fōr lē', Italian painter: b. Forli, about 1438; d. 1494. He was the first who applied the art of foreshortening to the paintings of vaulted ceilings. About 1472 he painted the 'Ascension' in the great chapel of the Santi Apostoli at Rome for Cardinal Riavio. In 1711, when the chapel was being rebuilt, this painting was cut out of the ceiling and placed in the Quirinal palace, where it still remains.

Form, in philosophy, a term used (1) objectively, to denote the assemblage of qualities which makes a thing what it is. Only the essential and permanent is considered, the accidental or adventitious being disregarded. The word is employed also (2) subjectively, to express the idea which the mind may supply of an object, as distinguished from that object as it is in itself. In this sense it is peculiar to the philosophy of Kant, who postulated two such ideas, namely space and time, supplied to the object by the mind through the operation of experience.

In botany, the term used to designate the unit of ecology, as that division of the study which treats of the relations existing between plants and their environments is now called. The word is frequently met with in such combinations as "form of vegetation" or "plant form." See BIONOMICS; PLANT GEOGRAPHY.

In music, that theory in the general art of composition in accordance with which themes, tonalities, phrases, and sections are so arranged as to obtain a correlated and symmetrical whole. The principal three recognized forms are those of the *lied, rondo,* and *sonata.* These admit of numerous variations. In so-called cyclical forms, as, for example, the symphony, the necessary correlation and symmetry is secured by the relation of the movements as to proportion and key, the succession of various tempi, and sometimes also the employment in one movement of a theme previously used in another.

Formâ Pauperis, fôr'ma pâ'pėr-is, **In,** signifying — in the character of a poor person — is the legal term both in Great Britain and the United States for suits carried on by individuals who are too poor to pay the usual fees. As early as the reign of Henry VII., a statute provided that any one taking oath that he was not worth £5 beyond his wearing-apparel and the subject in dispute, was entitled to have writs, according to the nature of the case, without paying fees, and the judges were to assign him counsel and attorney who should act gratuitously. This indulgence is granted to plaintiffs only at common law, and is granted to defendants only in prosecutions. A plaintiff must have a counsel's certificate of a good cause of action, and an affidavit of the party or his attorney must be laid before court that the case contains a full and true statement of material facts. A person admitted to sue *in formâ pauperis* is not entitled to costs from the opposite party, unless by order of the court or of a judge. In several of the United States the provision is governed by statute, while in others it is considered part of the common law.

Formaldehyde. See BACTERICIDE; DISINFECTANTS; FUMIGATION.

Form'alin, a solution produced by dissolving in 60 per cent of water 40 per cent of what is known as formaldehyde gas, CH_2O. This solution has hitherto been looked upon as a powerful disinfectant. Dr. Charles C. Barrows has recently employed formalin as a specific for sepsis or blood poisoning. The patient was a colored woman, 26 years of age, who was on the point of death; the virulent bacteria of septicæmia, streptococci, had been recognized in her blood, her pulse ranged from 150 to 160 and her temperature was 108. Into one of the large veins of the right arm an attempt was made to inject one litre of formalin solution of the strength of one part of formalin to one thousand parts of water. About 500 cubic centimetres of the solution found its way into the circulation. The temperature fell almost immediately and the pulse showed an instantaneous improvement. The day after another injection was made and examination showed that bacteria were no longer present in the blood. A third injection into the patient's left arm introduced 750 cubic centimetres into the circulation. The temperature fell to normal, no more bacteria were developed and the woman recovered rapidly.

For'man, Harry Buxton, English author: b. London 1842. He entered the Civil Service in 1860 and is an assistant general secretary at the General Post-office, London. Besides editing the poems of Shelley (1876–80), of Keats (1883) and other works, he has published: 'Our Living Poets' (1871); 'Elizabeth Barrett Browning and Her Scarcer Books' (1896); 'The Books of William Morris' (1897).

Formation, in geology, a term used of groups of rock, whether stratified or unstratified, having a similar origin or character. Thus it is usual to speak of a limestone, a sandstone, or a clay formation. The word has also been by some extended to be synonymous with system, or to denote a group of strata of the same age, as Canadian series, Carboniferous system, etc.

Formen'to, Felix, American surgeon: b. New Orleans, La., 16 March 1837; d. there, 4 June 1907. He studied at Jefferson College, Louisiana, and the University of Turin, Italy, and was a surgeon in the Franco-Sardinian army during 1859, and in the American Civil War was chief surgeon of the Louisiana Confederate hospital at Richmond, Va. At one time he was president of the American Public Health Association, later president of the Confederation of State and Provincial Boards of Health of North America, and in 1898 was appointed surgeon to the Louisiana Soldiers' Home. His publications include monographs on cremation, military surgery, alcoholics, etc.

For'mes, Karl Joseph, German-American operatic basso: b. Mülheim-on-the-Rhine, Germany, 1810; d. San Francisco, Cal., 1889. He made his first appearance at Cologne in 1841 as Sarastro in Mozart's 'Flauto Magico.' He quickly obtained an European reputation, and after connection in 1852–7 with the London Royal Italian Opera, came to the United States, where he was received with much approval and remained during the greater part of his life.

For'mic Acid, a monobasic organic acid having the formula CH_2O_2, or H.COOH, the final H in the last of these formulæ being the one that is replaced when the acid combines with bases to form its salts (which are known as "formates"). It is an important substance in organic chemistry, and may be obtained by the oxidation of methyl alcohol, as well as of starch, sugar, and other organic substances. The most convenient method of preparing the acid is by heating anhydrous glycerin with crystallized oxalic acid. The reaction is not a simple one, monoformin being one of the intermediate products; but the obvious part of the reaction is that the oxalic acid is converted into formic acid with liberation of carbon dioxid. Pure anhydrous formic acid is a pungent, colorless liquid, boiling at about 212° F. at ordinary atmospheric pressure (its vapor burning with a bluish flame), and freezing at about 47° F. into a white crystalline mass. Formic acid is completely resolved by strong sulphuric acid into water and carbon monoxid, $H.COOH = H_2O + CO$. It reduces Fehling's solution (q.v.), and also reduces gold and platinum to the metallic state, from their solutions. When boiled with the nitrates of silver and mercury, formic acid precipitates these metals in the form of grayish metallic powders.

Formic acid and its salts are used to a certain extent as disinfectants and preservatives. The acid takes its name from the fact that it exists, in the free state, in the bodies of red ants (*Formica rufa*), from which it may be obtained by crushing the ants and distilling the mass with water.

Formica, fôr-mī'ka; **Formicidæ**, fôr-mĭs'ĭ-dē, the genus and family respectively which contain the typical ants. See Ant.

Formicariidæ, fôr"-mī-ka rī'ī-dē, a family of small, tropical American birds, the so-called «ant-birds.» They are numerous in genera and species, are related to the tree-creepers and plant-cutters, and frequent forests and thickets, flying badly from the shortness of their wings and consequently feeling most at home on the ground, where they devour beetles, spiders, and insect larvæ and berries, but are not known to eat ants at all. The nests are usually made in low bushes. They wear sober colors, as a rule, and the sexes are similar.

Formigé, Jean Camille, zhoṅ kä-mēl fōr-mē-zhā, French architect: b. Bouscat, Gironde, 1845. He was a pupil of Laisné, and received from the French government a commission for a series of plans for, and restorations of, public structures; the latter including the Roman theatre at Orange, Vaucluse. He executed decorations in the Paris Hôtel de Ville, became architect of Paris streets and parks in 1885, built the Liberal Arts and Fine Arts buildings at the Paris Exposition of 1889, and the buildings of the Rumanian government at that of 1900.

Forming Machines, a term has been applied generally to the lathe, planer, shaper, and all that class of tools used by the machinist to produce the parts of machines that he manufactures. It has also been used to designate presses used for drop-forging, and for shaping metal in the cold, particularly to drawing-presses that receive a sheet of metal, grip it between two surfaces and then subject a part of it to slow pressure until it is drawn out to a cup-shape or the like, if properly done without any wrinkling. A form of rope-twisting machine is also known as a forming machine as well as a machine for forming tin cans. See Forging and Press.

Formosa, fôr-mō'sä, called by the Chinese *Taiwan*, an island lying off the coast of the Chinese province of Fu-chien, from which it is separated by a strait from 90 to 220 miles wide. Formosa, which was ceded by China to Japan in 1895, is crossed by the meridian 121° E. and the tropic of Cancer, and has a maximum length of 235 miles, while its breadth varies from 70 to 90 miles; area, 14,978 square miles. Forming one link in the volcanic chain that extends from the Aleutian Islands southward to New Guinea, it constitutes the eastern escarpment of what was once the great Malayo-Chinese continent, and is connected by a submarine plateau with the Chinese mainland. The backbone of the island, extending north and south, is formed of a range of densely wooded mountains, called by the Chinese Chu-Shan, which rise to upward of 14,000 feet, the highest known peak, Mount Morrison, being given as 14,362 feet. Eastward of this range lies a narrow strip of mountainous country, presenting to the Pacific a precipitous cliff-wall with in many places a sheer descent of from 3,000 to 7,000 feet, while a very short distance farther east the floor of the ocean sinks to a great depth at an extremely steep gradient. The western side of the range consists of a single broad alluvial plain, stretching from north to south of the island, seamed by innumerable water channels, and terminating at the coast-line in mud flats and sand-banks. Yet on this side of the island the land is rapidly encroaching upon the sea, as the consequence of the gradual elevation of the western seaboard and the deposition in and around the embouchures of the rivers of the large amount of sediment brought down by them from the mountains. This latter process is primarily due to the heavy rainfall of the northern, central, and eastern portions of the island, where the rain-clouds of the northeast monsoon, after crossing the warm Kiosiwo, or Japanese Gulf Stream, on coming in contact with the mountain barrier of the island become chilled and discharge their contents in rains of excessive violence. Apart from this heavy rainfall, the climate is not exceptional, the insular position ensuring a modification of the heat by sea-breezes. The mean of summer is 80° to 90° F.; of winter, 50° to 60°. Malarial fever is, however, prevalent in the north, and violent typhoons are very common at certain seasons.

The island is famous for the luxuriance of its vegetation; many of the hothouse plants of warm temperate climes grow wild on the mountain slopes and in the valleys, such as orchids, azaleas, lilies, rhododendrons, and convolvulus; besides which there is a profusion of ferns, tree-ferns, camphor- and teak-trees, pines, firs, wild fig-trees, liquidambars, bananas, bamboos, palms, indigo and other dye plants, fibre and paper plants, oil and soap plants, tobacco, coffee, and tapioca. «Rice paper» is prepared from the pith of a tree peculiar to Formosa. Of animal life it is noticeable that there are at least 43 species of birds peculiar to the island, that insects are scarce and that noxious wild animals are few; but that fish is plentiful near the coast. The resemblance of the animals found on the island to those on the mainland is one reason for believing there was once a land connection. However there are a number of animals on the island which appear to be of quite a different species from those found in China. This is especially true of some of the birds, mice, squirrels, and deer. The chief minerals are coal, of which there is a large supply, gold, salt, petroleum, and sulphur. Agriculture is an important industry, but the people engaged in mining are becoming more numerous.

Since the treaty of Tien-tsin, in 1858, there have been ports open for foreign commerce; those opened in accordance with the conditions of the treaty are: An-ping, Tainan, Takow, and Tam-sui. An-ping and Tam-sui have the largest amount of commerce. The principal exports are camphor, tea, rice, sugar, jute, hemp, and dyewoods. The chief imports are a coarse cloth for clothing, opium, fruits, lumber, metal goods, and manufactured tobacco. The most of the trade is with Japan. Formosa controls the camphor markets of the world. The eastern slope of the mountains is covered with the largest camphor forest yet discovered. The amount of camphor exported each year from the forests of China and Japan is about 500,000 pounds; and from

Formosa alone there is shipped between 6,000,000 and 7,000,000 pounds. Since Formosa was annexed to Japan, the Japanese government has made most successful efforts to preserve the sources of supply of camphor. When the island belonged to China the camphor-trees killed to collect the gum were not replaced and the camphor forests were being destroyed. The Japanese government insists that for every tree destroyed another one must be planted; and it is also establishing camphor plantations, so that in future the Formosa cultivated camphor will be a commodity of commerce. The price of the camphor varies because of the dangers incurred in collecting it. Savage tribes which have never been subdued inhabit the camphor forests, and they never hesitate to attack the camphor gatherers unless the latter are well armed and in bands large enough to protect each other. The Japanese government has now a large armed force of policemen, over 1,400, to protect the camphor gatherers, and the cost of protection is added to the selling price of the gum. The sale of the camphor is a government monopoly; it is not difficult to obtain a permit to gather camphor, but every pound must be sold to the Japanese government, which determines the price. Japan limits the amount to be exported, and will not buy a pound in excess of the limit. The cultivation of the tea fields is receiving attention from Japan.

The inhabitants, estimated to number about 3,000,000, consist of Chinese settlers, some Japanese, and the aborigines. Respecting the ethnological origin of these latter there exists some doubt; they seem to consist of several different tribes, mainly of Malayan and Negrito descent. The Chinese distribute them into three classes, Pepohwan, a race of civilized and sinicized agriculturists; Sekhwan, settled tribes who acknowledge Chinese rule; and Chinhwan, the untamed savages of the mountains, who wage fierce and unceasing warfare against the Chinese immigrants. The administrative headquarters were formerly at Taiwan, but on the constitution of the island into an independent province of the Chinese empire in 1887 — it had formerly been incorporated with Fû-chien on the mainland — they were transferred to Tai-pei or Bangka. The island was known to the Chinese before the Christian era, but does not seem to have seriously attracted their attention until the year 605 or 606 A.D. In the 14th century they established several colonies in Formosa, which, however, were withdrawn in the middle of the 17th century. Although Portuguese and Spanish navigators began to visit the island a century earlier, the first European people to establish themselves on it were the Dutch, who in 1624 built Fort Zealandia, near the modern Taiwan. They were, however, expelled in 1661 by a Chinese adventurer, Koxinga, who retained possession of the island for 22 years. Some years later a regular Chinese colonization of the western half of the island was carried through, the colonists coming principally from Fû-chien and Kwang-tung. Subsequently the island became notorious for the piracy of its inhabitants and the ill-treatment they inflicted upon navigators who chanced to be wrecked on their coasts. Accordingly in 1874 the Japanese invaded Formosa; but on the Chinese undertaking to check the evils complained of they withdrew. Ten years later the French, during their contest with China in Tongking, held for a time the coal districts of Kelung. The occupation by the Japanese troops did not take place without opposition from the natives and Chinese "Black Flags," but the Japanese were practically in full possession of the island before the end of 1895, and set themselves at once to the work of reorganization. Consult: Davidson, 'The Island of Formosa' (1903); Guillemard, 'Cruise of the Marchesa'; Girard de Rialle in 'Revue d'Anthropologie' (1885).

Formosa, South America, a province of Argentine, in the northeastern portion of the republic. It has an area of 42,000 square miles, and pop. (1900) 6,000.

Formo'san Deer, a small spotted deer (*Cervus taevanus*), allied to the Japanese sika (q.v.) and a favorite pet among the people of Formosa, who catch the fawns in the mountains.

Formosus, fôr-mō'sus, Pope: b. about 816; d. 896. He became cardinal bishop of Porto in 891 and succeeded Pope Stephen V. in 891. He condemned Photius, excommunicated the Emperor Lambert, Duke of Spoleto, and nominated in his place Arnoul, king of Germania. Stephen VI., his successor, had his body disinterred as that of a usurper, but under John IX., in 898, his pontificate was pronounced valid.

Forms of Address in the United States are neither so complicated nor so rigidly arranged as in countries where careful gradations of rank and title obtain. Usage, however, sanctions the forms given in the following list:

The President of the United States, governors of States ambassadors, and ministers,— "His Excellency."

The Vice-President of the United States, the heads of the executive departments, justices of supreme and superior courts, lieutenant-governors of States, and mayors,— "The Hon. ——."

Senators and representatives of the United States, or of States,— "The Hon. ——."

Ex-presidents, or ex-officials of any of the ranks above cited,— "The Hon. ——."

Archbishops, if cardinals,— "His Eminence the Cardinal Archbishop of ——."

Archbishops, if not cardinals,— "The Most Rev. the Archbishop of ——."

Bishops, in the Roman Catholic and Protestant Episcopal Churches,— "The Right Rev." or "The Right Rev. the Bishop of ——."

Bishops, in the Methodist Episcopal Church,— "The Rev. Bishop."

The designation "Esquire," once chiefly applied to lawyers, is now frequently employed in addressing gentlemen of position.

The forms of address used in foreign countries, particularly those monarchical in government, are arbitrary and elaborate.

Formula, Chemical. See CHEMISTRY.

Form'ulary, National, a volume published by a committee of the American Pharmaceutical Association containing prescriptions with directions for making a large number of widely used combinations of drugs. These combinations have been used in the treatment of disease for many years, and a more extended use of the formulary by the physician would do away with many of the proprietary remedies on the market.

Fornáris, José, hō sā' for-nä'rēs, Cuban poet: b. Bayamo, Cuba, 1826. He wrote the dramas 'The Daughter of the People,' and 'Love and Sacrifice'; and is the author of: 'The Harp of the Home'; 'Songs of the Tropics'; and other volumes of verse.

For'ney, John Weiss, American journalist: b. Lancaster, Pa., 30 Sept. 1817; d. Philadelphia 9 Dec. 1881. He was apprenticed in the office of the Lancaster *Journal* in 1833; was clerk in the National House of Representatives from 1851–5; and secretary of the United States Senate from 1861 to 1868. He was connected with several papers in Philadelphia and Washington. Author: 'What I Saw in Texas' (1872); 'Anecdotes of Public Men' (1873); 'Forty Years of American Journalism' (1877).

Fornix. See BRAIN.

For'rest, Edwin, American actor: b. Philadelphia 9 March 1806; d. there 12 Dec. 1872. In 1820 he made his first appearance in public in the part of Douglas in Home's tragedy of that name, and coming before the New York public in 1826 in the character of Othello, at once gained popularity. In 1836 he crossed the Atlantic and entered on a season at Drury Lane Theatre, London. In the parts of Macbeth, Lear, and Othello he achieved distinguished success, and acquired the friendship of Macready, Kemble, and others. He again visited England in 1845, and on this occasion quarreled bitterly and causelessly with Macready, whom he accused of trying to damage his reputation from professional jealousy. This quarrel crossed the Atlantic, and when Macready was playing in the Astor Place Theatre, New York, in 1849, the partisans of either actor stirred up a riot that was accompanied by serious loss of life. Between 1853 and 1860 he retired from professional life, but when he returned to the New York stage he filled the role of Hamlet with all his former acceptance. Latterly he suffered considerably from illness, and his last engagement was in 1871. He was a man of fine presence, well equipped for his profession, naturally frank and engaging. He left a large fortune. See Rees, 'The Life of Edwin Forrest' (1874); Alger, 'Life of Edwin Forrest' (1877); Barrett, 'Edwin Forrest' (1882).

Forrest, SIR John, Australian explorer and politician: b. Western Australia 22 Aug. 1847. He entered the survey department of Western Australia in 1865, and in 1874 was at the head of a party which explored the interior from Champion Bay on the west to the overland telegraph line connecting Adelaide on the south with Port Darwin on the north coast. After holding various government posts he was returned unopposed in 1890 to the first Western Australia Legislative Assembly for Bunbury, and was premier and treasurer 1890–1901. He was postmaster-general of Australia 1900–1; minister for defence 1901–3; minister for home affairs 1903–4; treasurer since July 1905; and since 1901 has represented Swan in Parliament. His publications are: 'Explorations in Australia' (1876); and 'Notes on Western Australia' (1884–7).

Forrest, Nathan Bedford, American soldier: b. Bedford County, Tenn., 13 July 1821; d. Memphis, Tenn., 29 Oct. 1877. Moving with his father to Marshall County, Miss., he was in a short while, by the death of his father, left to support his mother and family with a small hill farm. He undertook this work with devotion and energy, and, getting into business in Memphis, became able to purchase a large plantation, and was at the outbreak of the Civil War one of the wealthiest planters in Tennessee. Circumstances had forced him to neglect his own education, though he provided liberally for that of his brothers and sisters. On 14 June 1861 he entered the Confederate service as a private in White's mounted rifles, but soon obtained authority to raise a regiment, which he did, purchasing at his own private expense its equipment in Louisville, Ky. These supplies he carried to Memphis, displaying remarkable ingenuity and daring both in eluding the Federal authorities and in defeating a body of their troops with 75 Kentucky Confederates who had come to his assistance. Joining his regiment to the force defending Fort Donelson in February 1862, he was distinguished in the fighting at that point, and, when his superiors had determined upon surrender, led his men through a sheet of icy water past the Federal lines and escaped. Joining Albert Sidney Johnston (q.v.), he was distinguished at Shiloh, where he received a painful wound, which, however, did not long keep him from the field; and by a series of successful movements in Middle Tennessee, then occupied by the Federals, he rapidly rose to great distinction as a cavalry leader, and on 21 July 1862 was promoted brigadier-general. During Bragg's Kentucky campaign he performed great services both on the advance and retreat. Among his most famous exploits in Middle Tennessee was the expedition in which, with less than 1,000 men, he captured McMinville, and, surprising a garrison of 2,000 Federals at Murfreesboro, captured all the survivors of the fight, including Gen. Crittenden. On 8 May 1863 he captured a raiding force of Federals under Gen. Streight, near Rome, Ga., the Federal force being so much larger than his own that he pressed into service all the citizens in reach in order to form an adequate guard.

After highly distinguished service at the battle of Chickamauga, he was so dissatisfied with the failure to reap the full fruits of that great victory that he tendered his resignation. This was not accepted, but, instead, he was promoted major-general and assigned to the command of all the cavalry in West Tennessee and North Mississippi. Entering West Tennessee with a small force, he was reinforced by several thousand hardy volunteers, who, with his veteran troops, were soon welded into an invincible body known as "Forrest's cavalry." In February 1864 he routed Gen. S. Smith at Okatona, Miss.; then swept northward through Tennessee to the Ohio River, capturing Fort Pillow, Union City, and other posts, with their garrisons. In June 1864, with a much smaller force than the enemy, he defeated Gen. Sturgis at Brice's Cross Roads (or Tishamingo Creek), near Guntown, in North Mississippi, capturing all his trains and a third of his men. Gen. A. J. Smith then advanced against him, but after fighting a desperate battle at Harrisburg, near Tupelo, in Mississippi, retreated. Receiving reinforcements from Memphis, Smith advanced again, but Forrest foiled him by making a 60-hour ride to Memphis with half of his force, and by his daring entry into that city compelled Smith's rapid retreat. Then Forrest made havoc with Federal transportation, capturing garrisons and depots in Tennessee, and crowning his exploits by the capture and destruction of $6,000,000 worth of Federal supplies and a gunboat fleet at Johnsonville. Sherman wrote of this as a feat of arms which excited his admiration. Upon Hood's advance into Tennessee, Forrest joined him at Florence and performed important services. As commander of the rear guard of the Confederate army during the retreat from Nashville, his display of heroic qualities and brilliant leadership increased his already great fame. In February 1865 he was promoted lieutenant-general, and to him was assigned the duty of guarding the Confederate frontier from Decatur, Ala., to the Mississippi River. The surrender of the remnant of his command took place on 9 May 1865. During his career he had captured 31,000 prisoners. After the War he returned to civil life.

JOSEPH T. DERRY,
Author of 'The Story of the Confederate States.'

Forrester, Fanny, pen-name of EMILY CHUBBUCK JUDSON (q.v.)

Forsh'ey, Caleb Goldsmith, American engineer: b. Somerset County, Pa., 18 July 1812; d. Carrollton, La., 25 July 1881. He was educated at Kenyon College, Ohio, and the United States Military Academy, was professor of mathematics and civil engineering in Jefferson College, Mississippi, 1836–8, and from 1851–3 was engineer-in-charge of the governmental survey of the Mississippi delta. Though actively opposed to the secession movement, he became lieutenant-colonel of Confederate engineers upon the withdrawal of Texas from the Union. He collaborated in 'The Physics of the Mississippi River' (1861).

Forskål, fôr'skâl, **Peter,** Swedish botanist: b. Helsingfors 11 Jan. 1732; d. Djerim, Arabia, 11 July 1763. In 1761 he was selected by Frederick V. of Denmark to join the scientific expedition to Arabia, to take charge of the department of natural history. He set out on this expedition with Niebuhr, Von Haven, and Kramer, and collected plants in the environs of Marseilles, of which he published a 'Flora' at Malta. Niebuhr collected Forskal's papers, accompanied them with remarks, and published them under the titles: 'Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum, quæ in Itinere Orientali observavit P. Forskal' (1775); 'Flora Ægyptiaco-Arabica, etc.'; 'Icones Rerum Naturalium, quas in Itinere Orientali depingi curavit Forskal' (1776).

Forster, Johann Reinhold, yō'hän rīn'hōlt fôr'stĕr, German naturalist: b. Dirschau, Prussia, 22 Oct. 1729; d. Halle 9 Dec. 1798. In 1753 he became pastor at Nassenhuben, but devoted most of his time to the study of mathematics, natural philosophy, natural history, and geography. In 1772 he received the offer of naturalist to Capt. Cook's second expedition to the South Seas. In association with his son, he published a work on the botany of the expedition, and 'Observations Made During a Voyage Round the World.' He wrote also: 'Introduction to Mineralogy'; 'Flora of South America'; 'Zoology of India'; etc.

Forster, fôr'stėr, **John,** English historical writer: b. Newcastle-on-Tyne, England, 2 April 1812; d. London 2 Feb. 1876. He was educated for the law; held one or two public offices, and finally engaged in literature and journalism and was editor of the London 'Examiner' for nine years. He is best known for his 'Life of Charles Dickens' (1871–4). He also wrote: 'Statesmen of the Commonwealth of England' (1831–4); 'Life of Oliver Goldsmith' (1848); 'Walter Savage Landor' (1869;) etc.

Forster, fôr'stėr, **William Edward,** English statesman: b. Bradpole, Dorsetshire, 11 July 1818; d. London 5 April 1886. He was educated at the Friends' School at Tottenham, and was active in the woolen trade in Bradford. In 1850 he married the eldest daughter of Dr. Arnold of Rugby. In 1865 he became under-secretary for the colonies; in 1868 was appointed vice-president of the council on education and a privy councilor; and in 1870 accepted a seat in Gladstone's cabinet, and carried through Parliament the Elementary Education Bill (1870) and the Ballot Bill (1872). In 1880 he accepted the post of chief secretary for Ireland at a time when that country was distracted by political and agrarian tumults. To mitigate the severity of the numerous evictions he introduced a Compensation for Disturbance Bill (1880), which was rejected by the House of Lords. The following year he introduced a Land Bill and a Coercion Bill, both of which were passed, and in order to check the growing power of the Land League he declared that organization illegal, and imprisoned Parnell and other members of his party. In April 1882 the government resolved to release the Parnellites and adopt a more conciliatory policy, whereupon he resigned his office. Subsequently he was often found acting in opposition to the government, chiefly in reference to foreign affairs, and he was also opposed to a separate Irish parliament in Dublin. His opinion on the latter question carried great weight because of his well-known sympathy for Ireland, his abilities as a statesman, his experience in affairs, and his unquestioned honesty. Consult 'Life of Forster,' by Wemyss Reid (1888).

Forsyth, George Alexander, American military officer: b. Muncy, Pa., 7 Nov. 1837. He served with distinction in the Civil War; was brevetted colonel for gallant services at Five Forks, and brigadier-general in 1868 for his action in an engagement with hostile Indians. He was a member of the board of officers to inspect the armies of Europe and Asia in 1875–6, and on staff and frontier service till 1890, when he was retired on reaching the age limit. He has published: 'Thrilling Days in Army Life' (1900); 'The Story of the Soldier' (1900).

Forsyth, John, American politician: b. Fredericksburg, Va., 1780; d. Washington 21 Oct. 1841. He was graduated at Princeton College in 1799, and was admitted to the bar in Augusta, Ga., in 1802. He was elected attorney-general of the State in 1808, representative in Congress in 1812, and United States senator in 1818. In 1820 he was sent to Spain as resident minister, where he conducted the negotiations concerning the ratification and execution of the treaty by which Florida was ceded to the United States. In 1823 he was again chosen to the House of Representatives, and was one of the main supporters in Congress of Gov. Troup of Georgia in his contest with the national government concerning the removal of the Creek and Cherokee Indians. He became governor of Georgia in 1827, and in 1829 was again returned to the United States Senate. He opposed the South Carolina movement of nullification from its beginning, and voted in favor of Mr. Clay's compromise act of 1833. In the debate in 1834 on the removal of the deposits from the United States bank, he supported the President, who afterward appointed him secretary of state, an office which he retained till the retirement of President Van Buren in 1841.

Fort Adams, R. I., a United States military post established 1841, at Brenton's Point, R. I., near Newport. There was a garrison here during the Revolution. See MILITARY POSTS, U. S.

Fort Anderson. See WILMINGTON, CAPTURE OF.

Fort Ann, N. Y., a village and former fort in Washington County; on Wood Creek and Champlain Canal. The first fort was built here in 1709, rebuilt in 1757. The British captured the fort in 1777, and partially destroyed it. Pop. of village (1901) 430.

Fort Blakely, Siege and Capture of. Fort Blakely was erected by the Confederates as one of the inland defenses of Mobile, on the east bank of the Apalachee River, and opposite its confluence with the Tensas, about 10 miles northeast of the city. It was on high ground and nearly 3 miles in extent, with 9 well-built redoubts or lunettes armed with about 40 guns. In front was a deep and broad ditch, also an abatis. The garrison consisted of Gen. F. M. Cockrell's division of veteran troops and Thomas' division of Alabama Reserves, in all about 3,500 men, under command of Gen. St. John Lidell. On 20 March 1865 Gen. F. Steele set out from Pensacola and, by a circuitous march of 100 miles, reached the rear of the fort 1 April and invested it on the 2d with Garrard's division of the 16th corps, Veatch's and Andrews' divisions of the 13th, and Hawkins' division of colored troops, in all 13,000 men. Gradual approaches were made, accompanied by heavy and constant skirmishing, and by the 8th Steele had portions of his advanced lines within 450 to 600 yards of the works and 28 guns in position. A general assault was made about 6 P.M. of the 9th; there was a severe struggle in overcoming the obstructions in front of the work; but they were carried and the main works taken by assault, with 3,432 prisoners, 40 guns, and 16 battle-flags. The Union loss was 113 killed, 516 wounded. The Confederate loss is not known. The assault on Blakely was the last considerable engagement of the War, and was followed by the fall of Mobile and surrounding forts and by the surrender of the Confederate navy in the harbor. Consult: 'Official Records,' Vol. LI.; Andrew, 'Siege of Mobile.'

E. A. CARMAN.

Fort Bliss, Tex., a former United States military post on the Rio Grande, 3 miles from El Paso, established 1868. For the present post of this name at El Paso, see MILITARY POSTS, U. S.

Fort Bowyer, bō'yėr, Ala. (present site of Fort Morgan), a former United States fort at the entrance of Mobile Bay. It was built in April 1813 and was surrendered to the British 8 Feb. 1815.

Fort Can'by, Wash., a United States military post formerly called Fort Cape Disappointment, established on the north shore of the mouth of the Columbia River in 1864. See MILITARY POSTS, U. S.

Fort Caswell, kaz'well, N. C., a United States military post, established 1825, on Oak Island, Cape Fear River. See MILITARY POSTS, U. S.

Fort Chippewy'an, or **Chipeway'an**, Canada, a trading station on Lake Athabasca, owned by the Hudson Bay Company.

Fort Clark, Tex. See MILITARY POSTS, U. S.

Fort Clinton, N. Y., a fort built on the Hudson River, near West Point, in 1777. It was soon after abandoned.

Fort Collins, Colo., a city and county-seat of Larimer County, on the Colorado & S. R.R.; 74 miles north of Denver. The State Agricultural College is here. Pop. (1900) 3,050.

Fort Columbus, N. Y., a United States military post established on Governor's Island, New York harbor, in 1806. It is the headquarters of the Department of the East and has Castle William, military prisons. See FORTIFICATIONS; MILITARY POSTS, U. S.; MILITARY PRISONS, U. S.

Fort D. A. Russell, Wyo. See MILITARY POSTS, U. S.

Fort Darling (Drewry's Bluff), Attack on, 7 May 1862. President Lincoln, then at Fort Monroe, received a dispatch from Gen. McClellan that his cavalry had made a reconnaissance to Jamestown, on James River, that a Confederate battery at that point had been abandoned, and if it were possible for the Galena and other gunboats to move up James River, it would aid him in his movement up the Peninsula on Richmond. The President directed Flag-officer Goldsborough, if he deemed it proper, to send the Galena and two gunboats. On the morning of 8 May Capt. John Rodgers, with the Galena, Aroostook, and Port Royal, went up the river and engaged two batteries of 10 guns each, one of which he silenced; the other he passed, two Confederate gunboats retiring up the river as he approached. Rodgers worked his way up the river, meeting with no serious opposition until he arrived at Fort Darling, on Drewry's Bluff, eight miles below Richmond, a strong position on the right bank of the river, about 200 feet above it, and mounting five heavy guns, manned by the crews of the destroyed Merrimac and other ships at Norfolk, under command of Captain Farrand, C. S. Navy. The guns were mounted in such position as to give a close and plunging fire upon an advancing vessel. At the foot of the bluff the river had been obstructed by piles and sunken vessels secured by chains, and the shore was lined with rifle-pits, sheltering sharpshooters. Rodgers was now joined by the Monitor and Naugatuck, and on the morning of the 15th ran up and opened fire, the Galena leading and anchoring within 600 yards of the fort. The Monitor could not bring her guns to bear, and the action was principally confined to the Galena, which, after a contest of nearly three and a half hours, withdrew, having been struck 28 times, and losing 24 men killed and wounded. Two of the Confederate guns were dismounted, and Farrand reported a loss of 7 men killed and 8 wounded. Two or three days later, recognizing the fact that the co-operation of the army was needed to carry the position, Goldsborough proposed to McClellan a joint attack, but McClellan preferred waiting until he got his army across the Chickahominy. The Confederates strengthened the position and it remained in their possession until the close of the war, an obstacle to the advance of the gunboats up the James to Richmond, and also to the operation of the army investing Richmond and Petersburg. Consult: 'Naval War Records,' Vol. VII., Allan, 'Army of Northern Virginia.'

E. A. Carman.

Fort Dearborn, a fort built in 1804 by the United States government on the south bank of the Chicago River near its mouth and on the site of the present city of Chicago. At that time the river took a sharp turn to the south just east of the fort and flowed into the lake over a heavy sandbar, which was not capable of being crossed by anything larger than a small boat, and all large vessels bringing supplies to the garrison were compelled to anchor outside and land their passengers and cargoes in small boats. The site of the fort was on a reservation of six square miles which by Wayne's treaty with the Indians, made at Greenville in 1795, had been set aside from the United States. It was named in honor of General Henry Dearborn (q. v.), then Secretary of War.

The fort consisted of a stockade with two block-houses, built in the fashion of all military posts of that period which were situated on the frontier in the vicinity of Indian tribes. The quarters of the garrison were inclosed within the stockade and the first garrison consisted of one company of infantry (of the First regiment).

The growth of the settlement at Fort Dearborn was not rapid until after the War of 1812, owing to the numerous depredations of the Indians upon the white settlers and to the fact that it was so far in the wilderness, being reached from Detroit by a trail through the woods and from Mackinac by lake schooners, generally one in the spring and one in the fall.

Fort Dearborn owes its notoriety, however, to the massacre which occurred near there on 15 Aug. 1812. The second war with Great Britain had broken out and in the beginning in the northwest all the advantage lay with the British forces and their Indian allies. Mackinac had been captured, thus securing control of the upper lakes to the British, and the American government, apprehensive that a post among the Indians, so far from the frontiers, could not be successfully maintained, thought best to abandon it. Accordingly, General William Hull, in command at Detroit, issued orders to Captain Nathan Heald, in command of the garrison, to evacuate the fort and that the surplus stores should be divided among the Indians. These orders were executed and on 15 August the garrison and a body of supposedly friendly Miami Indians, escorting a number of women and children, marched out of the fort and set out for Detroit by a road which wound along the lake shore. At a point among the sandhills about two miles from the fort an ambushed band of about 500 Potawatomie Indian savages, in conjunction with the party of Miami who accompanied the troops, attacked the little expedition and the whole body of whites were either captured or killed. Two of the women and 12 children were butchered during the fight, and a number of the wounded men were killed afterward, but some were fortunate enough to be ransomed later. The Indians then sacked the fort and burned it.

In 1816 after peace was concluded the fort was rebuilt under Captain Bradley and its outlines were much extended, under the protection of its larger garrison a small village springing up. In 1823 the fort was again evacuated, but continued to be occupied from 1828 to 1837 when, the Indians having left the country, it was again abandoned, and finally, in 1856, destroyed.

Fort de France, fōr dé frāṅs, or *Fort Royal*, fōr-rwä-yal, Martinique, French West Indies, a town, seaport and capital of this island of the Lesser Antilles, which, except Guadeloupe, is the largest in the Caribbean chain. It is situated in the southwestern part of the island and on the north side of a deep and well-sheltered bay protected by a fort. The city is important as it is the military and naval headquarters and rendezvous in the French Antilles, the Governor's residence, and the terminus of the French transatlantic steamers, and the West Indian cable system. The principal buildings are the parish church, government offices, the barracks, arsenal, prison, and hospital. Fort Royal is the residence of the French Governor. There is a law school in the city. In the public gardens is a statue of the French Empress, Josephine, who was born in Martinique. In 1839 Fort de France was partially destroyed by an earthquake, and in 1890 fire nearly consumed the entire city. The eruption of Mont Pelée (q. v.), in May 1902, did no material damage to the city, but it became the distributing centre for the supplies sent to the island from outside sources. Pop. (1903), 22,164.

Fort De L'Écluse, fôr de lā'kluz', a fortress in the Department of Ain, France, on the Rhone River, west of Geneva, standing upon a crag 1,385 feet high, at the foot of Mont Credo, which commands the passage of the Rhone River from Switzerland through the defile of the Écluse. It was erected by the Dukes of Savoy, and during the 16th century was repeatedly the object of attacks by the Swiss armies, and was several times destroyed. During the reign of Louis XIV. it was rebuilt by Vauban at the King's command, but in 1815 was captured and demolished by the Austrians. Again coming into French possession it was completely restored and since then the fortifications have been remodelled and much strengthened.

Fort Dodge, Iowa, a city and county-seat of Webster County; on the Des Moines River, and on the Illinois C., the Chicago G. W., and the Minneapolis & St. L. R.R.'s; 135 miles east of Sioux City, 200 miles west of Dubuque, 85 miles north of Des Moines, and 200 miles south of Minneapolis.

Industries.— The city has many natural advantages, being an important railroad centre (the railroad shops employing, on an average, 1,200 men); in the vicinity are large deposits of coal, gypsum, and potter's and brick clay; and it is the jobbing centre for the surrounding territory. Among the industries are a shoe factory, oat-meal mill, several plaster mills, brick plants, pottery works, boiler works, and foundries.

Public Works, Institutions, Buildings, Etc.— The educational facilities comprise high and public schools, parochial schools, Tobin College, and Elmwood school. Nearly all religious denominations are represented in the city. Among the notable public buildings are the County Court House, Government Building, and Public Library. There are five banks in the city, with a combined capitalization of $475,000.

History, Government, and Population.— Fort Dodge was first settled in 1854 by Major William Williams, became a borough in March 1854, and was incorporated as a city in 1869. The affairs of the city are administered by a mayor, city solicitor, and city treasurer, and a council of eight members, four of whom are elected each year. The city owns and operates the water-works. The predominating foreign nationalities represented in the population are Scandinavians, Germans, and Irish-Americans. Pop. (1900), 12,162. C. F. DUNCOMBE,
Editor of 'The Chronicle.'

Fort Donelson, a fort erected in 1861 by the Confederates in Stewart County, northwestern Tennessee, just south of the boundary line between Kentucky and Tennessee, on the left bank of the Cumberland River, and about 63 miles northwest of Nashville, and 12 miles from Fort Henry. It was on a hill 120 feet above the level of the river and, having a line of rifle pits 2½ miles in extent to defend the land approach, and three heavy batteries commanding the river, it was considered one of the best fortified posts along the Confederate line of defense in the Mississippi valley. Here, on 13–16 Feb. 1862, an important battle was fought between General Grant in command of the Union forces, and General Buckner in command of the Confederates, finally resulting in the surrender of the fort by Buckner, together with 57 guns, 14,500 men, and immense quantities of provisions and munitions of war. See FORT HENRY AND FORT DONELSON.

Fort Douglas, a United States military post in Utah, on the Union Pacific R.R., three miles east of Salt Lake City and 37 miles from Ogden. It was established in 1862, occupies a reservation of over 9,000 acres at the base of the Wahsatch Mountains, and has quarters for about 500 soldiers.

Fort Dupont, a United States military post in New Castle County, Delaware, opposite Pea Patch Island. It occupies a reservation of about 175 acres and has quarters for two companies of infantry.

Fort Du Quesne, a colonial fort in Pennsylvania erected at the confluence of the Allegheny and Monongahela rivers and upon the site of the present city of Pittsburg (q. v.). It was begun in February 1754 by a force of Virginians under Captain William Trent, and Ensign Ward, who had been sent forward by Governor Dinwiddie, of Virginia, to erect a fortification of sufficient size to be a warning to the French against further intrusion on English territory. On 17 April, before the work had been completed, the Virginians were attacked by a force of 700 French and Indians and were compelled to leave the fort, which was then enlarged and completed by the French, who named it Du Quesne. Near the fort, on 9 July 1755, took place the terrible defeat of the British General Braddock (q. v.), who was ambushed there by a detachment of French and Indians, while on his way to retake the fort from the French. The fort and surrounding territory remained in the possession of the French until 25 Nov. 1758, when General Forbes, leaving Philadelphia early in July in command of an army of 10,000 British and Colonial troops, with a few Indian allies, met Colonel George Washington (q. v.), and together captured it, not, however, till the French had fired it and fled. It was then, at Washington's suggestion, renamed "Pittsburgh," in honor of the British Prime Minister, William Pitt.

The fort was occupied for the winter by a small garrison, and in 1759 General Stanwix built Fort Pitt, which was the scene of many engagements during the Indian wars, and the French and Indian War. During the period of Pontiac's Conspiracy in 1763 the Indians besieged the fort, then under command of Captain Ecuyer, from 22 June to 6 August, but were twice defeated by the troops from the fort, and were finally driven off by a force of 500 British regulars under Colonel Henry Bouquet, who had been sent by General Amherst. Bouquet, a short time afterward, built a brick blockhouse not far from the fort, and this "Old Blockhouse," which is still standing, is the only remnant of the extensive fortifications erected by the British during their occupancy of the vicinity till the outbreak of the American Revolution. This remnant is now owned and is being preserved by the Daughters of the American Revolution. See COLONIAL WARS IN AMERICA, *1755-63, Seven Years War; 1758, Louisburg . . . Du Quesne; 1763-4, Pontiac's War.*

Fort Edward, N. Y., colonial, on the upper Hudson at its great bend, where stands the present village of Fort Edward; known as the Great Carrying Place during the 17th and 18th centuries (that is, to Lake George and Lake Champlain), and an obvious advanced post for Canadian wars. Francis Nicholson built a stockade there for that purpose in 1709; it rotted away in disuse, but in 1755, at the opening of the French and Indian War, Phineas Lyman began another called by his name. It was finished by Col. Eyre under Sir William Johnson, who after the battle of Lake George (q. v.) renamed it Fort Edward, after the Duke of York, grandson of George II. In 1757 it was raided from Canada and 11 soldiers killed. Later, the survivors of the massacre of Fort William Henry (q. v.) were sent here by Montcalm, and shortly afterward several thousand militia flocked thither to the rescue, but had to be sent home as arriving too late. In March 1758 an expedition from there under Major Robert Rogers was nearly destroyed by the Indians. During this period Fort Edward was known to the French as "Fort Lidius" or "Lydius." Jane McCrea (q. v.) was living in a little settlement near the fort, when she started on her ill-fated journey 27 July 1777 to meet her lover in Burgoyne's camp. After her death she was buried near the "black house" at Fort Edward Centre. Her remains were removed in 1823 or '24 to the old Fort Edward Cemetery; in 1852 her remains were again exhumed and buried in the Union Cemetery between Fort Edward and Sandy Hill. The Jane McCrea Chapter, D. A. R., has erected a marker at Fort Edward near the spot where she was killed. In the Revolution the old fort was successively the headquarters of Schuyler, Burgoyne, and Stark. Consult Parkman, 'Montcalm and Wolfe' (1884), 'Fort Edward in 1779-80,' 'Historical Magazine' 2d series Vol. II. (187). Fort Edward village is located on the Delaware and Hudson Railroad, Champlain Canal, and Hudson Valley Railway. Here through a system of locks the Glens Falls Feeder empties into the Champlain Canal. The manufacture of pulp and paper constitutes the principal industry of the village, and here are large mills of the International Paper Co. Trust. It is noted as the home of the Fort Edward Collegiate Institute, has a good union school system, a flourishing national bank, and five churches. Fort Edward possesses many points of interest to the antiquarian and historian on account of its intimate connection with the events of the French and Indian, and the Revolutionary Wars. Pop. (1900) 3,521.

James A. Holden.

Fort Erie, Canada, a post village in Welland County, Ontario, on Lake Erie at the head of the Niagara River, opposite Buffalo, N. Y., with which it is connected by a railroad bridge. Three railways enter the town which is a port of entry and has an American consulate. Pop. (1900) 1,000. The present town stands upon the site of old Fort Erie which was the scene of considerable fighting during the War of 1812. On 28 May 1813 the British forces abandoned the fort and partially demolished it and during the next few months, with the varying fortunes of war, it was held alternately by the American and British forces. Early in July 1814 Major-General Jacob Brown (q. v.) with 5,000 troops backed by 4,000 New York militia, which had been ordered out and authorized for the war, invaded Upper Canada from Buffalo and one of his first objects of attack was Fort Erie which surrendered to him on 3 July. Two days later at Chippewa he successfully attacked General Riall with a loss of 511 men killed and wounded. After the bloody battle of Lundy's Lane (q. v.) on 25 July, fought between the American Generals Brown and Winfield Scott and the Canadian General Sir Gordon Drummond (q. v.), the American forces, numbering about 2,000 men, under command of General Ripley (both Brown and Scott having been wounded), were forced to return to the fort, having suffered a loss of 743 men as against a British loss of 878. The American forces were shortly afterward (7-14 August) unsuccessfully attacked by Drummond, who, after an almost constant bombardment during the seven days, retired with a loss of 500 men. Brown was, however, blockaded within the walls of the fort until September. The fort remained in possession of the Americans till 5 November, when, upon retiring from Canada, they blew up the fortifications and they were never subsequently rebuilt. See United States — the War of 1812.

Fort Ethan Allen, a United States military post located near Essex Junction, Vt., about five miles east of Burlington, occupying a reservation of 761 acres. It was established in March, 1893, has accommodations for about 800 troops, and was designed to form a link in the chain of military posts along the northern frontier of the United States.

Fort Fisher, in North Carolina, erected by the Confederates on the peninsula between Cape Fear River and the Atlantic to defend the entrance to the port of Wilmington, was one of the most formidable earthworks on the Atlantic coast and was built to withstand the heaviest artillery fire. Its parapets were 25 feet thick, with an average height of 20 feet, and mounted 44 heavy guns. At the close of 1864, when it was determined by the United States forces to reduce it and close the port of Wilmington to blockade-runners, it had a garrison of 1,400 men, under command of Col. William Lamb. The combined naval and army expedition sent against it was under command of Admiral D. D. Porter and General B. F. Butler. Porter's fleet of about 150 vessels, the largest that had ever sailed under the Union flag, left Hampton Roads 13 Dec. 1864 and arrived in sight of the fort on the 20th. As a preliminary to the attack the old steamer Louisiana was loaded with 215 tons of powder which was to be exploded under the walls of the fort, with the expectation that the explosion would dismount the guns, level the works, and demoralize the garrison, thus allowing the troops to land and easily take the work. At 1:40 A. M. of the 24th, without notifying Butler of the fact, when the Louisiana was within 300 yards of the beach and 400 yards of the fort, the powder was exploded, but did no damage, scarcely disturbing the slumbers of the garrison. At daylight the fleet ran in, and at 11 o'clock opened a furious fire, which was continued several hours, doing no material damage, and was responded to with spirit and effect. On the 25th the bombardment was renewed and under cover of it Butler landed 3,000 men two miles above the fort, and was assured by Porter that the navy had so completely silenced the work that all he had to do was to march his troops into it. But Butler and Weitzel, who was in immediate command of the troops, after a careful reconnaissance found the fort uninjured, deemed it unadvisable to attack it, re-embarked the men, and returned to James River to assist in the siege of Petersburg. Porter's fleet lost 83 men killed and wounded. The Confederates had 58 killed and wounded. The failure to take the fort produced great disappointment; it is now generally conceded that Butler and Weitzel acted wisely in not making the attempt. A second expedition against the fort sailed 12 Jan. 1865, and on the 13th 8,000 men were landed under Gen. A. H. Terry, who had been designated to command the land forces, which, as before, were under the immediate command of Gen. Weitzel. At 3.30 P.M. the fleet stood in and began a furious bombardment, which was continued next day, causing a loss to the garrison of 200 men, and silencing many of the guns. A combined naval and land attack was planned for the 15th, and 1,600 sailors and 400 marines were landed to co-operate with the army. The fleet opened fire at 9 A.M. and continued it until 3 P.M., when 50 steam-whistles from the fleet gave the signal for the land assault. The naval column, armed with cutlasses and pistols, charged the right flank or sea-face of the work, reached its foot, and those in advance began to climb the parapet, but the Confederates mounted on it repulsed them, and the entire body retreated in disorder with a loss of 82 killed and 269 wounded. The army was more successful; advancing on the left flank or land-face of the work, it forced a lodgment, and after a hard struggle, which was continued far into the night, carried the entire work, capturing, as reported by Gen. Terry, about 2,000 men, with a loss of over 900. The Confederate defense of the fort was one of the most gallant of the War, and cost them about 500 killed and wounded. The Union loss, army and navy, was 266 killed, 1,018 wounded, and 57 missing. The fall of Fort Fisher closed the port of Wilmington, and was soon followed by the fall of that city. Consult: 'Official Records,' Vol. XLII.; 'Naval War Records,' Vol. XI.; Ammen, 'The Atlantic Coast'; Maclay, 'History of the Navy,' Vol. II.; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

E. A. Carman.

Fort Gaines and **Fort Morgan.** Fort Gaines was a walled work on Dauphine Island, at the western entrance of Mobile Bay, and with Fort Morgan, a much larger work, on Mobile Point, nearly four miles distant, at the eastern entrance, was seized by the governor of Alabama 5 Jan. 1861. Both forts remained in Confederate possession until August 1864, at which time Fort Gaines had 30 guns. Fort Morgan was armed with over 40 guns, and had a mortar battery in front of seven heavy guns. Admiral Farragut attacked and passed both works when he ran into Mobile Bay, 5 Aug. 1864, and virtually destroyed the Confederate squadron. Gen. Gordon Granger landed troops on Dauphine Island on the 4th and began to invest Fort Gaines; on the 6th Farragut shelled it, and on the 7th the fort and its garrison of 818 officers and men surrendered. Fort Morgan held on longer, but Granger transferred his troops from Dauphine Island to the rear of the fort, invested it, got 34 guns in position to bear on it, and on the morning of the 22d, in co-operation with Farragut's fleet, opened his guns upon it, and kept up a continuous fire until the morning of the 23d, when the fort surrendered to Farragut.

E. A. Carman.

Fort Garry, Canada. See Winnipeg.

Fort George, Canada, a former fort on the Canadian side of the Niagara River. On 27 May 1813 it was captured by the American forces under Col. Winfield Scott. On 10 Dec. 1813 the fort was evacuated by Gen. McClure. See Fort George, Battle of.

Fort George, Battle of, 27 May 1813, in the War of 1812. The fort was near the mouth of the Niagara River, on the Canada side, nearly opposite Fort Niagara, and was garrisoned by about a thousand British regulars and several hundred militia under Gen. Vincent. The American force of some 4,000 undertook to take it in rear and capture the garrison; the nominal commander was Morgan Lewis, the real one Winfield Scott. The forces were landed from the fleet, nominal commander Chauncey, real one Oliver Hazard Perry, and a joint attack was made. The fleet enfiladed the beach; Scott advanced along the shore, and made a flanking movement. Vincent evacuated the fort, spiked the guns, and slowly retreated, parallel to the river, beyond Queenston Mt., losing 51 killed and 305 wounded and missing, from his regulars, while most of the militia were captured. American loss, 40 killed, 120 wounded. The other forts on the river were soon abandoned by the British.

Fort Getty, S. C. See Military Posts, U. S.

Fort Grant, Ariz., a United States military post and reservation at the foot of Mount Graham, established in 1863 by the California volunteers. See Military Posts, U. S.

Fort Greble, R. I. See Military Posts, U. S.

Fort Griswold, Conn. See Fort Griswold, Massacre of; Military Posts, U. S.

Fort Griswold, griz'wōld, **Massacre of,** 6 Sept. 1781. Hearing of Washington's southern march, Sir Henry Clinton, as the only available diversion, sent an expedition against New London, Conn., where a quantity of stores were collected, with slight defense from Fort Trumbull on the New London side and Fort Griswold on the Groton side of the Thames, and which was a nest of privateers that had greatly annoyed the British. Benedict Arnold was selected to head it, as a Connecticut man; an ugly method of making him seal his new allegiance. On taking possession of Fort Trumbull, it became evident that the American shipping would escape unless Fort Griswold were captured also; it was reported unfinished and occupied only by 20 or 30 men, and he ordered an attack on it. Shortly seeing that it was stronger than he supposed, and garrisoned by those who had escaped from Fort Trumbull, and that the ships were escaping up the river, he countermanded the order, but too late. The British detachment of 600 regulars had assailed the fort, where 157 militia had gathered; and after 40 minutes' assault, with the loss of 192 men, the British carried it, and despite the appeals for quarter, massacred nearly the whole garrison. Col. Ledyard, the commander, and 70 others were killed, 60 wounded, 35 mortally, and only 26 escaped unhurt. The British officers, however, did their best to stop the slaughter, and the atrocious story formerly told of the murder of the colonel is fiction. The massacre of garrisons *in terrorem,* to teach them not to defend untenable places, was justified by the European rules of war at the time, but had not been practised in America. Even American officers, however, spoke of it at the time as a regrettable but almost inevitable incident of war.

Fort Hamilton, N. Y., a United States military post at the Narrows, New York Bay, established in 1831. See Military Posts, U. S.

Fort Hancock, N. J. See Military Posts, U. S.

Fort Harrison, Battle of (including Chaffin's Farm, Fort Gilmer, and New Market Heights). In the latter part of September 1864 Gen. Grant ordered a movement against the Confederate troops north of James River, defending Richmond. Grant hoped to make Gen. Lee so weaken the garrison at Petersburg that the Union forces might carry it. The great object, however, was to prevent Lee sending reinforcements to Early in the Shenandoah Valley. September 28, during the night, Gen. Ord crossed from the south to the north bank of the James, and on the 29th, with 4,000 men, driving before him the Confederate outposts, appeared before Fort Harrison, on Chaffin's Farm, the strongest work on the Confederate line. Birney, with 10,000 men, moved by roads farther to the right. Stannard's division, which led the advance of Ord's column, moved to the assault of Fort Harrison, under a very severe fire of artillery and musketry, and after a sharp encounter carried it with its 16 guns and nearly 300 prisoners, at a loss of over 500.

Ord, being severely wounded, the command of his corps fell to Gen. Heckman, whose division, following Stannard's, passed to the right of Fort Harrison, attacked Fort Gilmer, and was repulsed with heavy loss. Meanwhile Gen. Birney had advanced on the New Market road, captured some of the advanced rifle-pits, running northeast from Fort Harrison, and established connection with Heckman. Gen. Grant now appeared and ordered an advance on the right. At 3 P.M. Birney made another assault upon Fort Gilmer, but was badly repulsed. Grant ordered the troops to entrench. Gen. Lee transferred seven brigades from his lines at Petersburg to the north side of the river, and massed 10 brigades at and near Fort Gilmer to assault and retake Fort Harrison. The assault was made at 2 P.M. of the 30th by Gen. R. H. Anderson, commanding Longstreet's corps, with five brigades, and was repulsed. Twice the Confederates re-formed and renewed the assault, but were repulsed, leaving a large number of killed and wounded and seven battle-flags on the ground, and the effort to dislodge the Union troops was abandoned. The Union loss on the 29th and 30th was 383 killed, 2,299 wounded, and 645 missing, an aggregate of 3,327. The loss of the Confederates is not definitely known, but it was near 2,000 in killed, wounded, and missing. Consult: 'Official Records,' Vol. XLII.; Humphreys, 'The Virginia Campaign of 1864–65.'

E. A. CARMAN.

Fort Henry and Fort Donelson. These forts were constructed by the Confederates just south of the boundary line between Kentucky and Tennessee, the former on the right bank of the Tennessee River, the latter on the left bank of the Cumberland; the distance between the two being 12 miles. On 28 Jan. 1862 Commodore Foote and Gen. Grant asked Gen. Halleck's permission to take Fort Henry. Halleck assented, and on the morning of 2 February Foote's flotilla of ironclads and gunboats, followed by a fleet of transports, carrying Grant's troops, left Cairo, anchoring 6 miles below Fort Henry on the morning of the 4th. The fort was defended by 17 heavy guns, and its land approach was covered by rifle-pits held by 3,000 men. Gen. Lloyd Tilghman was in command. About 11.20 A.M. of the 6th Foote steamed up toward the fort and attacked it with four ironclads, Tilghman, with about 90 men to work 11 guns bearing on the river, returning the fire. After a contest of an hour and a quarter Tilghman hauled down his flag and surrendered with 78 men, having lost 16 killed and wounded. The 3,000 men in the rifle-pits retreated to Fort Donelson. The fleet had 29 killed and wounded. Grant, who had landed his troops 6 miles below the fort, arrived too late to take part in the action.

Grant reported to Halleck that on the 8th he would take and destroy Fort Donelson. Foote, however, was compelled to return to Cairo for repairs to his fleet, and the movement was deferred until the morning of the 12th, when Grant marched across the country, with about 16,000 men, arriving before Fort Donelson in the evening. The fort was on a commanding hill, 120 feet above the level of the Cumberland, with three heavy batteries commanding the river, and a line of rifle-pits to defend the land approach. On the morning of the 13th the fort and works were held by 18,000 men, under command of Gen. Floyd. The rifle-pits 2½ miles in extent, were held by Gen. Buckner on the right and Gen. Pillow on the left.

Grant formed his line of investment with Gen. McClernand on the right and Gen. Smith on the left, and at dawn of the 13th opened a furious cannonade and sharp skirmishing. In the evening Foote's flotilla and reinforcements for Grant arrived — Crufts' brigade and several regiments from Fort Henry and Cairo. These were formed into a division of 10,000 men, under Gen. Lew Wallace, and put in the line between McClernand and Smith, raising Grant's force to 26,000 men. At 2 P.M. of the 14th Foote attacked the fort, and at the end of an hour and a half was compelled to withdraw, two of his ironclads being entirely disabled and the other two partially so. He had 54 men killed and wounded. It was then concluded that Foote should return to Cairo and repair damages, while Grant should perfect his investment, fortify his lines, and await the arrival of reinforcements and the return of Foote.

The Confederates shaped the course of events otherwise. They decided to break the right of Grant's investing line and escape by roads leading to Nashville. In pursuance to the plan adopted, Pillow, on the Confederate left, supported by a part of Buckner's command, advanced at daybreak of the 15th, with 10,000 men, and after a hard fight gained the right of McClernand's line and forced it back. McClernand called for assistance and, in the absence of Grant, who had gone to confer with Foote, Lew Wallace sent Crufts' brigade to his support, but the Confederates continued to gain the advantage, pushing back McClernand's two right brigades and their supports. Buckner made an attack upon McClernand's left and was repulsed; but rallying his men, he renewed the attack, and the whole right wing of Grant's army was forced back, the Confederates still following up their advantage, when Wallace threw Thayer's brigade to the right and across their line of advance and, after a sharp fight, checked them, driving some back to their entrenchments. It was 2 P.M. when Grant came on the field to find nearly half his army driven from position and the way open for Confederate escape. He ordered a counter-attack. Smith, commanding on the left, formed a brigade in column, led it under severe fire, and seized the Confederate works in his front and on the high ground surrounding the fort. Wallace and part of McClernand's force, advancing on the right, gained the greater part of the ground lost early in the day, and by night the line of investment was re-established. Grant made preparations to renew the attack early next morning, but during the night the Confederate commanders came to the conclusion that escape was impossible, that Grant was too strong to be beaten, and that nothing remained but a surrender. Floyd, senior in rank, announced personal reasons against a surrender and passed the command to Pillow, who in turn passed it to Buckner. Floyd and Pillow, with the aid of two small steamboats, succeeded in getting away with about 1,200 officers and men, principally of Floyd's old brigade, and Col. Forrest, with some 500 cavalry and other small detachments, escaped in the night by the river road.

At an early hour of the 16th, as Grant was about to renew the attack Buckner sent him a note proposing "the appointment of commissioners to agree upon the terms of capitulation," and suggesting an armistice until 12 o'clock. Grant replied: "No terms except unconditional and immediate surrender can be accepted. I propose to move immediately upon your works." Buckner surrendered 14,500 men, 57 guns, and a large amount of ammunition and stores. The Union loss, army and navy, was 510 killed, 2,152 wounded, and 224 missing. The Confederate loss, killed and wounded, was about 2,000. The capture of Forts Henry and Donelson broke the first line of Confederate defense in the Mississippi Valley, and caused the abandonment of Columbus, Bowling Green, and Nashville. Consult: 'Official Records,' Vol. VII.; Force, 'From Fort Henry to Corinth'; Swinton, 'Decisive Battles of the War'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. I.; Grant, 'Personal Memoirs,' Vol. I.

E. A. CARMAN.

Fort Hindman, or Arkansas Post, Battle of. After Gen. Sherman's failure at Chickasaw Bayou (26–31 Dec. 1862), his army and Admiral Porter's fleet returned to Milliken's Bend, where, 4 Jan. 1863, Gen. J. A. McClernand superseded Sherman in command and moved against Fort Hindman, situated on the north bank of the Arkansas River, 50 miles from its mouth, commanding the approach to Little Rock and protecting the valley of the Arkansas. The fleet, 3 ironclads and 6 gunboats, entered White River, and from it passed through a cut-off to the Arkansas, 9 January. The army of 29,000 men landed about four miles below the fort, a large square-bastioned work, on high ground, at the end of a horseshoe bend in the river, mounting 18 guns, and garrisoned by about 5,000 men, under command of Gen. T. J. Churchill. A line of rifle-pits surrounded it. The ironclads began the attack on the 10th, and the entire fleet, gradually moving up, shelled the Confederates out of the rifle-pits and back into the fort. On the 11th the navy opened a furious fire upon the fort, McClernand's artillery joining in the fire from the land side. Churchill's guns were silenced, and McClernand ordered a general assault. After a severe contest the fort was carried with a loss to the Union army of 134 killed, 898 wounded, and 29 missing. The naval loss was 6 killed and 25 wounded. The Confederate loss was 60 killed, about 80 wounded, and 4,791 captured. On the 12th McClernand received peremptory orders from Gen. Grant to return to Milliken's Bend with his entire command. The prisoners were sent to St. Louis, the fort was dismantled and blown up, and the fleet and troops went down the Arkansas to Napoleon, on the Mississippi. Consult: 'Official Records,' Vol. XXII.; Greene, 'The Mississippi'; Mahan, 'The Gulf and Inland Waters'; Maclay, 'History of the Navy,' Vol. II.; The Century Company's 'Battles and Leaders of the Civil War,' Vol. III.

E. A. CARMAN.

Fort Holmes, Mich. See MACKINAC ISLAND.

Fort Howard, Md. See MILITARY POSTS, U. S.

Fort Independence, Mass. See MILITARY POSTS, U. S.

Fort Jackson and Fort St. Philip. Fort Jackson was built between 1824 and 1832 on the right bank of the Mississippi, about 80 miles below New Orleans. Together with Fort St. Philip on the opposite bank, half a mile above, it defended the city from water attack. Both forts were seized by Louisiana State troops 11 Jan. 1861, were strengthened and garrisoned, and remained in Confederate possession until taken by Admiral Farragut in April 1862, at which time they were garrisoned by about 700 men each. Fort Jackson was armed with 74 guns, Fort St. Philip with 52. In March 1862 Farragut assembled a powerful fleet at Ship Island and at Southwest Pass, at the mouth of the Mississippi, for the capture of New Orleans, and 18 April Commodore Porter, in command of a strong flotilla, opened fire upon Forts Jackson and St. Philip. During six days he threw 16,000 shells, but was unable to reduce the forts.

It was found necessary to run past the forts and destroy the Confederate navy above before New Orleans could be taken. On the 24th Farragut, with 17 vessels, in single line, carrying 192 guns, steamed up the river, engaging both forts with heavy broadsides, of shot, shell, and canister, receiving heavy fire in return. Passing the forts and obstructions, he engaged and destroyed the Confederate fleet, in one of the most spectacular naval battles of the War. Within an hour and a half after leaving its anchorage Farragut's fleet had passed the forts and destroyed 11 Confederate vessels. With 13 of his own vessels Farragut proceeded up the river, and at noon of the 25th anchored before New Orleans, which was abandoned by the Confederate troops holding it, and surrendered by the civil authorities. Porter, who had remained below, continued his bombardment of the forts, which were surrendered on the 28th. The Union loss was 37 killed and 147 wounded. The loss in the forts was 14 killed and 39 wounded; that in the Confederate navy is not known. Consult: The Century Company's 'Battles and Leaders of the Civil War,' Vol. II.; Mahan, 'The Gulf and Inland Waters'; Maclay, 'History of the Navy,' Vol. II.

E. A. CARMAN.

Fort Keogh, Mont. See MILITARY POSTS, U. S.

Fort Lafayette, N. Y. See MILITARY POSTS, U. S.

Fort Leavenworth, lev'en-worth, Kan., a United States military post and reservation, three miles from Leavenworth, established in 1827. There is here a military prison and national cemetery.

Fort Lee, N. J., a former fort in Bergen County, on the west bank of the Hudson River. On 20 Nov. 1776 Gen. Greene and the American forces evacuated Fort Lee, and narrowly escaped capture by 5,000 British under Cornwallis.

Fort Logan, Colo. See MILITARY POSTS, U. S.

Fort McAllister, an earthwork erected by the Confederates at Genesis Point as one of the defenses of Savannah. It was 12 miles south of the city and 6 miles from Ossabaw Sound. On 27 Jan. 1863 Admiral Dupont attacked it with five vessels, and again on 1 February, but without effect. On 3 March three monitors, under command of Commodore Drayton, bombarded it, but did little injury. When Sherman, marching from Atlanta, appeared before Savannah the fort prevented communication between his army and the Union fleet, and Hazen's division of the Fifteenth corps was ordered to assault it. Hazen reached the vicinity of the fort about 11 A.M., 13 Dec. 1864, drove in the Confederate skirmishers, and at 4.15 P.M. had deployed nine regiments within 600 yards of the work. At that time the bugle sounded, and the line went forward over exploding torpedoes and under a close and severe fire of artillery and musketry, carrying the fort at 5 P.M. and capturing its garrison of about 250 men, 22 guns, and a large amount of ammunition. The Union loss was 24 killed and 110 wounded. The Confederate loss was about 50 killed and wounded.

E. A. CARMAN.

Fort McHenry, Md., a United States military post, on the Patapsco River, established in 1794. It was bombarded in 1814 by the British fleet, and was used as a rendezvous during the Civil War. See MILITARY POSTS, U. S.

Fort McPherson, Ga. See MILITARY POSTS, U. S.

Fort Macon, a work commanding Beaufort Harbor, N. C., constructed of brick and stone, and mounting nearly 50 guns. It was seized by Gov. Ellis, of North Carolina, about the middle of April 1861. After Burnside's capture of Newbern, 14 March 1862, Gen. Parke was sent to reduce the fort, then garrisoned by about 450 men. Parke captured Moorehead City and Beaufort, and then proceeded to invest the fort He cut off its communications, planted 11 siege-guns, and at 5:40 A.M. 25 April, in co-operation with four vessels of the navy, opened fire, and at 4 P.M. the fort surrendered with its entire garrison. Parke occupied it next morning and it remained in Union possession until the close of the War.

E. A. CARMAN.

Fort Madison, Iowa, a city and county-seat of Lee County, 18 miles from Burlington, on the Chicago, B. & Q. R.R. Here is the State penitentiary and the Catermole Memorial Library. There was a fort here as early as 1808, but was abandoned in 1832 when the town was established. Pop. (1900) 9,278.

Fort Meade, S. D. See MILITARY POSTS, U. S.

Fort Meigs, mĕgz, Ohio, a former fort on the Maumee River, where the Americans made a gallant defense in 1812 against the British and Indians. See FRENCHTOWN.

Fort Mer'cer, N. J., a former fort at Red Bank, on the Delaware River, that figured somewhat prominently in the Revolution. It was destroyed by the British 20 Nov. 1777.

Fort Mif'flin, Pa., a United States military post on Mud Island in the Delaware River. It was built in 1771 as one of the defenses for Philadelphia. It figured in numerous engagements in the Revolution. It is garrisoned at the present time. See MILITARY POSTS, U. S.

Fort Mims, Ala., Massacre of, a massacre of whites by Creek Indians at the temporary stockade, near Mobile, Ala., 30 Aug. 1813. Over 500 men, women, and children were killed by a large force of Indians under Weathersford, a half-breed.

Fort Monroe, Va., a United States military post at Old Point Comfort, commanding the entrance to Hampton Roads. Jefferson Davis (q.v.) was kept a prisoner here for two years after the Civil War.

Fort Montgomery, N. Y. See MILITARY POSTS, U. S.

Fort Morgan, Ala. See FORT GAINES AND FORT MORGAN.

Fort Moultrie, mōl'tri, S. C. When Major Anderson transferred his garrison from Fort Moultrie to Fort Sumter, 26 Dec. 1860, he spiked and dismounted the 52 guns of the fort and burned the gun carriages. The South Carolina authorities took possession of the fort on the 27th, remounted the guns, strengthened the work, increased its armament, and it became one of the strong defenses of Charleston Harbor, resisting all efforts of the Union fleet to pass it, or reduce it, and remained in Confederate possession until the evacuation of Charleston and all the forts in the harbor 17–18 Feb. 1865. See FORT SUMTER; FORT WAGNER. For early history see FORT SULLIVAN.

Fort Myer, Va. See MILITARY POSTS, U. S.

Fort Necessity. After the capture of Jumonville's force (see GREAT MEADOWS), Washington threw up earthworks and made a stockade fort, which he named as above. It soon became crowded with Indians and colonial companies, and a South Carolina company of regulars under Capt. Mackay; and Washington left the latter in command and moved 13 miles farther on, where was a small settlement. But the place was indefensible; and after summoning Mackay and his men it was decided to retreat to Fort Necessity. The next morning the French were upon them, 900 men besides Indians. Washington led out his men to battle, but the enemy kept off and fired from the woods, in a heavy rain. Washington withdrew his men behind the low, flimsy embankment; and after an entire day of mutual firing, with heavy loss on both sides, the French proposed a parley. The English were at the last extremity, with food and ammunition nearly exhausted, and guns in bad condition; and Washington would not consent to let them send an officer to his camp to observe this, and only yielded when they proposed to have him send one to theirs. The French terms were that the English should retire with all their baggage except artillery, agree to build no more forts beyond the Alleghanies for a year, return the Jumonville prisoners, and leave two officers with the French as hostages. The terms were accepted; but had the French held out a few hours more they could have killed or captured the entire force.

Fort Niag'ara, N. Y. As early as 1669 La Salle built a stockade at the mouth of the Niagara River, and Fort Conti, a fortified trading post was built here 10 years later. In 1686 it was called Fort Denonville and in 1725 it was named Fort Niagara. In July 1759 it was captured by the British and Indians under Johnson (see COLONIAL WARS), and was again captured by the British 19 Dec. 1813.

Fort Ninety-six, S. C. See NINETY-SIX.

Fort Payne, Ala., a city and county-seat of Dekalb County, on the Alabama G. S. R.R. It has large coal and iron industries. Pop. (1900) 1,037.

FORTRESS MONROE, OLD POINT COMFORT, VA.

Fort Pickens, a strong work on Santa Rosa Island, Fla., commanding the entrance to Pensacola harbor, and with Forts Barrancas and McRee opposite, defending the harbor and United States navy-yard at Warrington. Early in January 1861 it was under command of Lieut. A. J. Slemmer and practically unoccupied, Slemmer, with a small garrison, being at Fort Barrancas. Fearing that the secessionists would seize the fort, Slemmer, 10 January, transferred to it his garrison of 81 men from Barrancas, and on the 12th the governor of Florida seized Forts Barrancas and McRee, with 175 heavy guns, also the navy-yard, and demanded the surrender of Fort Pickens, which was refused. A second demand was made on the 15th and a third on the 18th, both of which were refused. Slemmer strengthened the work and held it until relieved by the arrival of reinforcements 12–13 April, when Col. Harvey Brown assumed command. Additional reinforcements were sent, and in June a regiment of New York troops, known as Wilson's Zouaves, was landed on Santa Rosa Island and encamped. On 9 October a body of Confederate troops, that had crossed from Pensacola and landed on the island during the night, surprised the camp of the Zouaves, and drove them back toward Fort Pickens, but the Zouaves being reinforced by four companies from the fort, the Confederates were driven in disorder to their vessels, with a loss of about 90 killed, drowned and wounded. The Union loss was 67 killed, wounded, and captured. No other serious attempt was made upon the fort, which remained in Union possession until the close of the War.

E. A. Carman.

Fort Pillow, constructed by the Confederates on the east bank of the Mississippi, about 40 miles above Memphis. It was bombarded by the Union fleet in its descent of the river and attack upon the Confederate fleet near Memphis, abandoned by the Confederates 4 June 1862, and 5 June was occupied by a small Union force. On 12 April 1864 it was garrisoned by parts of the 2d and 4th (colored) U. S. Artillery, and a detachment of the 13th Tennessee Cavalry, in all 557 men, with six guns, under command of Maj. L. F. Booth. At daybreak of the 12th Gen. J. R. Chalmers, of Forrest's cavalry command appeared before the fort with about 1,500 men, and after some hours of hard fighting drove the Union troops from their advanced rifle-pits back into the fort, which was attacked, and the Confederates repulsed, but securing a sheltered position within 100 yards of it. Forrest had come up while the fighting was in progress, and at 3.30 P.M. demanded the surrender of the fort, saying that he had sufficient force to take it, and would not be answerable for consequences should he be compelled to assault. Maj. Booth had been killed, but in his name an hour was asked for consideration. There were U. S. gunboats in the river, and believing that the request for an hour's consideration was to gain time for reinforcements to arrive, Forrest would give but half an hour. When the time was up the bugles sounded the charge, the assault was made, there was a short and severe struggle, many of the garrison were killed in the fort, and those who attempted to escape by the river were shot or, rushing over the bluff into the river, drowned. More than half of the garrison were killed or wounded, a very large proportion being killed. About 160 white and 40 colored prisoners were taken. The defenders of the fort fought bravely, but were simply overpowered. Forrest says in his report: "The river was dyed with the blood of the slaughtered for 200 yards. The approximate loss was upwards of 500 killed; but few of the officers escaped. There was in the fort a large number of citizens who had fled there to escape the conscript law. Most of them ran into the river and were drowned." Forrest reports his own loss as 20 killed and 60 wounded. Consult: 'Official Records,' Vol. XXXII.; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

E. A. Carman.

Fort Porter, N. Y., a United States military post on the Niagara River in the city of Buffalo. It was established in 1867, but prior to that date the government maintained a defensive work at Black Rock.

Fort Preb'le, Me., a United States military post, at Spring Point, in Portland Harbor, established in 1808.

Fort Pulaski, erected by the United States on Cockspur Island, for the defense of Savannah, Ga., and commanding both channels of the Savannah River. It was a brick work, with walls 7½ feet thick and 25 feet high above water. It was seized by Georgia State troops 3 Jan. 1861, and in January 1862 mounted 48 heavy guns and was garrisoned by nearly 400 men. Gen. Q. A. Gillmore was put in charge of operations to reduce it, and in February 1862 2 regiments of infantry, 2 companies of engineers, and 2 of artillery were landed on Tybee Island, mostly a mud-marsh, lying southeast of the fort, and soon constructed 11 batteries of 36 heavy guns, at distances from the fort varying from 1,650 to 3,400 yards. Causeways had to be constructed across marshes, over which mortars of 17,000 pounds were moved; the work was done entirely at night; all difficulties were overcome; and on 9 April the batteries were ready to open fire, the three breaching batteries being established at a mean distance of 1,700 yards from the fort. At sunrise of the 10th the fort was summoned to surrender; its commander, Col. C. H. Olmstead, replied that he was there "to defend the fort, and not to surrender it." Fire was opened at 8 A.M., and an hour later all the batteries were in full play, the Confederates replying vigorously, the fire continuing on both sides until dark. Firing was resumed at sunrise of the 11th, and the Confederates replied steadily; but by noon several of the guns were dismounted; the walls of the fort began to crumble under the weight of metal; and at 2 P.M. the white flag was raised, firing ceased, and 385 officers and men were surrendered, several of whom were severely, one mortally, wounded. The Union loss was one man killed. The result of the fall of Fort Pulaski was the closing of the Savannah River to blockade runners.

E. A. Carman.

Fort Riley, Kan., a United States military post on the Kansas River, near Junction City, Kan. It was established in 1852 on a reservation of 19,000 acres and was first called Camp Centre. It is about 140 miles from Fort Leavenworth, with which place it is connected by a military road completed in 1854. An appropriation of $100,000 was made by Congress in 1855 for the extension of this road to Bridger's Pass, between Nebraska and Utah, making it one of the finest roads in the country. The fort is the seat of the United States Cavalry and Field Artillery School and has accommodations for a large force of cavalry and infantry.

Fort Robinson, a United States military post in the Red Cloud Agency, situated in the western part of Dawes County, Nebraska, and on a fork of the White River, about three miles southeast of Crawford. The post dates back to 1874 and occupies about 20 square miles. There are accommodations for over 500 troops, with stables for the same number of horses.

Fort Royal, West Indies. See FORT DE FRANCE.

Fort Saint David, a town in the presidency of Madras, Hindustan, on the Coromandel coast, situated on the Tripapolore River, about 12 miles south-southwest of Pondicherry. It was besieged by the French in 1746, but withstood the siege and finally forced the French to retire. It remained in possession of the British and was the capital of their possessions in that section of India until 1750, when the French army under Gen. Lally again attacked the fort, this time with success, and razed the fortifications.

Fort St. Philip, La., a fort lying on the Mississippi River about 80 miles below New Orleans and nearly opposite Fort Jackson. The Spaniards originally built the old river front and it was not until the War of 1812 that the works were entirely enclosed by the United States government. Extensive alterations were made by the government after 1841. At the outbreak of the Civil War it was taken by the Confederates, but fell before the attack of Admiral Farragut's fleet in April 1862. See FORT JACKSON AND FORT ST. PHILIP.

Fort Sam Huston, hŭs'tŏn, Texas, a United States military post near San Antonio, established in 1865. There is a reservation here of 469 acres.

Fort Sanders. See KNOXVILLE, SIEGE OF.

Fort Schuyler, New York harbor. See MILITARY POSTS, U. S.

Fort Schuyler (Old), N. Y. See FORT STANWIX; ROME, N. Y.

Fort Scott, Kan., city and county-seat of Bourbon County; on the Marmaton River, and on the Saint Louis & S. F., the Missouri, K. & T., and the Missouri P. R.R.'s., 100 miles south of Kansas City.

Industries.— The chief income of the city is derived from the railroad shops, the Saint L. & S. F. employing 500 hands and the Mo. Pac. 550 hands. The city is situated in a rich agricultural region, this in itself a valuable source of income. Besides these industries there are manufactories of cement, syrup, brick and machinery. Fort Scott is also the largest horse and mule market in the State

Banks, Public Buildings, etc.—There are three banks with a combined capitalization of $200,000. Among the public institutions are the library containing 18,000 volumes, the Goodlander Home for Children, the old government fort buildings which have been preserved, and the National cemetery.

Church and Educational Institutions.— Religious services are held in 11 church edifices. The educational system is excellent, consisting of a high school and seven public schools. There are two commercial colleges in the city and the Notre Dame De Lourdes Academy is also located there.

History, Government and Population.— The city was first settled as a military post in 1844, became a municipality in 1850 and was chartered as a city of the first class in 1882. The public administration is vested in a mayor and a city council composed of 10 members, five of whom are elected each year. The major portion of the population are native born, with a sprinkling of negroes, Germans, Jews, and Irish. Pop. (1900) 10,322; (1905) about 14,900.

GEORGE W. MARBLE,
Editor 'Tribune and Monitor'.

Fort Smith, Ark., city and county-seat of Sebastian County, situated on the western border of the State at the junction of the Arkansas and Poteau rivers, and on the Saint Louis & S. F., Missouri P., Kansas City S., Midland Valley, F. S. & W., and Ark. Cent. R.R.'s.

Industries.— The city is in a rich agricultural region and derives a greater part of its income from this source. There are also coal mines near by. The city has a wagon factory, several furniture and chair factories, a wood-working establishment, machine shops, cotton compress, and oil wells. There are two daily and several weekly papers published.

Schools and Churches.— The city has eight public schools, a high school, two commercial colleges, a Catholic Girl's Academy, three parochial schools, and two conservatories of music. There are 13 churches, representing nearly all denominations.

Banks, Public Buildings, etc.— There are four banks (three national and one savings), having a combined capital of $900,000. Among the notable public buildings are the Federal and County court-houses, the United States jail, and a hospital and an opera-house. A National cemetery is located on the site of the former "Post" burying ground.

History, Government and Population.— Fort Smith was originally a French trading post, and in 1817 became the headquarters for the gathering and distribution of supplies for the United States army in the Southwest. It was called Belle Point by the early settlers, was incorporated in 1842, and received its city charter in 1886. The city is governed by a mayor, a board of public affairs, and a council of 10 members elected for two years. The city is lighted by electricity, gas, and natural gas, owns its water-works, and possesses an excellent system of electric railways. Pop. (1900) 11,587; (1905) about 27,000.

E. B. MILLER,
Secretary Commercial Club.

Fort Snelling, Minn. See MILITARY POSTS, U. S.

Fort Stanwix, N. Y., a former fort near the present site of Rome, N. Y., originally built in 1756, but abandoned, and rebuilt in 1758 by

Brigadier Stanwix. Here in the fall of 1768 a treaty was negotiated by Sir William Johnson (q.v.), the British superintendent-general of Indian affairs in North America, with the Six Nations, about 3,200 Indians being present. For the sum of $10,000, the Indians surrendered title to Kentucky, West Virginia, and western Pennsylvania. Soon after this the fort was again abandoned, but in 1776 it was once more rebuilt and named after that intrepid old soldier, Gen. Philip Schuyler. In 1777 the fort was the object of an attack by Gen. Saint Leger with 1,700 British soldiers and allies, but the garrison held out for 19 days, from 3–22 August when they were relieved by a force of Continentals under Gen. Arnold. In 1781 the fort was destroyed by flood and fire, and when rebuilt was again named Fort Stanwix. It was here on 22 Oct. 1784 that the three United States commissioners negotiated the treaty with the Iroquois Indians, known as the «Treaty of Fort Stanwix,» which provided for the cession to the United States of western lands claimed by them.

Fort Stedman, Assault on. In March 1865 Gen. Lee prepared to abandon Richmond and Petersburg, unite with Johnston at Danville, and attack Sherman, who was marching northward from Savannah. In order that he might wait for favorable weather, he decided on a sortie against Grant, to hold him near the Appomattox. The sortie was committed to Gen. Gordon, with about one half of the army. The point of Gordon's attack was Fort Stedman. At 4 A.M. 25 March the attack was made, and a rush of Gordon's men overcame the pickets and advance guards, took from 400 to 500 yards of the main line (Willcox's), including Fort Stedman, the defenders of which, after a spirited resistance, were overpowered and captured, turned its artillery upon the Union line, captured between 500 and 600 prisoners, and endeavored to sweep down the intrenchments, but met with a repulse. It was so dark that friend could not be distinguished from foe, but Gen. Parke ordered Willcox to recapture the works, Gen. Hartranft to support him. By 7.30 A.M. Parke had regained a part of the line and drawn a cordon around Fort Stedman, and Tidball's artillery had concentrated a heavy fire upon it and the line adjacent. Hartranft advanced at 7.45 A.M., attacked detachments of the enemy that were moving in the direction of City Point, capturing or driving them back, and at 8 A.M. Fort Stedman and the entire line was recaptured, together with 1,949 prisoners and 9 stands of colors, the Federal loss (Ninth corps) being 72 killed, 450 wounded, and 522 missing. The Sixth corps now attacked and captured the Confederate picket-line, losing 440 killed and wounded, and 30 missing; and the Second corps did the same, capturing 365 prisoners, and losing 51 killed, 462 wounded, and 177 missing. The Confederates made several efforts to recapture their own advanced lines, but failed. The entire Union loss in this engagement was 170 killed, 1,323 wounded, and 720 missing, an aggregate of 2,222. The Confederate loss is not definitely known; Gen. Meade estimates it at 5,000 men; it was probably not over 4,000, of whom one half were prisoners. Consult: 'Official Records,' Vol. XLVI.; Humphreys, 'The Virginia Campaign of 1864–65'; Walker, 'History of the Second Army Corps'; Powell, 'History of the Fifth Army Corps'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

E. A. CARMAN.

Fort Stephenson, Ohio. See FREMONT, Ohio.

Fort Stevens, a United States military post in Oregon, situated in the extreme northwestern part of the State at the mouth of the Columbia River. It is a little more than 100 miles northwest of Portland and about 9 miles west of Astoria, the fur trading post, which was established by John Jacob Astor in 1811. The grounds surrounding the post which was established in 1864 comprise 1,250 acres, and beside the quarters for the officers and artillery men stationed there, has a post office and railway station.

Fort Sullivan, S. C., the early name of Fort Moultrie, in Charleston harbor; notable for its defense against the British in the Revolutionary War. See COLONIAL WARS.

Fort Sumter, built upon a shoal in the narrowest part of the channel of Charleston harbor, three and a half miles from the city, and three fourths of a mile from the north end of Morris Island, was constructed on a rip-rap foundation, its walls of brick being 38 feet high and 7½ feet thick. When South Carolina secede the fort was unfinished and not garrisoned, but men were engaged in the work and in mounting guns. South Carolina passed an ordinance of secession on 20 Dec. 1860, and the secessionists looked to the immediate possession of all the forts in the harbor, one of which, Fort Moultrie, was held by Maj. Robert Anderson, with a garrison of 75 men. Fort Moultrie was indefensible from a land attack, and Anderson, believing that he was about to be attacked, on 26 December, skilfully transferred his command to Fort Sumter, the strongest and most inaccessible work in the harbor. Gov. Pickens demanded Anderson's immediate return to Fort Moultrie. Anderson refused, and the governor took possession of Fort Moultrie and all other works in the harbor, and seized the arsenal, post-office and custom-house in Charleston, raised the Palmetto flag over them, and thus inaugurated war against the United States. He began the construction of batteries on James, Morris, and Sullivan islands to command the harbor and reduce Fort Sumter. On 9 Jan. 1861 the merchant steamer Star of the West endeavored to land reinforcements and provisions for Fort Sumter, but was fired upon by the secession batteries and driven back. Again Gov. Pickens demanded the surrender of the fort, again Anderson refused, and negotiations were transferred to Washington. The construction of batteries continued and 1 March Gen. Beauregard was assigned to the command of all the Confederate forces at Charleston, with instructions to perfect preparations for reducing Fort Sumter. Anderson was now in danger of being starved out and, in accordance with promise given, Gov. Pickens was informed 8 April by a special messenger sent by President Lincoln, that an attempt would be made to land provisions, and provisions only, at Fort Sumter. Beauregard notified the Confederate government, and received orders 10 April to demand the evacuation of the fort, and to reduce it if refused. The demand was made at noon of the 11th. Anderson refused, but made the casual remark to the messengers carrying Beauregard's demand that, if left alone, he would be starved out in a few days, and Beauregard, "to avoid effusion of blood," asked when he would be ready to leave the fort. Anderson said he would evacuate the fort by noon of the 15th, should he not prior to that time receive "controlling instructions" from his government or "additional supplies." The reply was not satisfactory, and 3.20 A.M. of the 12th Anderson was notified that fire would be opened within an hour. At 4.30 A.M. the signal-gun was fired from Fort Johnson on James Island; all the batteries opened fire; Anderson replied deliberately; in 24 hours 2,500 shot and shell struck the fort or fell inside of it; the barracks were burned and the fort much damaged; the relieving fleet could not land; and on the afternoon of the 13th terms were arranged under which, on the afternoon of the 14th, Anderson saluted his flag and, with drums beating and colors flying, marched with his garrison out of the fort, was conveyed to a steamer, and sailed for New York. During the bombardment not a man was killed on either side.

When Fort Sumter fell into Confederate possession it had 78 serviceable guns. Additional guns were mounted in it and it was well garrisoned. The Union authorities sunk a number of old whalers filled with stones in the main channel of Charleston harbor to close the port to blockade-runners, and a blockading force was maintained off the harbor; but it was not until 7 April 1863 that any serious operation was attempted against the fort. Then Dupont, with nine ironclads, made an unsuccessful attack upon it. One of the ironclads, the Keokuk, which had approached nearest to the fort, was struck 90 times, and so much injured that she sunk off Morris Island, and her armament fell into the hands of the enemy, while the others withdrew after an engagement of 40 minutes, most of them being considerably disabled by the fire of the 69 heavy guns brought to bear upon them. The fleet fired 151 shots, not more than 34 of which struck the walls of the fort. Sumter discharged 810 shot, Fort Moultrie and other batteries 1,399, in all 2,209, of which 520 struck the different vessels. It had been expected that the fort would be reduced to a pile of ruins before the sun went down, but the result convinced the Union authorities that the fort and adjoining works could not be reduced by a purely naval attack.

It was now determined that Fort Sumter and Charleston should be taken by combined land and naval attacks, the land attack being by way of Morris Island, the capture of the batteries there, and the establishment of batteries to reduce Fort Sumter. For this purpose Gen. Gillmore was selected. He landed on Morris Island 10 July, made two unsuccessful assaults on Fort Wagner, 11 and 18 July, and then concluded to attempt the destruction of Sumter from ground already in his possession, so that the fleet could enter the harbor and command Charleston. (See FORT WAGNER.) A sufficient number of breaching-guns were in readiness 16 August; fire was opened on the 17th, and on the 24th Gillmore reported the practical demolition of the fort. From 18 guns he had thrown 5,009 projectiles, weighing 552,683 pounds, of which 4,147 struck the fort. Before daylight 23 August five monitors approached to within about 800 yards of the fort and opened fire, which was kept up until 6 A.M. Confederate officers now held a council, and the proposition was offered to abandon the fort, but as a matter of sentiment it was resolved to hold it. On 30 August Gillmore resumed fire, dismounting the remaining barbette guns and leaving but one casemate gun serviceable. As a means of defense against the fleet the work was entirely useless, and it was held merely as an infantry outpost. On 2 September six monitors opened fire on it, but it remained silent, not a single gun being in working order to reply. Early on the morning of 7 September, after the abandonment of Fort Wagner, Admiral Dahlgren demanded the surrender of Fort Sumter, which was refused. Meantime the Confederates were removing the guns from the fort and placing them in other parts of the harbor. During the night of 8 September a naval force of about 400 men, under Commander F. H. Stevens, atempted to carry the fort by assault. It was then defended by about 450 men, under command of Maj. Stephen Elliott, Jr. Stevens' men were in boats, and when towed within 800 yards of the fort the boats were cut loose and rowed for the fort, on approaching which they were met with a fire of musketry; as the men landed, hand-grenades and shells were thrown upon them; and simultaneously, at a signal from the fort, all the Confederate batteries on James and Sullivan islands, with one of their gunboats, opened fire, and the attack was repulsed, all who had landed being killed or taken prisoners. The reported loss was 4 killed, 19 wounded, and 102 captured. On 26 October Gillmore again opened fire with his heavy guns from Forts Wagner and Gregg, aided by the cross-fire of 150-pound rifles on board the fleet, which completed the ruin of the fort, and all aggressive operations for the season against Charleston ended, although a desultory fire was kept up against Sumter during November and December to prevent the remounting of guns. The casualties in the fort from 12 Aug. to 11 Dec. 1863 were 43 killed and 165 wounded. From a tabular statement prepared by an officer in the fort it appears that, from 12 Aug. to 31 Dec. 1863, 26,867 shot were fired at it, 19,808 falling against or into it. On the approach of Sherman's army the fort was evacuated 17 Feb. 1865, and 14 April following the same flag that Anderson lowered in 1861 was raised over it with imposing ceremonies. Consult: 'Official Records,' Vols. I.–XXVIII.; Doubleday, 'Reminiscences of Forts Sumter and Moultrie'; Crawford, 'Genesis of the Civil War'; Gillmore, 'Engineer and Military Operations Against Charleston in 1863'; The Century Company's 'Battles and Leaders of the Civil War,' Vols. I. and IV.; 'Naval War Records,' Vol. XIV.

E. A. CARMAN.

Fort Tot'ten, N. Y., a United States military post, established in 1862 at Willett's Point, on Long Island Sound, near Whitestone.

Fort Wadsworth, wŏdz'worth, N. Y., a United States military post on Staten Island, at The Narrows, in New York Bay. It was established in 1827, and was first called Fort Richmond.

Fort Wagner, a work constructed by the Confederates near the north end of Morris Island, a low, narrow, sandy strip of land, about

3½ miles in length, on the south side of Charleston harbor. It was 2,600 yards directly south of Fort Sumter, to which it was an outpost, and was constructed to hold and control all that portion of the island upon which effective breaching-batteries against Fort Sumter could be established. On the northern end of the Island was Fort Gregg, and the southern end was held by a small force of infantry and artillery. Preparatory to a combined naval and land attack on Fort Sumter and Charleston, it was determined to reduce Fort Wagner and take possession of the entire length of Morris Island, and Gen. Gillmore, an engineer officer of skill, was selected to command the land forces. On 10 July 1863, Gillmore, who had concentrated 6,500 men and secretly placed 47 siege guns and field guns in position on the extreme northern end of Folly Island, attacked the Confederate position on the south end of Morris Island, effected a landing, carried the Confederate batteries of 11 guns, and by 9 A.M. occupied three fourths of the island and pushed his skirmishers to within 600 yards of Fort Wagner. The navy assisted with four ironclads. At daylight of the 11th an attempt was made to carry the fort by assault, which failed, with a Union loss of 172 killed and wounded, and 119 taken prisoners, of whom 40 were wounded. The Confederate loss was 12 killed and wounded. After this failure counter-batteries were established against the fort, and it was determined to attempt, with the aid of the ironclads, to dismount its guns, and either drive the Confederates from it, or open the way to a successful assault. The navy kept up an almost incessant fire upon it, and the land batteries were established at distances ranging from 1,330 to 1,920 yards of it. Soon after midday of the 18th the navy and 41 light guns and siege-mortars opened a furious fire upon the fort, which was continued until nearly all its guns were silenced and its defenders driven into bomb-proofs, when about sunset, after 900 shot and shell had been discharged, Gen. G. C. Strong's brigade of six small regiments, supported by Col. H. S. Putnam's brigade of four regiments, made an assault. As the head of the column left the trenches the guns of Forts Wagner, Gregg, and Sumter opened on it, and as it neared Fort Wagner the Confederates mounted the parapet and poured in such a destructive fire of musketry that the leading brigade was repulsed; but the supporting brigade gained a foothold, which it kept for over an hour, when it was driven back. The Union loss in this second assault was 1,128 killed and wounded, and 389 missing; among the killed or mortally wounded being Gen. Strong and Col. Putnam, John L. Chatfield, and Robert G. Shaw (q.v.). The Confederate loss was 56 killed and 133 wounded.

Gillmore now turned his attention to Fort Sumter (q.v.), which, with the aid of the navy was, by 23 August, reduced to a shapeless mass with almost every gun dismounted or silenced. Meanwhile regular approaches were made against Fort Wagner, thousands of heavy shells were thrown against and into it, and by 26 August the trenches were within 250 yards of it, the intervening space being a flat ridge of sand, scarcely 25 yards wide, and for a great part planted with torpedoes. The Confederates were driven from position behind this flat ridge and the approaches continued until within a few yards of the fort, when the heavy guns of the army and navy opened on it. Final operations were inaugurated 5 September at daylight, and in 42 consecutive hours 17 siege guns discharged 1,411 shells at the work, 1,247 of which struck it, the ironclad New Ironsides joined in the attack, the fort was silenced, over 100 of the garrison killed and wounded, and an assault was ordered for the 7th. When morning came the fort had been abandoned and its garrison, with that of Fort Gregg, had escaped, leaving the entire island with the 25 guns of the two works in Union possession. The Union loss on Morris Island (10 July–7 September) was 381 killed, 1,372 wounded, and 565 missing, an aggregate of 2,318; the Confederate loss was 157 killed, 674 wounded, and 238 missing, an aggregate of 1,069. Consult: 'Official Records,' Vol. XXVIII.; Gillmore, 'Engineer and Artillery Operations Against Charleston, 1863'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

E. A. Carman.

Fort Wal'la Wal'la, Wash., a United States military post, established in 1857, at Walla Walla.

Fort War'ren, Mass., a United States military post on Georges Island, near Boston, established in 1837. During the Civil War it was used as a military prison.

Fort Washington, Md., a United States military post on the Potomac River, near Washington, D. C. It was established in 1815 as Fort Warburton.

Fort Washington, N. Y., the site of a former fort at 182d Street, New York, overlooking the Hudson River. It was built prior to the Revolution and surrendered to the British under Sir William Howe (q.v.) 16 Nov. 1776, after a terrific engagement. The loss of the fort caused consternation throughout the United States. Consult: De Lancey, 'The Capture of Fort Washington' (1877).

Fort Wayne, Ind., city and county-seat of Allen County. Situated in the northeastern part of the state, 102 miles northeast of Indianapolis, upon the Saint Joseph, Saint Mary's and Maumee rivers, confluence of the first two within the city's limits forming the last named. It is notable as a railway center, the following lines passing through or terminating there: Pittsburg, Fort Wayne & Chicago, of the Pennsylvania Railway system; Wabash; New York, Chicago & St. Louis; Grand Rapids & Indiana; Cincinnati, Richmond & Fort Wayne; Lake Shore & Michigan Southern; Fort Wayne, Cincinnati & Louisville; Cincinnati, Hamilton & Dayton. The city is central in a rich and highly developed agricultural region that produces abundant crops of the cereals of temperate climates. Considerable tracts of hardwood timber yet remain in what once was one of the most richly wooded sections of the northwest.

Manufactures.— These cover a wide range and embrace numerous establishments of large magnitude. In the various industries 10,000 operatives were employed in 1903. The manufactures include carwheels, Corliss and other steam engines, boilers, gas engines, gas machinery, iron and steel bars, freight and passenger cars, locomotives, electrical machinery and electrical fittings and fixtures, hosiery, gloves, caps, oil tanks, organs and pianos, women's garments, road construction machinery, carriages, wagons, washing machines, furniture, paper boxes, lumber, sash, doors, malt liquors, cigars, harness and leather findings and a considerable variety otherwise of products in iron and steel, wood and textile fabrics. The value of the manufactured products in 1903 was $15,000,000.

Municipal Service and Improvements.— The municipality owns and operates the public waterworks system, an abundant supply of pure water being procured from wells bored deeply into the rock, and distributed by means of two thoroughly equipped pumping stations. There is a handsome and substantial city hall and police headquarters and eight modern and thoroughly equipped houses advantageously situated shelter the city fire department. The public buildings in the city are a court-house (county), completed in 1902 at a cost of $1,000,000; United States post-office and court-house; a public library erected at a cost of $100,000 through a donation by Mr. Andrew Carnegie; county jail; high school and manual training school building, completed 1904 at a cost of $300,000, and 15 grammar and ward school buildings, most of which are of very modern construction and beautiful architecture.

Schools and Colleges.— The free-school system maintained by the city embraces a high school and manual training school, a training school for teachers, and 15 ward and grammar schools, together with kindergarten departments. The free-school system is governed by a board of three trustees, elected triennially by the city council, the immediate executive head of the schools being a superintendent elected by the board. There are 6 Roman Catholic parish schools in addition to a high school for boys and an academy for girls; and 6 German Lutheran parochial schools. Concordia College, founded in 1850, is seated in Fort Wayne, and is maintained under auspices of the German Lutheran church. Near the city is an academy maintained under auspices of Catholic sisters, an academy for the higher education of young women. Among other institutions of learning are a college of medicine and surgery, a conservatory of music, a school of art, two business colleges, and a school of oratory, expression and physical culture.

Churches and Charities.— There are 47 religious congregations and 40 church edifices, many of them beautiful and costly examples of ecclesiastical architecture. The congregations are distributed denominationally as follows: Baptist, 2; Christian, 3; Congregational, 2; Episcopal, 2; Evangelical Association, 1; Evangelical Lutheran (English), 3; Evangelical Lutheran (German), 4; German Lutheran, 3; Methodist Episcopal, 5; Free Methodist, 1; African Methodist Episcopal, 1; Presbyterian, 4; United Presbyterian, 1; Reformed (German), 2; Roman Catholic, 7; United Brethren, 1; Baptist Brethren, 1; Christian Science, 2. The city is the see of the Catholic Diocese of Fort Wayne. The city has a central charities organization and many of the religious congregations maintain comprehensive societies for charitable and benevolent work.

Hospitals and Asylums.— There are 4 large hospitals of modern equipment, 1 non-sectarian, 2 under Roman Catholic and 1 under German Lutheran administration. There are 3 orphan asylums, two sectarian and 1 maintained by the county; home for emergencies and a refuge for women. Just beyond the city limits is the State School and Home for Feeble-Minded Youth of both sexes and home for epileptic women.

Finance and Banking.— There are 4 national banks, 3 private banks, 3 trust companies and 6 building and loan associations. The national banks have (June, 1904) a total capital of $1,050,000, total surplus of $771,879 and total deposits of $6,053,992. One of the banks is a government reserve agent. Trust companies have (June, 1904) a total capital of $900,000, total surplus of $105,105, and total deposits of $2,095,835. Private banks have total individual responsibility of $1,000,000.

Parks and Cemeteries.— The total public park acreage of the city is 95.49, distributed as follows: Swinney, 45.24; Lawton, 31.20; Reservoir, 13; McCulloch, 4; Hayden, 1.12; Piqua, .75; Old Fort (site of stockade built by General Anthony Wayne in 1794), .18. There are 5 cemeteries — Achduth Veshalom (Hebrew), Concordia (German Lutheran), St. John's (German Lutheran), New Catholic (Roman Catholic), and Lindenwood (non-denominational).

Government.— The city is governed under a special charter, conferred by the state legislature, which provides for a municipal legislative body of two councilmen from each of the ten wards, chosen biennially, a mayor and city clerk, chosen quadriennially, and a board of waterworks' trustees, chosen biennially. The board of public works, board of public safety, health commissioner and park and street superintendents and city attorney and city comptroller are appointed by the mayor. Council fixes all municipal tax levies and appropriations and has final approval of all contracts and franchises.

Trade and Commerce.— Fort Wayne is an important and flourishing trade centre and has a commerce that embraces extensive wholesale and jobbing operations in dry goods, groceries, light and heavy hardware, drugs, millinery, paper, etc. The total volume of wholesale trade in 1903 had a value of $9,000,000. The total post-office receipts for 1903 were $177,496.

History.— The city takes its name from a fort built on a part of the present site of the city by General Anthony Wayne in 1794. The place, however, had a history that long antedated this. There is evidence that La Salle had visited the locality as early as 1670. It was the site of Ke-ki-on-ga, the "Central City" of the once powerful and warlike Miami Indians. At different times during the seventeenth and eighteenth centuries French and English had military posts at Ke-ki-on-ga. In 1790 General Harmer led an expedition against the Miami City, but was signally defeated in a fierce engagement on the Maumee River within what is now the limits of the city of Fort Wayne. In 1791 General St. Clair in a similar expedition was overwhelmed a short distance southeast of Fort Wayne by the Indians under the famous Miami Chief, Little Turtle. General Anthony in 1794 headed a third expedition against the Indians in the Northwest and after utterly defeating them at the battle of Fallen Timbers on the Lower Maumee in Northwestern Ohio, marched to Ke-ki-on-ga and in September of that year built his stockade on an eminence overlooking the confluence of the St. Joseph and St. Mary's rivers. These was no further serious trouble within the Indians until August 1812, when the conspiracy of Tecumseh and his brother The Prophet ensued in a close investment of Fort Wayne and its meagre garrison. The siege was vigorously pressed for about two weeks, when it was raised by a force that had been dispatched to relief of the beleaguered garrison. Fort Wayne at once assumed importance as a trading post and in 1825 the town itself was laid out. In 1840 Fort Wayne took rank as a city. Between 1850 and 1860 began the era of railroads, when growth received fresh and powerful impetus and Fort Wayne came to be one of the foremost industrial and commercial cities of the State. Pop. (1900) 45,115; (1907, est.) 57,000.

Harry M. Williams,
Managing Editor Fort Wayne 'Sentinel.'

Fort William, Canada, city in Thunder Bay District, Ontario; on Thunder Bay at the mouth of the Kaministiquia River; and on the Canadian P., the Canadian N. and the Grand T. P. R.R.'s; 426 miles east of Winnipeg. It is at the head of the Canadian navigation on the Great Lakes, is a terminus of the Canadian Pacific, and has splendid shipping facilities. Gold, silver and iron ore are found in the neighborhood. Lumbering is an important industry. There are also iron foundries, brick yards, machine shops, flour mills, and other manufactories. Beside elevators with 3,500,000 bushels capacity, the Canadian Pacific has expended over $5,000,000 in the erection of large wheat elevators, which have a capacity of 8,750,000 bushels. Fort William has several churches, a city hall, hign school, Separate school, four public schools, nine banks and two daily and one weekly newspapers. Fort William was founded by fur traders in 1805, became a town in 1887, and a city in 1907. The government is vested in a mayor and council of eight members elected annually. Pop. (1907) 15,000.

Fort Worth, Texas, city, county-seat of Tarrant County; on Trinity River, and on the Fort Worth & D., the Fort Worth & R. G., the Gulf, C. and S. F., the Chicago, R. I. & P., the Texas & P., the Missouri, K. & T., Houston & T. C., International & G. N., Saint Louis & S. W., and Red River, T. & S. R.R.'s; about 32 miles west of Dallas. It was organized as a town, under general State law, in 1873, with a population of 1,100; and chartered as city in 1882, with a population of 11,285. The government is vested in and administered by a mayor, nine aldermen, city marshal and assessor, and tax collector, elected by popular vote; city secretary, auditor, treasurer, superintendent of waterworks, chief of fire department, street commissioner, and other subordinate officials elected by the city council. The city owns and operates the waterworks and the street-lighting plant. The city-hall and fire halls are commodious structures of stone and brick. It has over 80 miles of improved streets; 68 miles of sewers, and nearly 100 miles of pipes. There are eight national banks and two trust companies and savings banks, with a capital and surplus of $2,965,353, and deposits amounting to $7,928,577. Fort Worth is the centre of the cattle interests and grocery trade of the State, and of the grain and milling interests of the northwestern portion of the State. Having 11 trunk lines of railway with 16 outlets, it is the greatest distributing point of the Southwest. The flour mills, breweries, packing houses, and foundry and machine works are the principal industrial enterprises of the city. The county court-house is constructed of granite and marble from the Texas quarries. The passenger station is one of the largest and finest in the country in a town of this size. The banking houses, colleges, medical schools, high-school building are costly and imposing structures. Fort Worth has one high-school building, 11 ward school buildings, Fort Worth University, Polytechnic College, Medical School, Saint Ignatius Academy, and the public free library. There are 42 church buildings, representing all denominations. There are also sanitariums, a free kindergarten, Rescue Home, a local Benevolent Home for Children, the Saint Joseph's Infirmary, and the State Masonic Widows' and Orphans' Home. There is one public park of 50 acres, several small parks, and three cemeteries.

The growth of population has been rapid but not unhealthful. The vital statistics show less than nine deaths to 1,000 for a series of years. There are no local causes for disease. It is nearly 700 feet above sea-level, and is fanned by cooling gulf breezes during the summer, making a pleasant and healthful place of residence. Pop. (1890) 23,076; (1900) 26,688; (1903 est.) 45,000.

B. B. Paddock,
Fort Worth, Texas.

Forth, fōrth, a river of Scotland, rising on the east side of Ben Lomond, in Sterlingshire.

Forth Bridge, The. See Bridge.

Fortifications («to fortify,» precisely following its Latin derivative, is *facere fortis*, «to make strong»), such artificial positions as are required for military use. Primarily, such positions are for defense; but no less important in operations against defensive works already established by an enemy. Two definitions, used in another connection, but officially approved by the late Col. Edward Bruce Hamley, president of the Queen's Staff College, London; by the late William T. Sherman, general of the American army, and by the late Theodore D. Woolsey, president of Yale University, indicate the drift of the subject-matter under immediate notice.

1. «Military Science,» the mother of all such constructive relations, «while that of force, as in all police or other protective law, is founded upon the adaptation of all possible means to meet an impending crisis. The wisdom of the statesmen differs only in degree from that of the ordinary householder, and both alike aim at a wise constraint of offensive elements and the radication of such as are adapted to that end. Hence, to meet the demand adequately, wisely, and successfully, thereby to secure ultimate public safety, is the expressive logic for personal action, municipal action, and military action. The brain-power is banded to various shaftings, and the mental processes differ by virtue of different adaptations, but the prime activities are

the same.» The citizen who is to be protected, equally with the technical expert, should be sufficiently interested to become actively sympathetic in whatever relates to the national defense.

2. «Military engineering,» as the second preliminary definition, «is the application of mathematics and mechanics to the maintenance, or the reduction of fortified positions, the interposition, or the removal of artificial obstacles to the passage of an army, and the erection of suitable works for the protection of territory or troops.» Rival systems of practical military engineering, stimulated by successive inventions, have so multiplied their technical terms, borrowed from many languages as well as from their authors, or local customs, that the ordinary citizen who desires but a suggestive history of that progress would be compelled to have both lexicon and scientific text-book by his side in order to fathom their mysteries.

The origin of artificial defense and the development of primitive types until isolated families or groups of families gradually crystallized into independent and self-supporting nations, are so familiar to the willing reader of general history as to need but brief mention. The defense of the retired domicile from wild beasts and the forays of irresponsible robbers was as distinctly a matter of prime necessity for the head of a family, as for the tiger, the wolf, or the robber, to find in thicket, cave, or mountain fastness, his own protection from pursuit and punishment. The simplicity of weapons of offense and defense harmonized with the demand for artificial protection against violence of every kind. The bow-and-arrow and javelin, with the sling, for long range; and the knife, sword, club, and battle-ax, of stone or metal, for hand-to-hand conflict, required protection from each. The hide-bound protective shield at first, and later, the more impenetrable metallic armor, were but types of the development which gradually evolved the fortification proper, in proportion as weapons enlarged their range of stroke as well as their destructive effect. The shield was, in fact, both the simplest as well as the true prototype of defense against superior force. Under its cover, one man could hold several antagonists at bay. When flanking assailants neutralized its protective value, men, in groups, enlarged its functions, until, by the hollow square, or the solid mass, a phalanx could withstand the onset of many times their number. Their uplifted shields were like a modern bombproof against falling flights of arrows while the men, thus protected, supplied constant reinforcements for those in front who were disabled by ax, sword-thrust, or javelin.

Social Conditions.— The sanctity of the home-domicile was, from earliest times, the basis of its protective and stubborn defense. The Hebrew, the Chaldæan and Egyptian traditions and records, as well as those of Greece and Rome, still later, perpetuated that philosophy; and the ancient German, Goth, Moor, and Briton, through all their feudal, racial, and political rivalries, alike honored precepts thus coincident with the first groupings of families for a common defense.

The «Home, as a Castle,» was not merely of British conception, but a vital factor in human happiness and safety. With the gradual accumulation of both numbers and wealth, the protection of the many became the duty of each individual, and the assertal of tribal or national superiority, on the part of the more numerous and powerful, engendered such competitive conflicts that centres of influence exacted more systematic and elaborate national defenses. Excursions against other states, and responsive invasions, were the means employed by ambitious rivals to increase their territorial domain and subject inferior peoples to their dominating control.

By this complex evolution of warring peoples, led by daring spirits, systems of more speedy intercommunication, transportation, and the accumulation of war material, arms and food included, became indispensable to the public safety, until warehouses, detached strongholds, internal citadels, and organized armies were the result. All draft animals and beasts of burden were utilized for attack or defense, so that the horse of the warrior might, in turn, drag the war chariot with its out-reaching scythe blade; and both camel and elephant carried miniature castles upon their backs for archers and spearsmen, mounted above.

Military Conditions.— The fundamental principle in all substantial fortifications has been the effort to ensure a destructive fire upon every available avenue of approach to the place protected, and, with this, to secure such enfilading and cross-fire that no position remained unprotected. Human competition has ever been the same in essence, and where no reliable historic record responds to inquiry, exhumed ruins, memorial tablets, and deciphered hieroglyphics, solve all doubt as to the proposition that military science and military engineering belonged to all human activity, ever the same in principle, and differing only in application and development. The paramount object was, to eliminate disparity in physical strength and enable the few to resist the many. Personal combat at short range came to a limit as people gathered in cities; and breastworks first, and then solid walls, became essential in proportion as the numbers of non-combatants gathered there for shelter and safety.

Illustrations.— The most primitive forms of which the earth retains an outline were oval, or circular, mounds or entrenchments, even before walled towns were constructed, these being more compact for defense of each front, or exposure, by defenders from the centre. More modern defenses, especially against savages, of the block-house type, had this peculiar value, and even women could prepare arrows, or load weapons, for defenders who in turn acted in all directions.

Such defenses were upon commanding positions, to guard against surprise, with wood and water always within easy reach. These were transient, and usually against predatory or nomadic peoples, of no greatly superior strength. As populous centres increased, defenses were of stone or brick walls of such height and breadth that large armies could mount their summits and chariots convey men and munitions from one point of defense to another. These were surrounded by a flooded moat, or ditch, and were easily made impregnable against an army of equal force and equipment. Towers at angles of quadrangular defenses, and to protect gates of entrance, exit, or for sallies upon an enemy, were supplied with lifting or draw-bridges, and mines and tunnels were excavated under the ditch itself for more ready surprise of a careless adversary. Cæsar describes a mine which he advanced beneath both ditch and wall, supporting the wall with timber until he could fill the shaft with dry branches, and upon setting all on fire, the wall crumbled, and he stormed the breach.

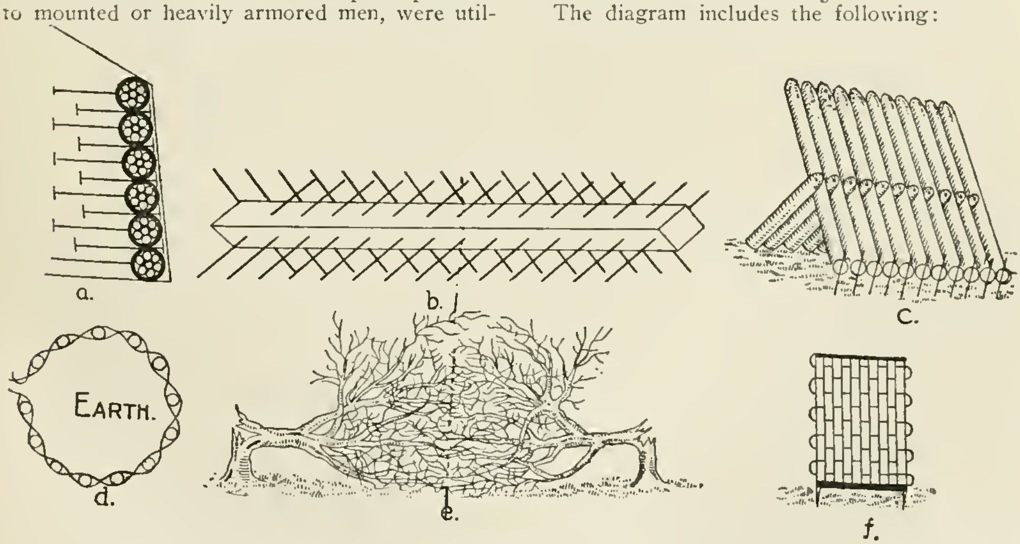
Great machines were made by which to reach engirdling camps, or crush assailants who attempted to bridge, or fill the ditch, and thus gain access to the wall summit by scaling ladders, when unable to force the gates. The catapult and ballista were two of these, which, on the principle of the spring-board and sling, and the increased length of its vibrating arm, the radius of its centrifugal force, would hurl heavy stones at a great distance and send blazing balls of tallow, or pitch, congreve-rocket-like, to destroy a hostile camp.

To meet these mighty forces, corresponding engines of swinging, battering timbers, called «rams» from the device curiously shaped in front, would strike a blow equal to the force of a 30-pound shot, powder-driven. Movable towers, protected by wet hides from fire, were advanced, putting its archers upon a level with those upon the city wall. Titus, at the siege of Jerusalem, brought such towers sufficiently near that, with grouped lances and timbers, he bridged the intervening distance and fought on the city wall itself.

With the increase of territorial domain, subordinate but correlated military engineering had its special province. Territorial boundaries, mountain passes, sharp defiles, river fords, and watercourses, had to be guarded by detached outworks, and these must have close relation, each to the next in order. Swamps, impervious to mounted or heavily armored men, were utilized, and their narrow approaches, or shallow portions, were so fashioned and guarded as to keep assailants from fire-range upon defenders. Outlying summits were made signal stations, both against herds of wild beasts, which in early times were as dangerous to flocks and herds as robbers or hostile invaders were to the inhabitants themselves. Bonfires and flaming torches, as well as a chain of vocal and flag-shaking sentries, became adjuncts to a better external defense. Cæsar had «soldiers who shouted to each other until the alarm reached his camp, through a great distance.» The ancient Persians, and later the Scotch and Swiss, were noted for this signal service, but no experience of the kind has such memorial emphasis as that described by the Hebrew prophet Isaiah, who saw in the system of his own people the forecast of a distant future, when «the watchman, from peak to peak, should see eye to eye, and together lift up the voice» in jubilant rejoicing over universal peace to be proclaimed the world around.

Before treating upon fortifications proper, within the limits of this article, there are subsidiary defenses, pro and con, which have antiquity for their use, and the latest of modern battlefields for their equally advantageous application to-day. Their names are familiar as household words, and yet are generally treated as simple types of barbarous usage, before firearms and the sphere of smokeless powder and electricity alike defied stone and iron defenses, and sent destructive missiles beyond human aim and human sight. A few plain illustrations indicate many which had effective use during the American Civil War of 1861–5.

The diagram includes the following:



(*a*) A parapet forming the front of a modern fort, with fascines, behind which earth is packed as they rise, one upon the other, and are locked into the trampled or rammed earth by hoop-poles or common sticks, the fascine being but a bundle of sticks, hooped, or tied with chain or rope.

(*b*) The Chevaux-de-frise, an iron cylinder, or a trunk of a tree, filled with spikes of iron or wood, to which, in case of wood, sword blades, and bayonets may be applied.

(*c*) Inclined and sharpened posts, really an inclined palisade, or stockade material, fastened to the earth, and its parts fastened together by chains or ropes.

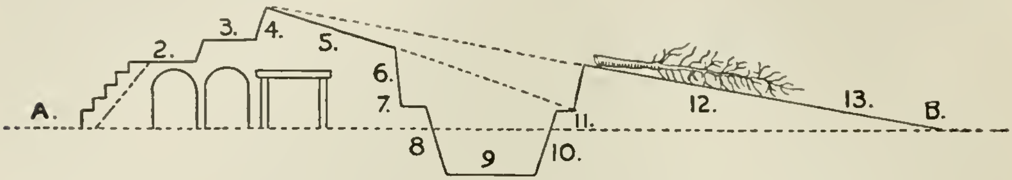
(*d*) A basket, open at both ends, made by inserting stakes in the ground in a circle, braiding them by willow, or other flexible green wood, and when filled with earth, forming material for building a parapet, or strengthening a low breastwork.

(*e*) A sample of felled trees, across roads, creeks, ravines, and obstructive to approach by horse or foot.

(*f*) A species of hurdles, when horizontal sticks, or poles, vertical or horizontal, are interlaced by willow, brush, or modern wire (as in Cuba), making a fence of stout resistance, and holding assailants under deadly fire.

The farmer's common harrow also was utilized extensively.

All these "obstacles" have been utilized in filling a surrounding ditch to prepare the way for storming the fort itself. Only old soldiers who participated in the American Civil War, or the Spanish war, can realize the extent of their use in actual service, and Cæsar himself, when establishing winter quarters, writes: "Having



A.— B. Level of parade ground, occupied by buildings and by bomb-proof magazine and hospital, so far as the same are not included in chambers beneath the parapet.

(1) The interior slope of the parapet, on a slight incline for easy ascent, or with steps, and these broken at intervals for entrance to chambers beneath.

(2) Level ground, or platform (*terre-plein*), for troops supporting guns.

(3) A step (*banquette*) for gun.

(4) Parapet.

(5) Exterior slope of parapet.

(6) A facing of wood, or masonry, or of *fascines* linked into the earth as it is built (see OBSTACLES, *a*), to hold the parapet in place, and called the *revetment*.

(7) A narrow shelf, path, or *berme*, between parapet and ditch.

(8) The side of ditch next to parapet, *scarped* down at an angle, and therefore called the *scarp* or *escarp*.

(9) The ditch itself, and faced with masonry in permanent works.

(10) The opposite side of the ditch, and therefore called the *counter-scarp*.

(11) A path, or border (*berme*), commanded by rifles from the parapet and used for defending the interior slope of the *glacis*, and for sallies through openings outward, or beneath, and called the *covered way*.

(12) The superior slope of the covered way, called the *glacis* because of its smooth descent to the general surface without the fort.

(13) *Abattis*, felled trees, with shortened and sharpened branches, directed outward, with the butt securely fastened at head of the *glacis*.

cut young trees and bent them, by means of their numerous branches extending on the sides, and the quick briars springing up between them, made these hedges present a fortification like a wall, through which it was not only impossible to pass, but even to penetrate with the eye." It will be noticed, later, that at the battle of Franklin, Tenn., during the Civil War, prickly osage-orange was a material factor in a successful defense.

Fortifications Proper.— Impregnable fortresses no longer exist. All along the trend of history the term has been fanciful and merely relative. Even Gibraltar, as an isolated fortress, aside from its political and moral force, has its military value as a well located rendezvous for troops and shipping, and the theoretical guardian of the passage from the Atlantic to the Mediterranean Sea. Of this passage, it has no supreme control, without a sufficient naval contingent. In all other respects, it simply defends itself, with no interior at its back, and when without control of the sea, by fleets, imprisons a valuable garrison. In modern times the stationary must yield to the mobile. The art of destruction is more potent and far-reaching than the skill of man to preserve his own workmanship.

Reference has been made to towers, as well as walls, and even after the invention of gunpowder, systems of defense, as well as isolated forts, had their progressive development, in which the United States followed European antecedents and the progressive systems of one general type until the Crimean war largely revolutionized modern practice. A single profile of a cross-section of defenses, as matured during more than two centuries, is sufficient for this article, with an accompanying sketch of the bastion system, which must under no conditions be neglected in any defense against a superior force.

The Bastion.— The *profile* thus noticed obtains throughout the fort, even when it assumes other forms than that of the simple quadrangle. The *pentagon* and *hexagon* have generally been used, leaving to the province of a simple *redoubt* the simpler outline of defense. Very early *projections* were *built out* from these fortified positions, at their angles, hence their name, *bastion*, to give a wider range of *outward* fire, as well as a more direct *flanking* fire, along the walls covered by these projections. These walls were called *curtains*. The containing lines of the salient angle were called *faces*, and the lines connecting the faces with the main wall were properly called *flanks*.

Before these curtains, or main walls, minor defenses were added, whether *ravelin* or *tenaille*, and these might be again covered by ditch and glacis, subordinate to but protected by the superior fire from the main position. A diagram of the simple bastion, similar to those in use around Washington in 1861–5, and common to all modern works, is added.

Inland Positions.— Isolated defensive positions of inferior type have been sufficiently noticed. Their history is common to every mature reader. Transient and movable defenses will be noticed in connection with army movements, although earth defenses already partake of the character once referable only to walls of solid masonry. As against a foreign enemy, the United States has more need of coast defenses than many other nations, as her commercial centres are largely upon the sea; but, as a nation, her capital may be classed with those of other countries, which look to frontier defenses for a substantial protection against foreign attack. But forts, on a frontier, may be ignored, *turned*, *left in the rear*, as when Paris was taken, while idle thousands of her defenders were lost to the national defense. Hence isolated capitals and commercial inland cities must have detached, but closely related outer defenses, beyond the reach of immediate assault or bombardment by an invading enemy.

During the American Civil War, when internal forces attempted the capital, the city of Washington furnished the best type of a city so assailed; 43 forts and batteries, and 36 additional batteries, mounted 99 rifled cannon in *embrasures* and 25 *in-barbette*, as well as 113 smooth-bore in *embrasures* and 147 *in-barbette*, making a total of 384 guns. But additional platforms were erected and made ready, so that a total of 743 guns could confront any new phases of attack. By direction of Gen. Scott, then in command, the writer was directed to visit all these works during their establishment, and at the time opposing forces were displaying their flag upon Munson Heights, within view from the outer works. The *cordon* of forts, batteries, stockades, block-houses, redans, and bridge-heads was complete.

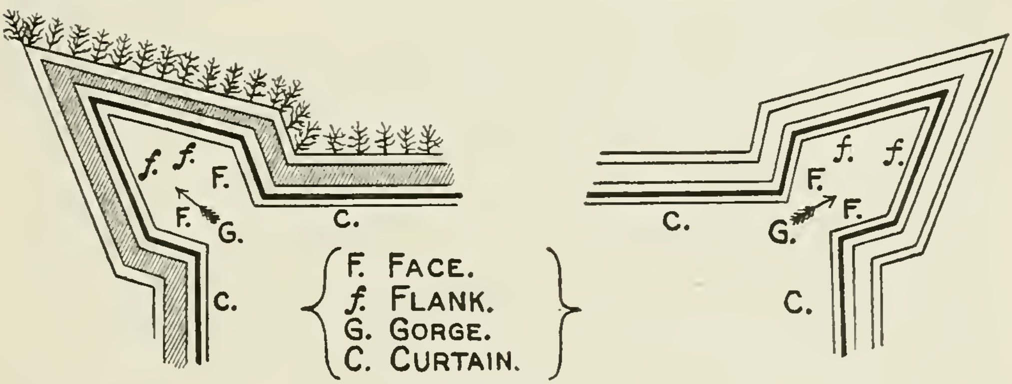
Sea Coast Positions.— Sea coast defenses, from earliest times, have been of massive masonry. Many that still frown innocently upon the American coast, between Boston and New Orleans, are chiefly monumental of obsolete defenses against hostile fleets. Two or three tiers of guns, in as many series of arched chambers, called *casemates*, with a fourth row mounted upon the exposed parapet, or rampart, were expected to cope successfully with the old 120-gun ship-of-the-line. Fort Moultrie, in rude form, in 1776, withstood resistance, with log ramparts, better than with later ones of stone, as in 1861, when sand bags were introduced to support its powers of resistance.

Modern guns, supplied with new explosives, shatter the hardest rock and splinter the toughest timber. The earth alone, and especially sand, will disarm the penetrating projectile of the present day. A single illustration harmonizes with the advent of the new system. Upon the trial of the first 81-ton gun, built at the Woolwich Machine Shops, near London, a mound of sand was erected on the proving grounds against the Thames embankment. Six times a bolt of 1,300 pounds was fired, increasing the powder-charge from 170 to nearly 300 pounds. When the last bolt was dug from the butt, it had entered but 47 feet, 5 feet under the surface of the sand.

Standard tables have long been under consideration to indicate the comparative resistance of earths and gravel, but in all cases, sand, which quickly closes upon what it receives, has been the most obdurate to defy deep penetration. And now, upon the British as well as the American coast, modest mounds or piles of sand present a very indistinguishable target, while, to the nearer view, the abundance of wild grass, daisies, buttercups, and tansy, is its only relieving feature. And yet behind each sand pile, in separate sections, each for a single gun, is to be found the most formidable land defense of modern times. The former "42-pounder" of the casemate and the main battery of a ship-of-the-line, and weighing but 8,750 pounds, is replaced by a gun 40 feet in length, weighing 58 tons, and capable of sending a shot of more than one half a ton, charged by 475 pounds of powder, nearly or quite 7 miles, once each 3 minutes.

A quick release drops the gun below the parapet for reloading. Each battery, however many guns may fall within its control, is operated at will, as if but a single piece were in position. A revetment of solid masonry holds the sand piles in position, and beneath the gun-carriages, which are exposed to the weather, are the necessary passages which communicate with all sections of the battery. Magazines and tackling for handling shot and shell are also under bomb-proof cover, and both placement and independent action of each piece are complete. At suitable distance, but within a practical community of range through adjustable range-finders, sand "pits" for mortars are located. Each mortar revolves upon its own platform, and groups of fours, in closely related pits, can be handled, through signal communication, in connection with the heavy gun batteries, and command a joint delivery of fire upon the same hostile force. As with the gun placements, each mortar pit is independent, in magazine and other appliances, for efficient service.

Floating Batteries.— The battleship as well as the stone fort has also changed character, and become a floating steel fortress. An encircling squadron, in concave formation, can concentrate a weight of metal upon an exposed land defense that cannot be returned by a full equivalent. Other floating batteries, the peer of any, must intervene in support of the land defense, with auxiliary "torpedo boats" and "destroyers." The contingency of landings to take open batteries, in their rear, is increased by swift steam transportation, and the gravity of defense is more serious in proportion as a nation, having a large coast to defend, has distant, dependent territory, equally demanding a mobile naval force



CLASSIFIED DEFENSES.

for its defense. The submarine boat, the dirigible balloon, and wireless telegraphy, menace modern commercial ports with visitations only less fatal than those of the earthquake and volcano.

Field Fortifications.— This branch of military engineering has a duplex character, but of quite uniform general requisites. They may either constitute the chief defense of a city, or neutralize the numerical superiority of an enemy in the field by wise adjustment of their lines. Two illustrations are suggestive of their value:

On 5 April 1862, when both officers and men were alike inexperienced in operations of war, between large armies and over extended territory, remote from their general base, the Federal army was confronted at Pittsburg Landing, Tenn., by a largely superior force under command of Gen. Albert Sydney Johnson, of the Confederate army. Skirmishing occurred during the day; but Gen. Grant, the chief Federal commander, believing, as he advised his superior, Gen. Halleck, and states in his 'Memoirs,' that there was hardly the slightest possibility of attack, as reinforcements were on the way to his support, failed to entrench. On the following morning, an attack was made in force, driving the Federal army back to the Tennessee River, where the arrival of Gen. Buel's division alone averted a serious disaster. Neither Gen. Grant nor Gen. Sherman committed a similar error of judgment later in the war.

On 30 Nov. 1864 Major-Gen. John M. Schofield retired from Pulaski, closely followed by the two-fold superior army of Gen. Hood. After fighting daily for three weeks, and after frequent rains, leaving with night he marched directly to the city of Franklin, Tenn., where in the bend of the Harpeth River, he gave battle. Between morning and 3 o'clock of that afternoon, when the combined Confederate divisions made an impetuous assault, his wearied soldiers had so utilized the shovel, pick, fence-rails, locust trees, and osage-orange hedges that, behind their shelter, he repulsed the assault, inflicted a loss of nearly 7,000 men upon his adversary, including 12 general officers, in killed, wounded and captured, and safely fell back upon Gen. Thomas, at Nashville, with a loss of but 20 wagons and less than half the casualties of his opponent.

Similar entrenchments had their ancient types in those of Cæsar, who invariably established his camp within a quadrangle surrounded by a rampart of the height of from 7 to 9 feet, with gates on four sides, and sufficiently large in area to include all animals and supplies belonging to his command. On one occasion, seeking winter quarters, he carried a parapet, with ditch, 16 miles, from Lake Geneva to Mount Jura, 15 feet high, and with various small redoubts on the line, so that practically he multiplied his numerical strength three-fold. In modern times, the Crimean war introduced a system of earthworks which withstood a heavy fire before which granite walls had crumbled.

Reduction of Fortified Positions.— Field works, against a fortified position, assume an attitude of counter-defense, as well as a cover for siege or assault. The relative strength of the assailing force belongs to another branch of the military art; but it must be proportionately greater, as the circumference of the investment enlarges, and must prove able, at any vital point, to meet any sally of the garrison, either by numerical superiority, or its equivalent, in artificial defense. Inequalities of the ground, commanding summits, a safe communication with the base of supply, are *strategic* conditions; but all are parts of the position to be assured. After estimating accurately the intervening distance, and at what nearer approach the encircling ditch may be filled, or bridged, for assault, the advance begins. A mortar battery in the rear, or guns in an elevated position, may play upon the intervening space to protect the *pioneers* in locating rifle-pits, while establishing the *first line* of works. The general advance, as thus initiated, is that of a ship beating against the wind, and the zig-zag course adopted borrows its name, *traverse*, from marine usage. Successive files of men dig these traverses, throwing the earth outward to the front, as a cover from fire, and thereby open a way for the advancement of guns, as well as of engineers and troops. A second line, *parallel* with the first, is opened to the right and left, where guns are at once placed in position. A third line, or *parallel*, is so planned as to place the defensive works at the mercy of the besieger. At Yorktown, Va., in 1781, with a river base and no sufficient escape by sea, the effectiveness of the advanced parallel compelled surrender. At Yorktown, in 1862, with works open at the rear for retreat, the scientific soldier in command rightly assumed that the scientific soldier at his front would attempt no assault until his third line was perfected and armed. Hence, he wasted the ammunition of the besieger to the last safe limit, and withdrew his own force in good order, to suit himself.

To this suggestive summary of fortifications, for the unprofessional reader, must be added the statement, that topographical and geographical features largely dominate in matters of attack or defense. *Boundary* lines, whether of mountain or river; interior or coastwise positions; the control of only one or of both banks of a navigable river, give character to defenses and methods for their reduction. Notable illustrations are found in the Dardanelles, the entrance to the Baltic Sea, the Suez Canal, and, prospectively, of vast moment, the Inter-Oceanic Canal in Central America. In proportion as Nature lends her secrets of omnipotent power to the inventive genius of man, so will fortifications change their forms and relations until nations shall control the secret which should inspire all such warlike devices, that of substantial and universal fraternity and peace.

HENRY B. CARRINGTON, U. S. A.

Fortifications, Modern Seacoast. The modern science of seacoast fortification wrought marvelous changes during the years intervening from 1893 to 1903. All the great maritime nations expended enormous sums of money to better fortify their coast lines. The United States after 16 years of labor practically completed, during the summer of 1903, the most costly and the most substantial and powerful system of seacoast fortifications in the world. The great improvements made during the latter part of the 19th century in the construction of heavy guns rendered it necessary to revise the system of fortifications formerly in vogue. Iron and steel turrets have taken the place of masonry on exposed sites, where earth cannot be employed to advantage. These turrets are revolving cupolas with spherical roofs, and in most instances even the largest guns are mounted on disappearing carriages. This is essential since the forts are now called upon to prove their prowess against steel-plated warships.

Great Britain concluded the rebuilding of her forts with iron and steel as long ago as 1880, at a cost of $37,000,000 for nine harbors alone. At Dover, England, solid iron turrets of enormous thickness have been built to carry two 80-ton guns to each turret. Steel cupolas of the Gruson pattern to the number of 28 have been constructed since 1890 in various harbors of Germany, Austria, Belgium and Holland. In 1900 the Italian government placed an order for two of these cupolas to mount two 120-ton Krupp guns each, for the defense of the naval station at Spezzia. The order was conditioned on a test shield or segment of the cupola resisting three shots of the Armstrong 100-ton gun — a test which it successfully withstood, though the same gun had pierced every other known form of construction.

The 20th century fortifications of the United States seacoast finished in 1903 are excelled by those of no other nation in the world. The work was outlined if not actually begun in 1886, when a board of military engineers proposed a system of steel turrets, armored casements, barbette batteries, mortar and floating batteries, and submarine mines. So rapid was the advance of military progress that the original plans were largely changed and modified. The vastness of this work and the great cost can be imagined when America has 5,558 miles of seacoast demanding protection of the most improved kind. Between 1886 and 1903, three fourths of the work was finished, and yet huge rifles and mortars to the value of $15,000,000 were required to complete the undertaking. A modern, high-power coast-defense gun is a huge and elaborate machine, the effective management of which requires great skill. A single 12-inch rifle for one of the modern forts cost $45,000, its carriage $41,000, and the emplacement of concrete in which it stands $60,000, or a total initial cost of $146,000. The total expense for each modern fortress amounts to over $2,000,000. The 20th century fortress is not a walled enclosure as of old, but a hole in the ground, or rather a series of holes called emplacements, built of concrete, and each of them containing one or more guns. No lofty, menacing structure strikes the eye of the observer who approaches the works, but instead there is likely to be rolling greensward with shrubbery, suggesting rather the skill of the landscape gardener than that of the military engineer. The real protection consists of 30 feet of iron and masonry and 30 feet of earth, which form a plane sloping outward, so that any projectile striking is promptly buried or glances off harmlessly.

Fort Warren, on Georgies Island, in the harbor of Boston, Mass., which is one of the most notable fortifications in the world, has an armament of 30 guns and mortars. Several of the guns are 12-inch rifles, but the exact character of the armament is kept carefully secret by the military authorities. The mortars are arranged behind the cannon and are capable of throwing explosive shells for a distance of three miles, and with sufficient accuracy to destroy a vessel at that distance. The projectiles carry an enormous charge of maximite which is three times as powerful as gunpowder. Over 600 of these mortars, each of 12-inch calibre, are distributed among the various coast fortifications. They are a vast improvement on the old-style mortars of cast iron with steel hoops. A mortar of the new, modern type is 13 feet long and weighs nearly 30,000 pounds, and requires a charge of 125 pounds to send its conical projectile on its deadly mission. Weapons of this character have not yet undergone a test in actual war. The modern 12-inch rifle is 40 feet long, weighs 104,000 pounds, requires a charge of 520 pounds, and fires a 1,000-pound projectile a distance of 9 miles, with a velocity, upon leaving the muzzle, of 2,100 feet per second. The 12-inch gun could send the same projectile 14 or 15 miles, if the muzzle was sufficiently elevated, but it would be useless in aiming at an enemy who is beyond the limit of vision, for a ship is out of sight only seven miles away owing to the curvature of the earth. These guns shoot three kinds of projectiles. One is the so-called armor-piercing shot, which is nearly solid, having only a small cavity to contain a high explosive. The second is the armor-piercing shell, which has a larger cavity so as to contain more of the explosive. The third is the torpedo shell, which is in effect a torpedo, having thin walls and containing a large bursting charge of maximite. This explosive is a government secret so far as its composition is concerned. Most of the great rifles are mounted upon disappearing carriages, so they are safe from the fire of the enemy except at the very moment of firing. When its fire has been delivered the gun is lowered promptly below the parapet, and after being reloaded is uplifted again to the firing position.

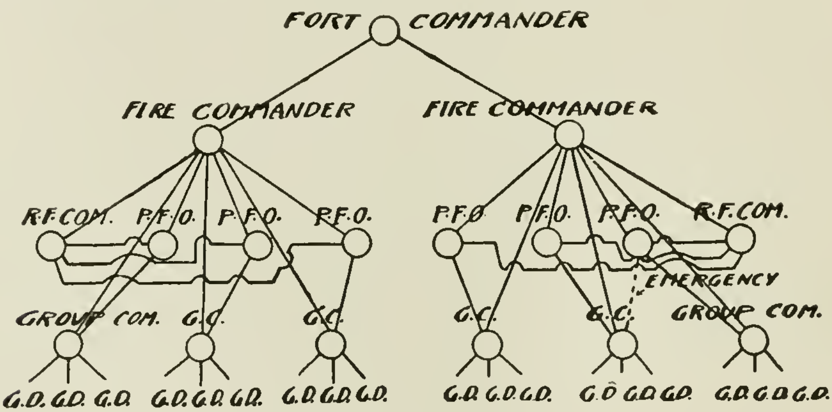
At Fort Wadsworth, on Staten Island, N. Y., at The Narrows, is located another almost perfect system of coast defense, which is regarded by army officers as a model or typical artillery station. The fortification consists of three separate batteries or groups of guns — one battery of five 8-inch guns and two of two 10-inch guns each, a fire commander's station, three position finding stations, a power and electric plant, a storage battery plant of 60 cells for storing of light and power for the stations when the main power plant is not in operation (for example, if it should be wrecked by a shell), two electric searchlights of 60,000 candle-power beam and wires connecting the electric plant with all parts of the fortification and connecting the stations by telephone.

The War Department has prepared the accompanying diagram to illustrate the system of control in the typical artillery station. The diagram is not arranged particularly for the works at Fort Wadsworth. In command of this fortification is a fort commander. Under the fort commander are two fire commanders, each being in control of three groups of guns. Each group in the diagram is composed of three guns, but the number may be more or less. Generally it is the number which one officer can supervise efficiently in action. Each of these officers is called a group commander. Between the fire commanders and the groups of guns is a line of range finders and position finders under a range finder commander and position finding officer. Finally each gun has its firing crew of three, under command of a gun director, who may be an officer or a non-commissioned officer. The guns are of course behind emplacements. At Fort Wadsworth nature has provided a natural defense in a high hill with a slope terraced to the edge of the water. Behind the hill the fortifications are constructed. On the hill above is the fort commander's station, which controls the approaches to the harbor. The telephone places the fort commander in direct communication with those under his command. The printing telegraph, unknown in the days of the Civil War, is also used in the scheme of communication. The fort commander sitting in his station, communicates his orders to the fire commander by telephone, giving information as to the general scheme of defense. The fire commander communicates with the range finder commander, and then on down the line to the group commander and thence to the three gun directors under him. Under this system the fort commander has perfect control over the guns. If a hostile fleet approaches, he can detect it from his elevated station long before the ships' guns have the fort in range. He can direct the attention of the fire commanders to it, if they have not seen it, and inform them with what guns he wants the firing on it opened. In accordance with a map of the harbor which lies before him he can direct that these guns be turned against a certain target or ship. The fire commanders will transmit his order to the position finding officers, who will indicate the position and range to the group commanders. Then the guns will be aimed and fired. The position finder occupies the most important station, because upon the accuracy of his work depends the effectiveness of a shot which will cost the government $1,000 and possibly cost the enemy $2,000,000 or the value of a modern warship. In aiming the guns allowance is made for the moving enemy and for the force of the wind. The firing is done by stop-watch and every second of time is important.

At the outbreak of the Spanish-American war, the government, owing to the parsimony of Congress, possessed no smokeless powder. In July 1903, millions of pounds of this explosive were safely stored at the various seacoast fortresses. When the American forces took possession of the fortifications at Havana, many of the front sights of the Spanish guns were missing. These cannon were made at Spanish arsenals, and it is supposed that the same defect existed in the guns on the Spanish warships, which may account for the slight damage inflicted upon American ships by the guns of Spain.

The modern system of seacoast defenses of the United States, comprises the following fortifications:

Fort Foster, Maine, on Gerrish's Island, in Portsmouth Harbor.
Fort Gorges, Maine, on Hog Island Ledge, in Portland Harbor.
Fort Preble, Maine, at Spring Point, in Portland Harbor.
Fort Scammel, Maine, on House Island, in Portland Harbor.
Fort Stark, N. H., at Jerry's Point, in Portsmouth Harbor.
Fort Warren, Mass., on Georgies Island, in Boston Harbor.
Fort Strong, Mass., at Long Island Head, six miles from Boston.
Fort Banks, Mass., at Grover's Cliff, near Boston.
Fort Adams, R. I., on Brenton's Point, near Newport.
Fort Greble, R. I., on Dutch Island, Narragansett Bay.



ARRANGEMENT OF FORT BATTERY.
Diagram designed by the War Department.

Fort Wetherill, R. I., on Conanicut Island, Narragansett Bay.
Fort Hamilton, N. Y., at The Narrows, New York Harbor.
Fort Lafayette, N. Y., at The Narrows, New York Harbor.
Fort Michie, N. Y., on Great Gull Island, 12 miles from New London, Conn.
Fort Tompkins, N. Y., on Staten Island, at The Narrows.
Fort Wadsworth, N. Y., on Staten Island, at The Narrows.
Fort H. G. Wright, N. Y., on Fisher's Island, entrance to Long Island Sound.
Fort Carroll, Md., at Seller's Point Flats, Patapsco River.
Fort Howard, Md., at North Point, Patapsco River.
Fort Smallwood, Md., at Rockpoint, 10 miles from Baltimore.
Fort Hunt, Va., Potomac River.
Fort Washington, Md., Potomac River.
Fort Moultrie, S. C., on Sullivan's Island in Charleston Harbor.
Fort Sumter, S. C., in Charleston Harbor.
Fort Oglethorpe, Ga., at Savannah.
Fort Pulaski, Ga., on Cockspur Island, Savannah Harbor.
Fort Taylor, Fla., at Key West.
Fort Barrancas, Fla., near Pensacola.
Fort Pickens, Fla., on Santa Rosa Island, near Pensacola.
Fort Gaines, Ala., on Dauphin Island, in Mobile Bay.

Fort Morgan, Ala., at Mobile Point.
Fort St. Philip, La., 65 miles below New Orleans.
Fort San Jacinto, Texas, near Galveston.
Fort Rosecrans, Cal., at San Diego.
Forts Miley, Baker, and Winfield Scott, Cal., in San Francisco Harbor.
Forts Casey, Columbia, Lawton, Walla Walla and Wright, Wash., in Puget Sound.

The foregoing are the new-type fortifications and in addition to these there are nearly 100 other forts along the Atlantic and Pacific seacoasts, not yet remodeled or equipped with the modern appliances of warfare. See ARMY OF THE UNITED STATES; ARTILLERY; MILITARY POSTS, U. S.

Fortiguerra, Niccolo, nē-kō-lō' fōr-tē-gwā'ra, Italian poet and prelate: b. Pistoia 7 Nov. 1674; d. Rome 17 Feb. 1735. A prelate at the court of Pope Clement XI. In his epic poem 'Ricciardetto,' so-called from one of the Paladins of Charlemagne, he wished to show that it was easy to imitate Ariosto. He wrote the first canto of this poem in one night, and continued it to 30 cantos. It appeared (1738) under the name of Carteromaco, which had been assumed by the author during his life. Its principal excellence consists in the description of situations. His short poems and sonnets are to be found in different collections of Italian poets.

Fortu'itism (Lat. *fors,* chance), a doctrine or theory of causation which denies the existence of a final end or object in the course of things. Such a doctrine in the domains of nature results in theories such as that of Darwin, who has been charged with denying design in the changes and developments of organized creatures, that is, the design of a single controlling mind, namely, of a supernatural creator. The opposite to fortuitism is teleology (q.v.), which is the theory of a final end or object in the processes of nature and history, as resulting from the plan or scheme originating in the mind of the Supreme Being.

Fortu'na (Gr. Τυχή), the goddess of success. According to Hesiod she was a daughter of Oceanus; according to Pindar, a sister of the Fates. She had temples at Corinth, Elis, and Smyrna, and worshipped in Italy before the building of Rome, and had a celebrated temple at Antium, in which were two statues, which were consulted as oracles, and gave responses either by signs or by lot. She had also a temple at Præneste, whence she was called *Dea Prænestina.* No less than 26 temples were erected to her in Rome, the first of which was built by Servius Tullius. She is generally delineated with two rudders, with one of which she guides the ship of prosperity, with the other that of misfortune. At a later period she was represented with a bandage over her eyes and a sceptre in her hand, and sitting or standing on a wheel or globe. She is usually dressed as a matron. On a coin of the Emperor Geta she is represented sitting on the earth with her bosom bare, her right hand resting on a wheel, and holding in her left hand, resting on her lap, a horn of plenty.

Fortunate Islands. See CANARY ISLANDS.

Fortuna'tus, a German collection of tales which originated about the end of the 15th century, though many of the tales and legends included in it are of much older date. The substance of the book is that Fortunatus and his sons after him are the possessors of an inexhaustible purse of gold and a wishing-cap, which however, in the end, prove the cause of their ruin. The moral is that worldly prosperity alone is insufficient to produce lasting happiness. The oldest printed edition of the book now extant bears the date 1509. Later German editions mostly bear the title, 'Fortunatus, von seinem Seckel und Wunsch-hütlein.' It has been reprinted in the third volume (1846) of Simrock's 'Deutsche Volksbücher.' Versions of the story have appeared in French, Italian, Dutch, Danish, Swedish, and even Icelandic. The first to dramatize the subject was Hans Sachs, in 'Der Fortunatus mit dem Wunschseckel' (1553), after whom comes the English Thomas Dekker, with his 'Pleasant Comedie of Old Fortunatus' (1600), a work which made its reappearance in German about 1620. The most poetical edition of the story is that given by Tieck in his 'Phantasus' Consult Schmidt, in Ersch and Gruber's 'Encyklopädie' (Sec. 1, Vol. XLVI.).

Fortune, Robert, English author and botanist: b. near Berwick-on-Tweed, England, 1813; d. Scotland 16 April 1880. He learned gardening in early life, and gained a position in the botanical garden at Edinburgh. In 1842 he was appointed collector of plants for the Botanical Society of London in northern China. He published the results of his inquiries in his 'Three Years' Wanderings in the Northern Provinces of China' (1853). In 1848 the East India Company engaged him to visit China to compare the qualities and commercial value of different kinds of tea. He visited the East several times afterward and published an account of his numerous botanical discoveries in 'Two Visits to the Tea-countries of China' (1852); 'Residence Among the Chinese, Inland, on the Coast, and at Sea' (1857); 'Yedo and Peking' (1863).

Fortune Bay. By the fisheries treaty of 1871 with Great Britain (see FISHERIES QUESTION), the American fishermen were granted equal rights on all British coasts. The Newfoundlanders were very jealous of this intrusion on their fishing grounds, and in 1878 the Fortune Bay fishers attacked and drove away some Gloucester vessels. Demand was made on Great Britain for damages, and £15,000 was ultimately paid.

Fortune-telling, predicting the future of an individual, by means of signs or indications noticed by the fortune-teller. Chiromancy is the art of reading the lines or wrinkles on the palm of the hand, as indicative of the future for the person so marked. Necromancy is the art of consulting the dead about the future. In chartomancy playing cards are supposed by their suit or denomination when turned up after being dealt out, to reveal coming events. The ancient astrologer used to decide from the stars the good or bad fortune of an individual, the hour and day of whose birth was taken as data in calculating the planetary conjunctions on which the horoscope was based. In every great city, even of the modern world, there are hosts of people who make a profession of fortune-telling, and there are many more who are credulous enough to believe in their pretensions. The law does not recognize the power of anyone to foretell the future, and the deluded victim of such charlatans, who has paid the wizard for a supposed revelation of the future, can bring the latter to justice for obtaining money on false pretences. In the ancient world there was a strong belief in fortune-telling, or the power to predict the future. At Rome the government appointed official fortune-tellers of the state, who from the flight of birds or the appearance presented by the entrails of sacrificial victims made calculations as to coming events. The oracles of Delphi and Dodona were consulted by the wisest and best pagan Greeks. At Rome fortunes were told, or believed to be told, by Fortune herself in her temple at Antium. The literature of the Middle Ages is full of allusions to fortune-telling, which also played a part in the fiction and drama of all countries up to the middle of the 19th century. The belief in witches, wizards, and fortune-tellers has utterly disappeared among educated people, as fortune-telling has disappeared from literature. This results, to a large extent, from the advances made in physical science, the clearer views which prevail concerning causation, and the limits of human experience. Rationalism, in its newest form of agnosticism, has likewise cleared the intellectual atmosphere, and made delusion and imposture less and less able to obtain a footing or exercise an influence over sane minds.

Fortunes of Nig'el, The, an historical novel, with scene laid in the London of James I., published by Sir Walter Scott in 1822. The introduction to this work contains interesting self-criticism by the author.

Fortuny y Carbo, Mariano, mä-rē-ä'nō fōr-too'nē ē kär'bō, Spanish painter: b. Reus near Barcelona 11 June 1839; d. Rome 21 Nov. 1874. He studied at Madrid, traveled in Morocco, and settled at Rome, where he became the centre of a school of artists in revolt against over-study of the "masters." In 1866 he went to Paris, where his pictures, mostly genre subjects from Southern and Oriental life, had a great success. Among the best known are: 'A Spanish Marriage'; 'A Fantasia at Morocco'; 'The Academicians at Arcadia'; 'The Seashore at Portici.' The Metropolitan Museum of New York contains his 'Lady in Black,' and 'Camels at Rest,' and many other pictures of his are contained in public and private American art collections. He was also known as an able etcher. See Lives by Davillier (1875), and Yriarte (1886): Muther, 'History of Modern Painting' (1890).

Forty, a number that has sometimes been regarded as peculiarly significant. The idea may have originated with readers of the Bible, who notice that Moses was 40 days on the mount: Elijah was 40 days fed by ravens; the rain of the flood fell 40 days, and another 40 days expired before Noah opened the window of the ark; 40 days was the period of embalming; Jonah gave Nineveh 40 days to repent; our Lord fasted 40 days. He was seen 40 days after his resurrection, etc.

The weather on St. Swithin's Day portends, as it is foul or fair, 40 days' rain or dry weather; a quarantine extends to 40 days; 40 days, in the old English law, was the limit for the payment of the fine for manslaughter; the privilege of sanctuary was for 40 days; the widow was allowed to remain in her husband's house for 40 days after his decease; a knight enjoyed 40 days' service of his tenant; a stranger at the expiration of 40 days was compelled to be enrolled in some tithing; members of Parliament were protected from arrest 40 days after the prorogation of the house, and 40 days before the house was convened.

Forty Immortals, The, the members of the French Academy. See ACADEMY, FRENCH.

Forty Thieves, a band of robbers in the tale 'Ali Baba' in the 'Thousand and One Nights.' They dwell in a cave, the door of which opens at the words "Open, Sesame."

Forum (Lat. for a market-place; connected with *foris,* out of doors), the open space in the centre of a city, in Roman times, where the people assembled, as on common ground, for amusement or the transaction of business. Here elections were held; here were the public buildings, civic and administrative. Included in the forum was the comitium, with its tribunals for the orators who addressed the people. The *curia* or senate house stood, with other buildings, on the forum; and between the public edifices stretched lines of shops or *tabernæ.*

In the days of the kings and under the early republic there was but one forum in each city, small or great. In this open space all public business, political and legal, and all mercantile transactions were carried on. Dramatic representations, exhibitions of gladiators, combats of wild beasts and horse races also took place in the forum. The single forum eventually gave place to two forums, one of which was given up to law administration and politics, and the other to mercantile traffic. Eventually, each important commodity had its own forum. There was the *forum boarium,* cattle market; *forum suarium,* hog market; *forum olitorium,* vegetable market; and *forum piscarium,* fish market. The trade shops, as of gold- and silver-smiths, saddlers, blacksmiths, tinsmiths, money-lenders, booksellers, etc., were ranged round these fora, or occupied streets adjacent to them. The temples that edged the forum at Rome, like the mediæval cathedrals, were sometimes used for secular purposes. Thus, the senate often held meetings in the Temple of Concord, while the Temple of Saturn was used as state treasury, and was also the depositary of public archives, before the erection of the Tabularium. There are a great many ruins which enable us to gain a fair idea of the fora of other cities beside Rome. The fora at Pompeii are as follows. The principal forum; 450 feet from north to south: in its north side was the Temple of Jupiter, the Basilica, or law court, and the temple of Apollo; on the west and on the east side the *macellum* (meat market), the *senaculum* or curia, the Temple of the Genius of Augustus, and the *Scholæ* or corporation building. The triangular forum, *forum triangulare,* contained a Doric temple to the south, and an Ionic portico at the entrance.

In the open spaces of the forum were set up many statues of distinguished men. Even in the days of the republic it was necessary to order the clearing out of such statues, together with crowds of altars, arches, and memorial columns which blocked up the place.

The forum par excellence was of course the original Forum Romanum. It was situated in the hollow between the Palatine, Capitoline and Quirinal hills. The early tribes met on this common and neutral ground. Under the Tarquins the consolidation of the tribes is suggested by the completely adorned and enclosed appearance of the Forum. The Temple of Saturn appeared in 497 B.C., that of the Dioscuri in 484 B.C., that of Concord in 367 B.C. The first court-house, Basilica Porcia, was not built before 184 B.C.; three more were built later, and it was this increase of buildings that occupied so much of the vacant space that the fish, meat, hog, vegetable and other markets were obliged to retire to other quarters of the city.

Julius Cæsar was the first to add special forums to those already in existence, and his Forum Julium was followed by the Forum Martis of Augustus, sometimes called Forum Augustus. Then came the Forum Pacis of Vespasian, the Forum Transitorium of Domitian and Nerva, the Forum Trajani of Trajan. These all lay side by side, north and east, with the Forum Romanum. The Forum Julium had in its centre a temple of Venus Genetrix, the patron goddess of the Julian gens round which it formed a sort of sacred precinct. The Forum Augustum was dedicated to Mars and in it was situated the Temple of Mars Ultor. This building was flanked by two triumphal arches, and Cæsar had intended that it should commemorate, with appropriate statues, the extension of Roman dominion. The Forum Nervæ was dedicated to Minerva and contained her temple. As the main thoroughfare through this district of the city crossed this forum it was commonly known as Forum Transitorium. The most gorgeous architectural group in the imperial city was exhibited in the Forum Trajani, which had its own special Basilica, like the great forum. It was entered by a triumphal arch, surrounded by a double colonnade; an equestrian statue of the emperor stood in the centre, flanked on each side by a half circle. The Library, Column and Temple of Trajan completed the cluster of marble structures.

The appearance of the Forum Romanum during the last days of the empire may be described as follows: Looking toward the Capitol the spectator would see the Temples of Concord, of Vespasian, and the Dii Consentes. The Temple of Saturn stood between the slope of the Capitol and the Vicus Jugarius. Beside it was the Arch of Tiberius, near that of Septimius Severus. Between these two arches were the rostra. The political buildings stood on the farther side of the arch of Severus. Here was the Senate house or the Curia, while the Temple of Janus rose side by side with the Basilica Æmilia. On the south and opposite side was the vast Basilica Julia, and the beautiful Temple of the Dioscuri. East from this group of buildings was an open space occupied by the Temple of Julius, side by side with which was the triumphal arch of Augustus, and beyond these is the most interesting tract of the old forum, the centre of antique and primitive Roman religion. The Shrine of Vesta, the Temple of Antoninus and Faustina, the Templum Urbis made up a magnificent range of noble and solemn structures, and we are reminded also that at this point once stood the arch of the Fabii at the opening of the ancient Via Sacra.

The invasions of the Goths did not bring much destruction upon the forum. It was in the 11th century that the buildings were devastated at the sacking of Rome (1084), when Gregory VII. was delivered from the Castle of San Angelo by Duke Guiscard. The rarest monuments of the antique world were employed as fortresses. The 16th century witnessed the antiquarian curiosity and reckless vandalism of the Renaissance. The Forum of Cicero and Augustus became a wilderness with only a few isolated columns to mark the site of temples or palaces. Under the learned and liberal Pius VII. the relics were preserved from further destruction and the archæologist Carlo Fea then began those excavations which have been continued by Lanciani.

Bibliography.—Jordan, 'Topographie der Stadt Rom im Alterthum' (1871); Middleton, 'The Remains of Ancient Rome' (1892); Nicholas, 'The Roman Forum' (1877); Lanciani, 'Ruins and Excavations of Ancient Rome' (1897); Boni, official report of excavations, 'Notizie degli scavi' (1899 et seq.); Platner, 'Topography and Monuments of Ancient Rome' (1904).

Forum Ecclesiasticum, a church tribunal or court. It is either internal or external—*Forum Internum, Forum Externum.* The *Forum Internum* is what is known as the tribunal of penance, the confessional, where the penitent is both accuser and accused; and the confessor is the judge who condemns or acquits or pardons, and exacts satisfaction for wrongs and reparation of injury done to others whether in reputation or property. The *Forum Externum* is any ecclesiastical tribunal outside of the sacrament of penance that is concerned with church government. What are the sanctions by which the judgments of the Church's tribunals are enforced? Has the Church the right to inflict temporal pains and penalties on offenders against her laws? That the Church does possess such power is the teaching of the Church herself: the doctrine which declares she does not possess it has been explicitly condemned. The proposition that "the Pope or the whole Church collectively cannot punish any man, however wicked he may be, with a coercive penalty" unless the civil power gives them authority to do so, is condemned by Pope John XXII., and a similar proposition was condemned by Pope Pius VII. in the bull *Auctorem Fidei:* one of the propositions condemned by Pope Pius IX. in the *Syllabus* (1864) declared that "the Church has no power to employ force." In proof of the necessity of such power in the Church, the case of a bishop is cited who teaches heretical doctrine: has not the Church, it is asked, power to depose him; or must the matter go before a tribunal of the civil power? It is held that to make such resort to the secular courts necessary is to render the Church powerless to execute her divine commission, and to make a civil judge the judge of a purely ecclesiastical cause. On the ground of the canon law the Church has the right in herself "to inflict stripes, to impose fines, to imprison in a monastery" offenders against her laws; in short, to impose all penalties short of the effusion of blood, *citra sanguinis effusionem,* or its equivalent. Practically, the power of the Church at present is confined to the infliction only of her spiritual penalties, and these only when they do not in any degree directly or indirectly impair the civil rights of the person who incurs the spiritual censures; when they do so trench on his civil rights, the person has recourse to the secular courts. Thus in this country cases are often brought into the civil tribunals of rectors of parishes or pastors of churches who have been deposed by bishops or other ecclesiastical superiors; and courts find it within their competence to decide whether the act of the superiors has been done in entire conformity with the constitution and laws of the religious body concerned, and the civil and contractual rights of the complainant.

Forward, Walter, American statesman: b. Connecticut 1786; d. Pittsburg 24 Nov. 1852. He studied law and was admitted to the bar in 1806. In 1822 he was elected to Congress; and in 1841 was appointed by President Harrison first comptroller of the treasury, and was reappointed by President Tyler in September of the same year. On retiring from the cabinet in 1843 he resumed law practice. In 1849 he was appointed *chargé d'affaires* to Denmark, but resigned in 1851.

Forwood, William H., American military surgeon: b. Delaware 7 Sept. 1838. He was graduated at the medical department of the University of Pennsylvania and at Georgetown University, Washington, D. C.; entered the regular army as an assistant surgeon in 1861, and served throughout the Civil War. He also served in many Indian campaigns; was surgeon and naturalist with the exploring expedition through Wyoming, Montana, and Idaho, in 1883; located military hospitals in Savannah, Ga., and the camp hospitals in Montauk Point, during the Spanish war; and was appointed surgeon-general of the army with the rank of brigadier-general in 1902.

Foscari, Francesco, frän chĕs'kō fōs kä'rē, doge of Venice: b. 1372; d. Venice 1 Nov. 1457. In 1416 he was named procurator of St. Mark's, and in 1423 was elected doge. His son Giacopo, being accused of ordering the assassination of a senator Donati, the enemies of the family created such commotion in the state that, unable to clear himself to their satisfaction of the charge, he was banished from the city, the father having to ratify the sentence. Love of his country, and devotion to his wife, compelled the banished Foscari at all hazards to revisit his beloved Venice, where, being discovered by his enemies, he was denounced, again made prisoner, put to the question of the rack, and a second time banished, dying soon after of his wounds, or the torments of his secret punishment, and of grief at separation from his idolized family. The fate of the son had such an effect on the doge that the bereaved father went mad, in which state the enemies of his family compelled him to abdicate. He died three days after in a spasm, upon hearing the bells of St. Mark's announce to Venice the election of a new ruler. Byron has written on the subject a tragedy entitled 'The Two Foscari.'

Foscolo, Ugo, oo'gō fōs'kō-lō, originally **Niccolo,** Italian author: b. Zante, one of the Ionian isles, 26 Jan. 1778; d. Turnham Green, near London, 10 Oct. 1827. A man of passionate temperament, and withal an ardent patriot, Foscolo was bitterly disappointed when by the Treaty of Campo Formio Venice was given to Austria, and his disappointment found vent in the 'Lettere di Jacopo Ortis' (1802), a sort of political Werther. Becoming finally undeceived as to Napoleon's intentions with regard to his native land, he returned to Milan, where he published in 1807 his best poem, 'I Sepolcri,' a work composed in the spirit of the ancient classic writers, and remarkable for its smooth and polished versification. About this time he wrote a translation of Sterne's 'Sentimental Journey,' and two tragedies, 'Ajace' and 'Ricciarda,' both showing political tendencies. In 1809 he was appointed to the chair of eloquence in Pavia. His inaugural address, 'Dell' Origine e dell' Ufficio della Letteratura,' although full of the same love of classic beauty which marks the 'Sepolcri,' is turgid and affected in style. When in 1814 the Austrians entered Milan, Foscolo withdrew to Switzerland, and in 1816 he went to London. There some of his best writings were published, namely: 'Essays on Petrarca'; 'Discorso sul testo del Decamerone'; 'Discorso sul testo di Dante.' His remains were finally deposited in the Church of Santa Croce, Florence, in 1871. His works and letters were published at Florence in 12 volumes by Le Monnier (1850–62). Consult Lives by Pecchio (1836); Carrer (1842); Artusi (1878); Antona Traversi (1884); and De Winckels (1885–6).

Fos'dick, Charles Austin ("Harry Castlemon"), American writer of juvenile books: b. Randolph, N. Y., 6 Sept. 1842. He served in the Union navy in the Civil War from 1862 to 1865. Besides contributions to periodicals, he has published under the pseudonym "Harry Castlemon" over 30 books for boys, among which are: 'The Gunboat Series' (1864–8); 'Rocky Mountain Series' (1868–71); 'Rod and Gun Series' (1883–4); 'The Buried Treasure'; 'The Steel Horse'; 'Jack the Trader'; 'The Houseboat Boys'; etc.

Fosdick, William Whiteman, American poet: b. Cincinnati, Ohio, 28 Jan. 1825; d. there 8 March 1862. He gained some distinction as a poet by a drama entitled, 'Tecumseh.' He also published: 'Malmiztic the Toltec' (1851), and 'Ariel and Other Poems' (1855).

Foss, Cyrus David, American Methodist bishop: b. Kingston, N. Y., 17 Jan. 1834. Having been graduated at Wesleyan University in 1854, he became an itinerant in the New York Conference of the Methodist Episcopal Church in 1857, was pastor at Chester, N. Y. (1857–9), Brooklyn (1859–65), and New York (1865–75). In 1875–80 he was president of Wesleyan University, and in the latter year was elected bishop. He made official missionary tours of the stations of the Methodist Episcopal Church in Europe (1886), Mexico (1893), and India and Malaysia (1897–8).

Foss, Sam Walter, American poet: b. Candia, N. H., 19 June 1858. He has been librarian of the Somerville, Mass., public library from 1898. His published works include: 'Back Country Poems' (1894); 'Whiffs from Wild Meadows' (1895); 'Dreams in Homespun' (1897); 'Songs of War and Peace' (1898).

Fos'sa, or **Foussa,** a large, brown, unstriped carnivorous mammal of Madagascar (*Cryptoprocta ferox*), which has the form of a huge weasel (twice the size of a house-cat), and like a weasel is lithe, active and bloodthirsty. Its systematic place is by no means decided. It is placed by Beddard as representing a distinct sub-family of the civets; while Mivart and Lydekker regard it merely as a genus of civets. Zittel, in view of its dentition and the retractibility of the claws, among other features, regards it as occupying an intermediate place between the civets and the cats, and associated with such composite extinct forms as *Dinictis, Proœlurus* and *Pseudœlurus,* but classifies it in the *Felidæ.* It is the largest carnivore in Madagascar, and preys chiefly on birds and lemurs.

Fossil Footprints. See ICHNOLOGY.

Fossil Plants. See PALÆOBOTANY.

Fossil Vertebrates. See FOSSILS; PALÆONTOLOGY.

Fossilif'erous Rocks, rocks in which are found embedded the petrified remains, or molds of plants and animals. See FOSSILS; PALÆONTOLOGY; etc.

Fossils, the impressions or remains of plant or animal forms preserved in rocks by natural causes. Fossils supply data, from which the geologist can determine the relative ages of sedimentary rocks. The first man to realize their chronological importance was the English surveyor, William Smith, known as the father of historical geology, although acute observers like Leonardo da Vinci had pointed out long before that fossil shells were not freaks of nature, but had been laid down where found in the sediments of some body of water.

Most fossil remains are of marine types; many are of fresh-water and land-and-water types; comparatively few are of land types. The reason is plain. Animal remains lying on the ground are eaten by animals, or if not eaten, soon decay, and the bony skeleton, if buried by sand or loam, is slowly dissolved by percolating water. Plant remains decay even more rapidly. In water, decay is retarded. Thus mastodon remains have been found in swamps where the animals were occasionally mired, but of the infinitely greater number of mastodons that died on drier ground no trace is left. Old lake beds are frequently rich in plant and animal remains. Fishes, insects, birds, and land animals, and the leaves, flowers, and fruits of trees are preserved in the fine-grained shales or the sands and clays of the lake deposits in several western States. In old swamps, plants formed thick masses of vegetable matter, now turned to coal, imprints of leaves and stems being common in the shale overlying a coal-seam. In the sea, conditions are most favorable for the preservation of organic remains, and marine deposits have formed thick and extensive beds. Hence, of all the fossils found, marine types are most numerous. Fossils are preserved in several ways, which may be classified under three heads. (1) Some of the original substance may be preserved, as the carbon in a leaf, or the bone or shell of some animal. (2) All the original substance may dissolve away, but its shape may be preserved. This may happen in two ways: (*a*) the external form may be preserved in the sediments, forming a mold, or (*b*) the internal form may be preserved, forming a cast. A mollusk dies; its soft parts decay; the interior of the shell fills with sand or ooze; the shell is deeply buried. The sediments consolidate; the calcareous material of the shell may dissolve; but both its external and internal form are preserved. (3) In rare cases the structure of organic remains is preserved by a true petrifaction, the organic substance being replaced, atom by atom, by some mineral compound, like silica or calcium carbonate. A striking illustration of this method of preservation is fossil wood, in which the replacing silica preserves minute details of structure. See COAL; CORAL ISLANDS; GEOLOGY; PALÆONTOLOGY; PALÆOBOTANY.

Foster, Abby (KELLEY), American reformer: b. Pelham, Mass., 1811; d. 1887. She was married to S. S. Foster (q.v.) in 1845. At first a teacher, from 1837 she appeared as a platform lecturer in support of the abolition of slavery, being the first woman to assume this role, and she suffered much harsh treatment from the opposition. After her marriage she traveled and lectured with her husband, and later spoke also in behalf of woman's suffrage and prohibition.

Foster, Benjamin, American artist: b. North Anson, Maine. A pupil in New York of Abbott Thayer, and in Paris of Luc Oliver Merson, and Aimé Morot, he obtained various recognition of his excellence in landscape, including a bronze medal at the Paris Exposition of 1900, and the Webb prize of the Society of American Artists in 1901. Among his works are: 'Mists of the Morning,' for which he received the Webb prize, and 'Night Scene at the Paris Exposition,' purchased by the French government for the Luxembourg Gallery.

Foster, Birket. See FOSTER, MYLES BIRKET.

Foster, Charles, American legislator and cabinet officer: b. near Tiffin, Ohio, 12 April 1828; d. Springfield, Ohio, 9 Jan. 1904. He entered a mercantile career at Rome, now Fostoria, Ohio, and became the proprietor of the largest country business in the State. At the time of the Civil War he was active in the recruiting of troops. In 1870 he was elected to Congress in a district previously strongly Democratic, and in 1872, 1874, and 1876 was re-chosen. While in Congress he was for some time a member of the ways and means committee. He was elected governor of Ohio in 1879, and again in 1881, his administration being marked by special attention to the non-partisan management of public institutions. In 1891 he was appointed secretary of the treasury by President Harrison, and in that post he negotiated a loan of $25,364,520 at the unprecedentedly low rate of 2 per cent. Subsequently he was a commissioner on several diplomatic missions of importance and performed his duties with great skill and satisfaction to his government.

Foster, David Skaats, American author: b. Utica, N. Y., 1852. After a common-school education at Utica, he there entered the coal and iron business. His publications include: 'Rebecca the Witch and Other Poems'; 'Elinor Fenton,' a novel; 'Spanish Castles by the Rhine,' and 'Prince Timoteo.'

Foster, George Eulas, Canadian statesman: b. Carleton County, New Brunswick, 3 Sept. 1847. He was graduated at the University of New Brunswick in 1868, studied also at Edinburgh and Heidelberg, was professor of classics and history in the University of New Brunswick in 1872–9, and in 1882 was elected to the Canadian Parliament. In 1885–8 he was minister of marine and fisheries; in 1888–96 minister of finances. Upon his visit to England in 1894 in connection with Dominion finances, he negotiated a loan of $11,250,000. He was government leader in the Commons in 1895.

Foster, Gilbert, English artist: b. Manchester, England, 9 May 1855. He studied art with his father, a portrait painter, and exhibited his first picture at the Academy in 1876, since which date he has been a yearly exhibitor. Among his paintings are: 'Lingering Light' (1890); 'Birds of a Feather' (1891); 'The Last Faint Pulse of Quivering Light' (1892); 'The Azure Mead' (1895); 'Hush of Night' (1898); 'A Garden of Lyonnesse' (1900); 'A Garden of Memories' (1901).

Foster, Hannah (Webster), American novelist: b. 1759; d. Montreal, P. Q., 17 April 1840. Her published works are: 'The Coquette, or the History of Eliza Wharton,' one of the earliest of American novels; 'The Boarding School' (1796); and 'Lessons of a Preceptress' (1798).

Foster, Henry, English scientist: b. Woodplumpton, Lancashire, 1797; d. Isthmus of Panama 5 Feb. 1831. He entered the royal marines, but after the peace of 1815 devoted himself chiefly to astronomical studies. The gold medal of the Royal Society of Great Britain was awarded him for his services on the Arctic Expedition of Capt. Ross in 1818-19. On 27 April 1828, he sailed on the Chanticleer, as commander of an expedition to determine the direction of the principal ocean currents in both hemispheres. He was drowned while exploring the Chagres River in Panama.

Foster, John, English essayist: b. Halifax, Yorkshire, 17 Sept. 1770; d. Stapleton, near Bristol, 15 Oct. 1843. A Baptist clergyman, self-educated and with an advanced point of view, he contributed to the 'Eclectic Review' regularly as well as delightfully; but his volume of 'Essays' (1805) constitutes his chief title to recognition. Four in number, these composiions are respectively: 'On a Man's Writing Memoirs of Himself'; 'On Decision of Character'; 'On the Application of the Epithet Romantic'; and 'On Some of the Causes by which Evangelical Religion has been Rendered Less Acceptable to Persons of Cultivated Taste.' All are marked by great solidity and depth of thought, combined with a lucidity and nervousness of style which no English author has surpassed. Of the four essays the palm is generally given to that 'On Decision of Character,' though in the opinion of Robert Hall the fourth of the series was the work on which Foster's fame with posterity would rest. As a preacher Foster never succeeded in attracting much attention. His discourses, though solid and philosophical, were of too abstract and unadorned a nature to be readily appreciated by a popular audience. In 1817 he wrote his 'Essay on the Evils of Popular Ignorance, in which he exposed the fearful condition of the masses in the large towns of England, and strenuously urged the establishment of a national system of education.

Foster, John Gray, American military officer: b. Whitefield, N. H., 27 May 1823; d. Nashua, N. H., 2 Sept. 1874. He was graduated at the United States Military Academy in 1846, entering the engineer corps. At the outbreak of the Civil War he was assigned to duty at Fort Sumter and was one of its garrison during the siege. In 1861 he was commissioned a brigadier-general of volunteers; took a leading part in the capture of Roanoke Island in 1862; was promoted major-general of volunteers; and became commander of the Department of North Carolina, defending that region with skill. Subsequently he commanded the Departments of Ohio and Florida, and in 1865 was brevetted major-general, United States army.

Foster, John Watson, American diplomatist: b. Pike County, Ind., 2 March 1836. He was graduated at the Indiana State University in 1855; studied law, and was admitted to the bar in Evansville, Ind. After the Civil War, during which he served in the Federal army with distinction, he was editor of the Evansville *Daily Journal* and postmaster of that city; minister to Mexico in 1873-80, to Russia 1880-1, and Spain 1883-5. He was special commissioner to negotiate reciprocity treaties with Spain, Germany, Brazil, and the West Indies in 1891; and United States secretary of state 1892-3. Subsequently he was the agent for the United States before the Bering Sea Arbitration Tribunal at Paris; participated in the peace negotiations with Japan; and in 1898-9 served as a member of the Anglo-American Joint High Commission. He has published a pamphlet, 'The Alaskan Boundary' (1899), and 'A Century of American Diplomacy 1776-1876' (1900).

Foster, John Wells, American geologist: b. Brimfield, Mass., 1815; d. 1873. He was graduated at Wesleyan University in 1834, and having removed to Ohio, studied law and was admitted to the bar there; in 1837 became an assistant in the geological survey of Ohio; and in 1847 was appointed an assistant to Prof. Jackson in a survey of the region about Lake Superior. The results of this survey, executed in connection with J. D. Dana, appeared in several volumes published by authority of Congress. Foster aided in the organization of the Republican party in Massachusetts, and from 1858 was resident in Chicago, where he made a notable study of the ethnology and palæontology of the Mississippi basin. Among his works are: 'The Mississippi Valley' (1869); 'Prehistoric Races of the United States' (1873).

Foster, Judith Ellen (Horton), American temperance advocate: b. Lowell, Mass., 3 Nov. 1840. She was married to E. C. Foster in 1869. She studied law and in 1872 was admitted to the State bar of Idaho. In 1870-84 she was superintendent of the legislative department of the National W. C. T. U., and upon the affiliation of the society with the Prohibition party, joined the Non-Partisan W. C. T. U., of which she was president in 1889-93. Her publications include: 'Constitutional Amendment Manual' (1882); 'The American Renaissance.'

Foster, Lafayette Sabine, American statesman: b. Franklin, Conn., 22 Nov. 1806; d. Norwich, Conn., 19 Sept. 1880. He was graduated at Brown University in 1828 and admitted to the bar in 1830; took an active part in Connecticut politics, and was elected to the legislature in 1839, serving several terms. He was elected to the United States Senate in 1854; was president pro tem. of the Senate in 1865; and, after Andrew Johnson became President, was acting Vice-President of the United States. His senatorial term expired in 1867, but on account of his moderate and conservative course in the Senate his re-election was strongly opposed, and he withdrew his name. In 1870 he was again elected to the State legislature, but resigned in June of that year to take his seat on the bench of the Connecticut supreme court. In 1878 he was appointed a member of the commission to devise simpler forms of legal procedure for State courts, and in 1878–9 was commissioner from Connecticut to settle the disputed boundary question with New York.

Foster, Sir **Michael,** English physiologist: b. Huntington 8 March 1836; d. London, 29 Jan. 1907. He was a surgeon 1860–6; became prælector of physiology at Trinity College, Cambridge, in 1870, and from 1883–1903 was professor of physiology at Cambridge. He was president of the British Association in 1899 and was knighted the same year, and was member of Parliament for London University from 1900. He published: 'Text Book of Physiology'; 'Lectures on History of Physiology,' etc.

Foster, (Myles) Birket, English artist: b. North Shields 4 Feb. 1825; d. Weybridge, Surrey, 27 March 1899. He began his artistic career as a wood-engraver, executing illustrations for 'Punch' and the 'Illustrated London News,' and for several volumes of English classics. From 1859 he drew much in water-color, being particularly successful in his presentation of rural life and landscape. Among his subjects in this genre are: 'Nutting'; 'Feeding the Ducks'; and 'Cows in the Pool.' His works are widely popular in England, where they have been much engraved.

Foster, Randolph Sinks, American Methodist clergyman: b. Williamsburg, Ohio, 22 Feb. 1820; d. Newton, Mass., 1 May, 1903. He was educated at Augusta College (Millersburg, Ky.), entered the Methodist Episcopal ministry as an itinerant in 1837, was transferred from the Kentucky conference successively to Ohio and New York, and was president of the Northwestern University 1857–60. In 1868 he became a professor in Drew Theological Seminary (Madison, N. J.), and in 1872 president of the institution. In the latter year he was also elected bishop, and in 1896 retired from the ministry. Among his publications are: 'Centenary Thoughts'; 'Studies in Theology'; 'Philosophy of Christian Experience.'

Foster, Robert Verrell, American theologian: b. Wilson County, Tenn., 12 Aug. 1845. He was educated at Cumberland University (Lebanon, Tenn.), and the Union Theological Seminary, and from 1877 has been a professor in the former, originally of Hebrew and New Testament Greek, subsequently of systematic theology. Of his publications may be named: 'Old Testament Theology' (1890); 'Systematic Theology' (1898).

Foster, Roger, American lawyer: b. Worcester, Mass., 1857. He studied at the University of Marburg, Yale, and the Columbia Law School, in 1880 was admitted to the New York bar, and was special counsel to the board of health of New York in 1896–8. His writings include, besides many pamphlets and articles in periodicals: 'A Treatise on Federal Practice' (1890–2); 'A Treatise on the Income Tax of 1894' (1895).

Foster, Stephen Collins, American songwriter: b. Pittsburg, Pa., 4 July 1826; d. New York 13 Jan. 1864. He was educated at Athens Academy and Jefferson College, Pennsylvania. He composed the music and wrote the words of over 125 popular songs and melodies, among which are: 'Old Folks at Home'; 'Nelly Gray'; 'Old Dog Tray'; 'Come Where my Love Lies Dreaming'; 'Suwanee River'; etc.

Foster, Stephen Symonds, American abolitionist: b. Canterbury, N. H., 1809; d. 1881. He was graduated at Dartmouth College in 1838; studied theology at the Union Seminary, became an anti-slavery orator, and was known for his radical methods. His attacks upon the Church for its position in regard to abolition aroused hostility against him, and his practice of interrupting church services was the cause of several mob disturbances. He published 'The Brotherhood of Thieves: A True Picture of the American Church and Clergy' (1843).

Foster, Theodosia Toll («Faye Huntington»), American author: b. Verona, N. Y., 1838. She was married to James H. Foster 1869. She was educated at the Oneida Seminary, and was for many years principal of a school at Verona. Her works include a long series of volumes of fiction, such as: 'Ripley Parsonage' (1877); 'What Fide Remembers' (1885); 'The Boynton Neighborhood' (1895); and 'Lewis Elmore — Crusader' (1898).

Fosto'ria, Ohio, a city in Seneca County, 35 miles from Toledo, on the Baltimore & O., and Lake Erie & W. R.R.'s. It was named in honor of Charles Foster, governor of Ohio (1891–3), who was influential in building many factories here. Pop. (1900) 7,730.

Fothergill, fŏth'ėr-gĭl, **Jessie,** English novelist: b. Manchester, England, 7 June 1856; d. London 30 July 1891. Her stories show a keen faculty of observation, and include: 'Healey, a Romance' (1875); 'Aldyth' (1876); 'The First Violin' (1878), in which German life is faithfully portrayed; 'Probation' (1879); 'Kith and Kin' (1881); 'Made or Marred'; 'Borderland' (1886); 'One of Three'; 'The Lasses of Laverhouse' (1888); 'A March in the Ranks' (1890); 'Oriole's Daughter' (1893).

Fotheringay (fŏth'ėr-ĭn-gā) **Castle,** the site of which was near Peterborough, England, 27 miles northeast of Northampton. The castle to which a melancholy interest attaches as the scene of the imprisonment, trial, and execution of Mary Queen of Scots, was demolished by her son James I. Several of the illustrious Plantagenets are buried in its church.

Foucault, Jean Bernard Léon, zhŏñ bār-nār lā-ŏñ foo-kō, French scientist: b. Paris 18 Sept. 1819; d. there 11 Feb. 1868. He was editor of the 'Journal des Débats' from 1845, in 1854 became physicist to the Imperial Observatory, and in 1855 received the Copley medal of the Royal Society of London for his measurement of the velocity of light. His inventions include a device much used in the employment of the electric light in microscopic and optical researches. He also demonstrated (1851) by means of the pendulum and the gyroscope, the rotation of the earth upon its axis.

Foucault Currents, or **Eddy Currents,** are electrical currents generated by induction within the substance of a massive conductor that is moving in a magnetic field, or which is exposed to the influence of a variable field. If the conductor is filiform, like a wire, no current can be produced in it save in the direction of its length. If a massive conductor be thought of, however, as composed of an infinite number of closed circuits, each composed of a single wire, and all tangled up and then melted into a solid mass, it is evident that (in general) currents will be induced in all of these imaginary circuits when the conductor moves, or when the field to which it is subjected varies. In the actual case the conductor is not composed of wires melted together, but currents are nevertheless generated within it just as though these wires had an actual objective existence. Mathematical equations can in fact be written down, from which it is possible to compute the direction and intensity of the current that is flowing, at any given instant, through any proposed point of a conductor in a known but varying field. Such calculations are seldom made outside of college class-rooms, however, because it is known from the general principle of the conservation of energy that the direction of the Foucault currents is everywhere such as to oppose the change (of whatever sort it may be) which produces them. Hence such currents tend to diminish the efficiency of all motors, dynamos and transformers in which they occur, and designers therefore strive to avoid them so far as possible. In armatures and in transformers, for example, it is customary to laminate the masses of iron that are exposed to changing fields, the individual parts being insulated from one another by air gaps or otherwise, and their surfaces of separation disposed (as nearly as practicable) so as to be perpendicular to the direction in which the Foucault currents tend to flow. In galvanometers, masses of copper are often purposely disposed near the sensitive needle with distinct advantage; for while they do not affect the total deflection of the needle, they cause it to come to rest very quickly after the circuit is broken, the motion of the needle inducing Foucault currents in the copper, which tend always to bring the needle to rest. The energy that is expended in the generation of Foucault currents is transformed into heat, and raises the temperature of the mass within which the currents are flowing. The name refers to the French physicist Foucault, who studied the subject with much care.

Foucault's Pendulum Experiment, a curious and remarkable method invented by Jean Bernard Léon Foucault (q.v.), of showing the rotation of the earth on its axis, by observing a vibrating pendulum, and his experiment goes under the above name. In this experiment a graduated disk is seen to turn, while a pendulum freely suspended maintained its plane of oscillation. If a heavy ball is suspended by a fine wire and set to vibrate like a pendulum, it may easily be shown, either mathematically or by experiment, that the point of suspension, with the wire and ball, may be rotated round an axis, passing along the length of the wire, without interfering with the vibration In other words, the pendulum will continue to vibrate in the same plane, although the point of suspension be turned round the axis of suspension. It follows immediately from this that if we could suspend a pendulum at the north or south pole and set it vibrating it would continue to swing in the original plane of vibration; and as the earth is turning on its axis, a marked line on the earth's surface would appear to turn underneath the pendulum; or rather, it would seem to an observer, accustomed to feel as if the earth were at rest, that the plane in which the pendulum vibrates turns round relatively to the marked line on the earth's surface. It is easily shown that a similar phenomenon may be observed in any latitude except at the equator; the amount of rotation, however, that the plane of vibration of the pendulum seems to undergo is not so great in low latitudes as in high latitudes; but still in our latitudes rotation takes place to an extent easily observable. The performance of this experiment requires the greatest nicety. The pendulum is suspended on a fine wire, the support of the wire being constructed with great accuracy, so as not to interfere with the vibrations. The motion of the pendulum must be strictly confined to one plane; and, for that reason, in setting it to vibrate the bob is drawn aside and fastened by a silk thread, and when everything has come perfectly to rest the bob is released by burning the silk thread. During its subsequent motion it is protected from currents of air by glass screens. It need scarcely be remarked, however, that this experiment is nothing more than an illustration. Our knowledge of the rotation of the earth, drawn from astronomical considerations, cannot be strengthened by it. This experiment was first made public in 1851, when it was exhibited by M. Foucault before the Academy of Paris.

Foucaux, Marie Filon, mä-rē fē-lôṅ foo-kō, French author: b. 1842. She wrote several historical studies and works of fiction on the Empire and Restoration periods, among them: 'Les belles amies de M. de Talleyrand' (1880); and 'Une intrigante de la Restauration' (1888). Further publications by her include several volumes on Sanskrit literature under the pen-name "Mary Summer." Of these the most noteworthy is her 'Contes et legendes de l' Inde ancienne' (1878), crowned by the Academy.

Fouché, Joseph, zhō-zěf foo-shā, Duke of Otranto, French politician and detective: b. Nantes 29 May 1763; d. Trieste 25 Dec. 1820. The Revolution, into which he entered with enthusiasm, found him teaching philosophy in Nantes; he became advocate, and was sent to the convention by the department of Loire-Inférieure. Here he was placed on the Committee for Public Education, voted for the death of the king, and was implicated, at least nominally, in the atrocities of the period. In 1793 he was sent to the department of Nièvre to enforce the law against such persons as had incurred suspicion. In 1794 he incurred the hatred of Robespierre, and thus had a strong stimulus to assist in his downfall. In August 1795, he was expelled from the convention, and kept a prisoner till the amnesty in October. In 1796 he communicated important information to the director Barras as to the designs of Babeuf and was rewarded in 1798 by being sent to Milan as ambassador to the Cisalpine republic. Here he labored with Gen. Brune to establish a second 18th Fructidor; both were in consequence recalled. He appeared in Paris in 1799, after Barras had gained the ascendency, and was appointed ambassador to Holland.

Shortly after Fouché was recalled and named minister of police. Here he first had full opportunity to display his great talents, and exercise an important influence on the interior policy of France. The situation gave him great power during the war. After the battle of Waterloo, Fouché urged Napoleon's second abdication, and advised him to seek an asylum in the United States. He placed himself at the head of the provisional government, negotiated the capitulation of Paris, obtained the removal of the army behind the Loire, and thus prevented useless bloodshed. Louis XVIII., whose return to the throne he had not at all supported, made him again minister of police: and it is to his credit that he labored so zealously in favor of moderate measures as to incur the hatred of all the ultra-royalists. He therefore resigned his office in 1815; and went as French ambassador to Dresden. As he was struck at by the decree issued in 1816 against the murderers of the king, he sought an asylum in Prague. He afterward went first to Lintz, and then to Trieste. It was Fouché who made the famous remark on the execution of the Duke of Enghien, of which he disapproved: "*C'est plus qu'un crime, c'est une faute*" (It is more than a crime; it is a blunder). Consult Martel, 'Etudes révolutionnaires: Etude sur Fouché' (1819).

Foucher, Jean, zhŏṅ foo-shā, early explorer and colonizer in South America: b. Cambrai, Flanders, 1508; d. 1567. He was with Sebastian Cabot at the discovery of the Paraguay River, in 1534 shipped as pilot to Mendoza's expedition to Paraguay, led an exploring party to the foothills of the Peruvian Cordilleras, and was a counselor of Cabeza de Vaca (q.v.), with whom he was sent prisoner to Spain. Having received pardon he was appointed governor of Entre Rios, where he maintained a friendly attitude toward the natives and made further explorations.

Fouchet, Jean Antoine Joseph, zhŏṅ äṅ-twän zhō-zĕf foo-shā, Baron, French diplomatist: b. St. Quentin, France, 1763. The date of his death is not known. He was a law student in Paris when the Revolution broke out and published a pamphlet in defense of its principles. Soon afterward he was appointed a member of the executive council of the Revolutionary government, and was French minister to the United States in 1794–5. Subsequently under Bonaparte he was prefect of Var and, in 1805, of Ain. On Napoleon's return from Elba he was made prefect of the Gironde.

Foucquet, Jean, zhŏṅ foo-kā, French painter: b. Tours about 1415; d. Paris about 1485. He received his early artistic training in Italy, where he painted a portrait of Pope Eugenius IV., and later entered the service of Louis XI. of France. For the king he executed several portraits. His best work consists of 40 miniatures in a prayer-book for Etienne Chevalier. Only in comparatively recent times has he been recognized as a founder of the French school.

Foula, foo'la, island, the most westerly of the Shetland group, lying 16 miles southwest of the nearest point of mainland. It is a little over 3 miles in length and is 2½ miles in breadth. Pop. (1900) 326.

Foulis, fowlz, **Robert and Andrew,** Scottish printers: b. Glasgow, the former in 1707; d. 18 Sept. 1781; the latter in 1712; d. 178_. In 1739 Robert commenced business in Glasgow as a bookseller; and in 1742, having obtained the appointment of printer to the university, began in that capacity to issue editions of the ancient classics, which have made his press famous, both from the beauty of their type and their accuracy. In this latter respect one of his editions of Horace stands pre-eminent, and is hence known by the name of the 'Immaculate' edition.

Foulk, George C., American naval officer: b. Pennsylvania about 1860: d. Kioto, Japan, 1894. He was graduated from the United States Naval Academy, and after service on the Asiatic station, was withdrawn from naval duty to act as secretary and interpreter to the embassy of the Korean empire, the first sent by that country to a western nation. In 1884 he became naval attaché to the American legation at Seoul. He traveled widely in the country, and was influential in introducing many western methods and manners. Later he again served in the navy, and became professor in Doshisha University at Kioto, Japan.

Foulke, William Dudley, American author: b. New York 20 Nov. 1848. He was graduated at Columbia in 1869, at the Law School of the University in 1871, practised law in New York, removed to Indiana, and there became a member of the State Senate (1882–6). In 1889–90 as chairman of a special committee of the National Civil Service Reform League, he made important investigations in connection with the United States civil service. In 1893 he was chairman of the Suffrage Congress at the World's Columbian Exposition. His publications are: 'Slav or Saxon' (1887); 'Life of O. P. Norton' (1899); 'Moya' (1900).

Foundation. The term designates either the lower courses of a masonry structure, or a specially prepared surface or bed in contact with the soil or bed-rock upon which a structure of any kind is to be built. In practice there are many cases, however, in which the bed and the lower courses of the masonry structure jointly comprise the foundation proper, and render difficult or unnecessary the drawing of any marked distinction between them. Such combinations generally afford foundations of great permanency and strength, the most important qualities in connection with architectural and engineering works.

Oftentimes, in the erection of such works of great magnitude as well as those of lesser importance, the requisite care and attention are not devoted to the construction of the foundations, thus seriously impairing the integrity of the superstructure. This carelessness, however, appears to develop periodically; but, the errors of one period are naturally so fruitful of injurious results that they not only lead to the exercise of greater care during the period following, but stimulate the development and adoption of more scientific and skilful methods.

This is very clearly shown in the works constructed during the Roman Period. The earlier Romans erected their buildings on the most solid foundations constructed of large blocks of concrete, composed of quarry rubbish, gravel, or burnt earth, bonded by an excellent mortar. This material formed under the superstructures homogeneous basements of veritable artificial rocks capable of sustaining the heaviest of buildings without rupture or settlement. During the later Roman period, however, the foundations were much neglected, so that the architects of the 12th century were afforded so many examples of important edifices fallen on account of bad foundations, and for no other reason, that they were compelled to exercise greater care, and employ more skilful methods.

These remarks are especially applicable to the foundation methods practised at the present time. The architectural and engineering works of to-day have passed from the types of comparatively light superstructures to those of mammoth size and enormous weight, requiring the strongest and most permanent foundations that modern engineering skill is capable of designing, and the application of reinforced concrete or concrete steel methods to the construction of practically all classes of foundations appears to represent the best practice of modern times.

The employment of a particular type of foundation depends upon the character of the soil and the presence of water, and the widely varying conditions met with in practice have developed several classes of foundation structures which may be briefly designated as peat foundations, sand foundations, hard soil foundations, pile foundations, etc., which may be more intelligently described in the special paragraphs following a few very general but necessary remarks on foundation soils.

Foundation Soils.— These vary in character from hard and solid bed-rock, hard-pan, and firm sand to liquid mud, quicksand and silt. It is clear that hard bed-rock, hard-pan, firm sand, and various kinds of compact clays are the best materials to sustain foundation structures; but practical experience has very satisfactorily demonstrated that almost every substance in nature is capable of supporting the weight of any other substance, no matter how small the sustaining capacity of that material may be, provided the weight to be sustained is distributed over a sufficiently large area, and provided the conditions of the soil are permanent. Under any conditions, however, other than those obtaining in the case of solid rock, the adoption of the particular type of foundation requires the exercise of the highest order of forethought on the part of the constructing engineer in arranging for the proper distribution of the weight of the superstructure, and in providing means to counteract the injurious effects of any vibration to which it might possibly be subjected.

The sustaining power of soils depends upon their composition, the amount of water which they contain or which may drain through them, and the degree to which they are confined. Sound hard bed-rock of ledge formation will support loads up to 36 tons per square foot, but if the rock is seamy and rotten its sustaining capacity will be materially less, and will require special treatment in the construction of foundations thereon. In general, the composition of the different kinds of substrata varies so greatly that it is impossible to apply specific rules; but the latest practice assumes the following safe allowable pressures: For hard-pan, eight tons per square foot; compact sand and clean gravel free from lateral movement, five tons per square foot; dry clay, three tons per square foot; and loam, one ton per square foot Soft, watery clays, mud, quicksands, and silt have very little or no sustaining power, and have to be penetrated until firmer material is reached, and require to be compacted by draining, or consolidated by other means. If piles are employed, and they are driven to bed-rock or to refusal, the sustaining power is determined by the crushing strength of the material of the pile — timber, iron, or reinforced concrete, as the case may be.

Peat Soil Foundations.— In soils such as peat, it is almost impossible to carry the walls down to a sufficient depth to reach a solid base. In such cases one of three methods has to be adopted — to lay a strong concrete floor spread over a sufficient area; to use cylinders of iron or brick work; or to employ piles. If a concrete floor is employed, it should cover the entire surface to be occupied by the building, and should extend to some distance beyond the footings of the walls in order to prevent cracks and settlements. These injuries are usually caused by heavy walls being placed too close to the edge of the concrete floor, causing it to buckle and crack, and to settle irregularly under the unequal weights of walls of different thickness. This condition is somewhat obviated under the French system by forming a lip under the edge of the concrete floor, converting it into a kind of inverted tray which confines the substratum within its limits. The material of the foundation should be strong and homogeneous, while that of the superstructure should be of the coursed and bonded, or articulated, construction, so that if necessary it would yield slightly at the joints and thus accommodate itself without fracturing to any slight or unequal settlements during construction.

Sand Soil Foundations.— In hard stable sand or gravel, or in compact dry clay above water level, the construction of strong, permanent foundations require comparatively simple methods. If the location is in cold countries, the preliminary excavation is carried well below the frost line, and the bottom is carefully leveled off to receive the concrete bed, or the broad footing formed by the lower courses of the masonry.

In the case of compressible soils, artificial means in the form of piles, or of beds of concrete are first employed to reinforce the sustaining power of the substratum, and upon the platforms thus obtained the foundation proper is then constructed. On the other hand, if the foundations have to be constructed upon running sand, the greatest care and skill is required to prevent the work from being undermined by pumping out sand with the water during constructing operations. About the only way to handle such a case is to make a good concrete floor the entire width of the trench by putting it in as quickly as possible, sealing up the sides of the trench, and then pumping out the water when it reaches the level of the top of the concrete, and not from a sump. In building dock-wall upon running sand, the probable effects due to the cessation of pumping operations in the course of construction, require to be carefully considered. In such a case, the entering water will exert a varying pressure on the floor of the dock and the foundations of the walls according to the difference of tide levels on the outside of the dock.

Foundations for bridge piers on or across sand are usually constructed by sinking iron tubes or piles equipped with large disks or screw shoes at their lower ends, the diameters of which are regulated to support the weight intended to be placed upon them.

Clay Soil Foundations.— As in the case of sand and gravel free from lateral movement, the construction of foundations in dry clay calls for the application of the simplest methods; but, in clay strata impermeated with water, and having a tendency to slide, especially in the case of hillside excavations, the problem becomes more difficult and complex, and requires special methods for its successful solution. As a rule, such soils do not slide piecemeal, but move as a mass with an almost irresistible energy capable of rupturing the strongest timbers as if they were toothpicks. The only way to proceed in such cases is to disturb as small a section as possible at a time so that any forward impulse may not be communicated to the entire mass, and to provide strong cross walls in the basement to act as buttresses. The foundations should be carried down to or below the ultimate drainage level so as to prevent shrinkage by any subsequent draining of the subsoil which will lead to disastrous settlements.

Pile Foundations.— These consist of groups of piles of timber, iron, or concrete, plain or reinforced, sunk into the substrata and capped with platforms of timber or concrete upon which the superstructure is finally built.

Timber piles are tree trunks of varying diameter and length, with the bark removed and the knots and lateral branch stems cut off. Iron piles are of two kinds: the screw pile, consisting of a shaft of iron or wood, equipped at the foot with an iron casting in the form of two screw blades ranging in size from one to five feet in diameter; and the disk piles, consisting of hollow tubes carrying disks at their lower ends instead of screw blades. Concrete piles consist of cylinders of concrete formed in place, and of columns of reinforced concrete of rectangular cross-section made above ground and subsequently driven into place by means of a pile driver.

Various methods are employed to sink or drive piles into place. Timber piles are driven by the use of hammers which are raised and dropped by some form of engine developed power, and by the aid of jets of water under pressure, as suggested by Sir James Brunlees as early as 1850, and first employed by him in connection with the sinking of iron piles in the construction of the foundations to carry a railway across the treacherous sands of Morecambe Bay. Some of the most notable deep pile foundations constructed by the driving method are those under the new Public Library building, and the Illinois Central Railway passenger station in Chicago, Illinois. The passenger station consists of a structure 180 by 220 feet in plan, 9 stories high, with a tower 13 stories high, and a station 3 stories high connected with a train shed 680 feet long. Borings taken on the site showed the substrata to consist of ten to twenty feet of rubbish accumulated by dumping, and below that, several irregular layers of stiff blue clay and quicksand down to bed-rock, more than 60 feet below the surface. These conditions led to the adoption of a deep pile foundation, and about 1,700 piles, arranged in groups or clusters, were driven under the columns. These piles ranged in size from 40 to 60 feet in length, and from 11 to 16 inches in diameter at the butt. Thirty-two per cent were black gum, 22 per cent pine, 21 per cent oak, 7 per cent basswood, and 15 per cent hickory, with a few maple and elm. They were driven with drop hammers weighing 2,800, 3,200, and 3,800 pounds respectively, the fall ranging from 35 to 50 feet. A cast iron cap was fitted over the heads of the piles to prevent them from being crushed or split, but in spite of this protection over 8 per cent of the heads suffered serious injuries of that character. The piles were all driven in groups until the tops of all were below the leads, then the driving was completed by the use of a follower. Water was kept running continuously around the pile at the surface during the driving operations and was found to materially aid in the sinking of the piles. After the piles had been driven home, the tops were sawed off to a uniform height of three feet below datum, thus placing all the timber below low water level. As this was at least ten feet below the surface, the trenches had to be sheathed, and were kept drained by continual pumping. The earth was excavated to the depth of 18 inches below the top of the piles and rich Portland cement concrete was tamped in flush with the tops. Finally, oak caps 12 inches square were drift-bolted to the centre of each pile, and the space between the timbers was filled with concrete.

When piles are sunk with the aid of jets of water, the work is accomplished much more simply and rapidly than by driving. A pipe two or three inches in diameter is attached to the side of the pile and connected to a pump. The pile is first covered with pitch and then the water is forced through the pipe under the bottom of the pile, so that the sand is converted to a degree of fluidity that allows the pile to descend rapidly to the desired depth. When one pile has been put down home, the feed pipe is detached and spiked onto another and the operation is repeated. The accuracy and certainty of this method is so great, that it is a common practice to make the holes for the bolts in the piles before they are brought into position. After the pile is down and a reasonable length of time has been allowed for the churned up sand to subside, it recovers its solidity and grips the pile so tightly, that it is almost impossible to start it again.

When hollow iron piles are used, the water is conveyed through the centre of the tube under hydraulic pressure, disturbing the sand under the piles and allowing them to sink by their own weight to the proper depth. Upon withdrawing the pressure and stopping the flow of water, the sand returns to its former consistency and holds the pile stationary. Numerous valuable and interesting experiments show that the gripping power of quicksand is equivalent to a uniform supporting power of five tons per square foot, and that such sands possess this power at the depth of only a few feet below the surface, and, furthermore, that an increase in depth is not accompanied by a relative increase in the supporting power. Under favorable conditions the water jet method can be applied equally well to the sinking of cylinders and caissons.

Concrete piles have been used during a comparatively recent period, but their success has been so great that their development in the future promises to bring them into general use in the place of timber and iron piles. These piles, as previously mentioned, are either formed in place, or they are molded above ground. A great many methods have been suggested for forming the hole to contain the concrete when the pile is formed in place. One method consists in driving a double shell of metal into the ground and then withdrawing the inner shell, leaving the outer shell as a mold for the concrete. Another method, shown by Fig. 1, employs a single shell equipped with a concrete or a steel point. The shell is first driven to the desired depth and then withdrawn slowly and the space it occupied filled with concrete, the surface being kept at a sufficient depth below the end of the tube to maintain the head required to resist the pressure of the ground. Concrete piles used for underpinning are usually sunk with the aid of the water jet to a depth sufficient to reach firm strata, and the bottom of the excavation is enlarged by means of a spiral expanding device so as to form a base, as shown in Fig. 2.

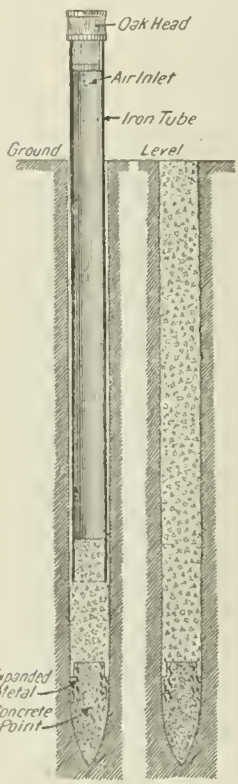


FIG. 1.

Piles made in place may be reinforced, if desired, but usually reinforced concrete piles are formed above ground. They are designed like columns, the reinforcement consisting of vertical bars of steel connected at intervals with horizontal wire rods or plates. Up to the present time they have been made only in square and triangular cross-section, circular molding being too expensive, and the arrangement of the required reinforcement being too complex. The general character of these piles is illustrated by Fig. 3, which shows the construction of the piles designed (but not used) for the foundations of the Hallenbeck building, New York city.

The supporting power of piles depends upon their action as a column resting on a hard base, or upon the friction against their sides developed by the gripping action of the material through which they have been driven. Very often the supporting power is a combination of both actions. The amount of this power may be calculated in various ways, but at their best the results are of necessity only approximations. The supporting power of a pile driven to bed-rock is determined by the crushing strength of the material of which it consists, but if it is supported wholly or in part by friction, its supporting power is calculated by a formula based upon factors obtained by experiment, or upon the distance penetrated by the pile under the blow of the driving hammer. A formula based upon the last named factor and commonly used for determining the safe loading on piles is given by the expression —

$$P = \frac{2Wh}{p + 1},$$

in which P = safe loading in tons upon a pile, W = weight of hammer in tons, h = height of fall in feet, and p = penetration in inches under last blow.

The construction of the pile foundations for the Chicago Public Library building afforded valuable information relative to the supporting power of piles as determined under actual conditions. Piles of Norway pine were driven with a steam hammer having a total weight of 8,300 pounds, the hammer alone weighing 4,500 pounds and delivering 54 blows per minute, with a stroke of 42 inches. The last 20 feet of driving was accomplished by means of a follower. The piles were placed about two and one-half feet centre to centre and the supporting power of four piles was tested by building a platform on top of them and loading it with pig-iron. Levels were carefully taken on each pile. They stood four days with a loading of six tons on each pile, eight days with a loading of 37 tons per pile, and 10 days with a load of 50 tons

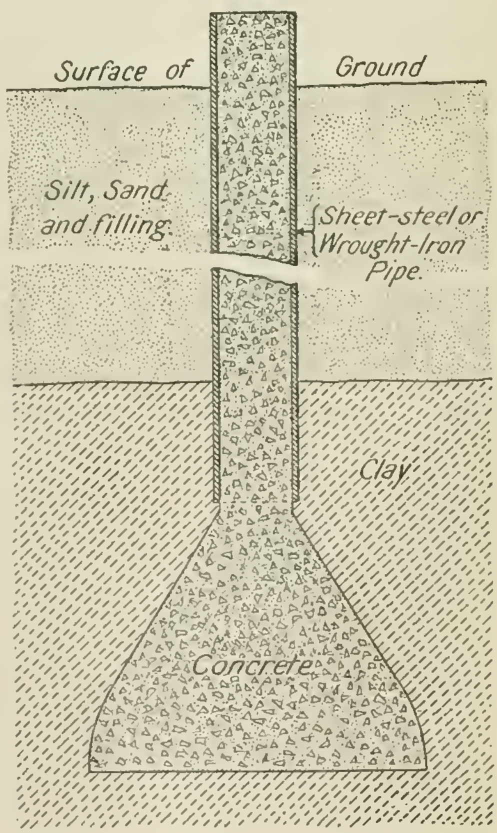


FIG. 2.

per pile. The settlement did not exceed 0.01 of a foot. These tests indicate that if 250 pounds per square inch be assumed for point resistance, the average frictional resistance will amount to about 3.2 pounds per square inch of side surface of pile, or about 432 pounds per square foot. In the case of an ordinary pile, seven inches through the top and 14 inches at the butt, driven to a depth of 45 feet, the point resistance would be 6,000 pounds, and the frictional resistance 59,000 pounds, a total earth resistance of 65,000 pounds, equivalent to the supporting power of the pile considered as a column, and allowing a factor of safety of 3 to 4.

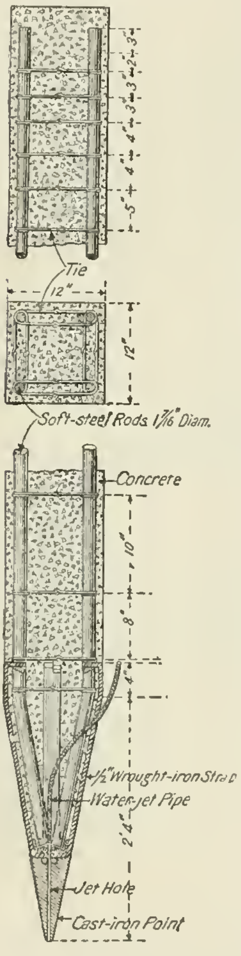


Fig. 3.

Usually, the determination of the point at which a pile is considered as having been driven to a firm bearing depends greatly upon the judgment of the engineer in charge, based upon his experience in the particular locality in which the work is being performed. The best practice, however, affords the following safe specifications of allowable penetration. For piles meeting a hard resistance a penetration of one inch under the blows of a 2,000-pound hammer falling 10 feet, and for piles held by friction, a penetration of three inches under the blows of a 2,000-pound hammer falling 15 feet. The minimum distance between centres usually depends upon the hardness of the substrata and the size of the butts. Spruce piles may be advantageously driven 24 inches between centres, while large and long piles ought not to be driven closer than 30 inches between centres. Another factor that must be carefully considered is the supporting power of the soil as a whole. For example, if that power is equal to two tons per square foot, and each pile is capable of sustaining 18 tons, it is useless to place the piles closer than three feet between centres.

In connection with the use of timber piles in places where the durability of the timber is very liable to be seriously impaired by the attacks of the Teredo worm, the latest practice appears to favor the system of armoring them with concrete. In such cases the timber piles are usually driven in sets of three to a firm

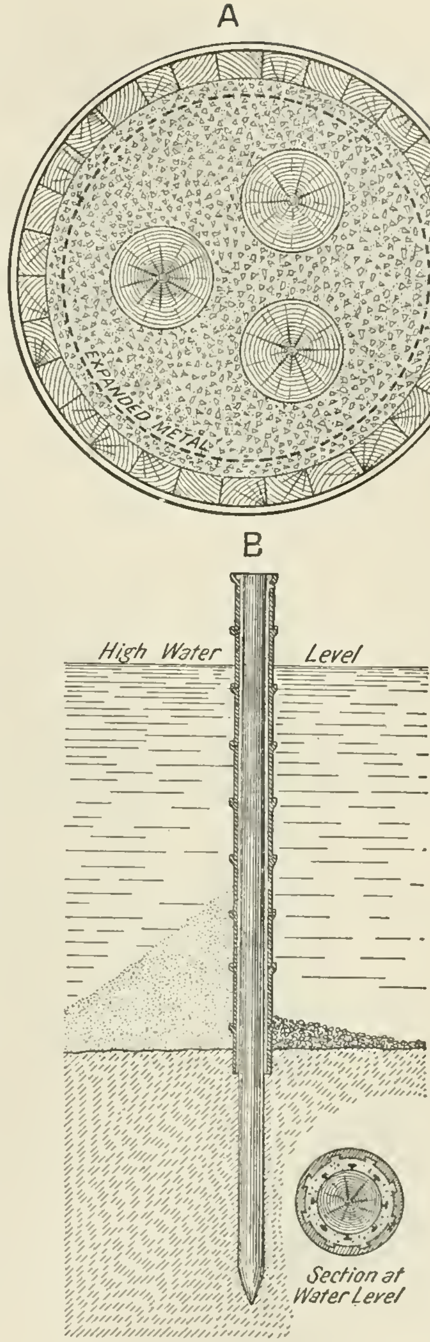


Fig. 4.

bearing. They are then cut off, one two feet, one four feet, and one eight feet, below the level of the wharf platform. A wooden stave cylinder of three-inch planking is then placed around the piles and driven into the mud to a depth of 12 feet, and the bottom of the cylinder sealed. The contained water is then pumped out, and a cylinder of expanded metal is set within the wooden cylinder, and the remaining space filled with concrete. Diagram A, Fig. 4, illustrates this protective method as employed in wharf construction on the Pacific coast.

Another method still more recently introduced consists in the use of terra-cotta pipes as an outer covering for the piles. In this case the armoring is limited to individual piles. Before driving the pile, large-headed nails are driven into the surface of the wood near the level of the water line. The pile is then driven into place and the sections of terra-cotta pipe placed around it. The annular space of about two inches between the inner surface of the pipe and the pile is then filled with concrete. The method is especially applicable to works along the coasts of the South Atlantic and Gulf States, where there are no ice fields to contend with, and where no strong tidal and river currents necessitate the use of heavy masses of stone to protect the piles from the great force thereby exerted against them. This method is illustrated by diagram B, Fig. 4.

Platform Foundations.— These structures are designed to distribute a concentrated weight over a large area in soft substrata when piles are not employed. They may consist of beds

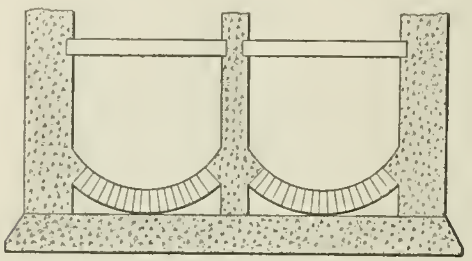


Fig. 5.

of concrete, or of masonry or brick arches sprung between supporting piers or columns, as shown by Fig. 5. They may also consist of platforms of timber grillage — timbers placed across each other in alternate layers, or of platforms of concrete or masonry reinforced with a grillage of steel bars, as illustrated by Fig. 6, which shows the platform foundations of a World's Fair building in Chicago, consisting of a concrete bed reinforced with a steel rail and I-beam grillage, to support the base castings of the main columns.

Subaqueous Foundations are those constructed in the substrata of river beds or other bodies of water, or where the existing conditions necessitate the building of structures in water and below the level of its surface. This class of work is accomplished by the use of cofferdams, cribs and open caissons, pneumatic caissons, by dredging through wells, by forcing cement into the substrata under pneumatic pressure, and by freezing the substrata.

Cofferdam Method.— The use of cofferdams is limited to the construction of foundations in shallow waters where the depth of the necessary excavation to reach a firm bearing is small, or in water bearing substrata on land. They are usually constructed by driving a double row of sheet piles — heavy timber planking — around the area in which the foundation is to be built. The space between the piles is then tamped in solidly with clay, and the water pumped out of the enclosure, so that the work of excavating and the subsequent masonry construction may be carried on in the open air. Cofferdams are sometimes constructed of walls composed of bags of clay piled around the foundation area, and reinforced with barrels of sand banked on the outer side of the walls.

Crib and Open Caisson Method.— Under this method, the foundation bed is first prepared by dredging until a solid material is reached, or by driving piles to a sufficient depth to reach a firm bearing. When piles are employed they are cut off at a uniform depth below the level of the water surface and constitute the supporting bed of the caisson. The caisson consists of a water-tight box-like structure open at the top. It is floated over the position of the bed, previously prepared by dredging, and the masonry work built up in its interior until it gradually sinks and rests upon the bed. The side walls are then removed, leaving the bottom of the structure — the crib — in the foundation between the masonry and the supporting bed. Fig. 7 illustrates the foundation for a pier constructed by this method, the crib being supported by piles.

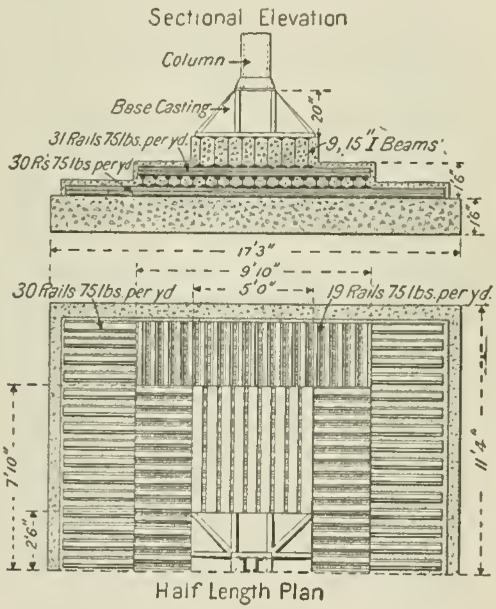


Fig. 6.

Pneumatic Caisson Method.— In this method two water-tight box-like structures built of timber or of metal are used. They are connected together one above the other, the lower caisson being inverted, that is placed bottom up, and the upper one open at the top. This structure is floated and anchored over the position selected for the pier and the masonry built inside the upper caisson until the lower edge of the lower caisson rests on the bed of the body of water. The contained water in the lower caisson is then expelled by compressed air, allowing men to enter and excavate the underlying material within the limits of the caisson. As the excavated material is discharged by being passed out through the top of the caisson, and the masonry work is added to course by course, thus keeping it always above the surface of the water, the caisson sinks lower and lower into the substrata until it reaches solid rock or other firm material. The lower caisson is then filled with concrete, and the sides of the upper caisson are removed, leaving the masonry on the foundation formed by the lower caisson with its concrete filling. Fig. 8 shows the longitudinal section of a caisson of this type.

The pneumatic method, although one of the most effective, is limited in its application to work at a depth of about 100 feet below the surface of the water, as it is impossible for men to work conveniently and effectively under a

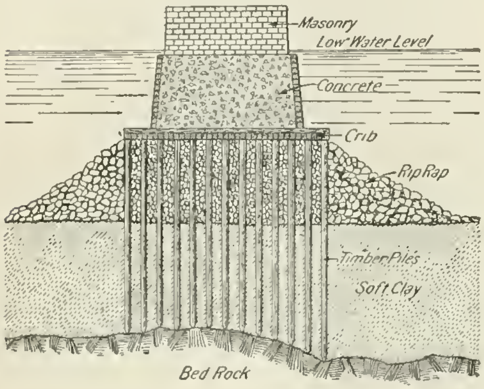


Fig. 7.

greater air pressure than that required to sustain a column of water of that height.

Although the iron-lined timber caissons used in the construction of the first East River or Brooklyn suspension bridge, measuring 102 feet by 168 feet each, with a working chamber 9 feet 6 inches in depth, are among the largest ever constructed, a clearer idea of the application of the pneumatic caisson method to works of great magnitude may be obtained from a description of the caissons used in constructing the foundations for the piers of the second East River or Williamsburg suspension bridge, completed in 1904.

This structure, although having a suspension

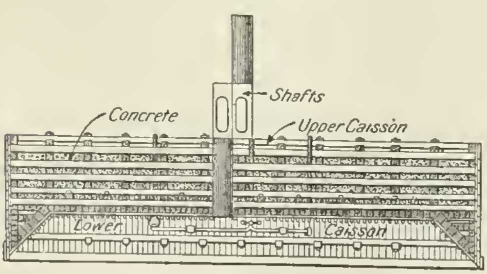


Fig. 8.

span the same length as that of the older bridge, is of much greater magnitude in many other ways. Each of its two steel towers is supported by two piers, as shown by Fig. 9. The following description is that of the north caisson of the New York tower, but it also applies in almost every particular to the other three. As determined by borings, the bed consisted principally of sand, and some clay and boulders. Below this, at a depth varying from 45 to 75 feet below high water level, the formation consisted of gneiss rock with a very irregular surface. The caisson was sunk through the sand, clay and boulders until it rested on the rock, which was then blasted away and stepped so as to make a fair bearing for the edge on all sides. The caisson measured 60 feet by 76 feet on the sides, with a total depth of 19 feet, and a working chamber 7½ feet in height. The walls were two feet nine inches thick and were built of two courses of 12 by 12-inch timbers, the outer course placed longitudinally and the inner vertically. Two layers of 3-inch planking were placed on the outside, and one layer on the inside. The bottom of

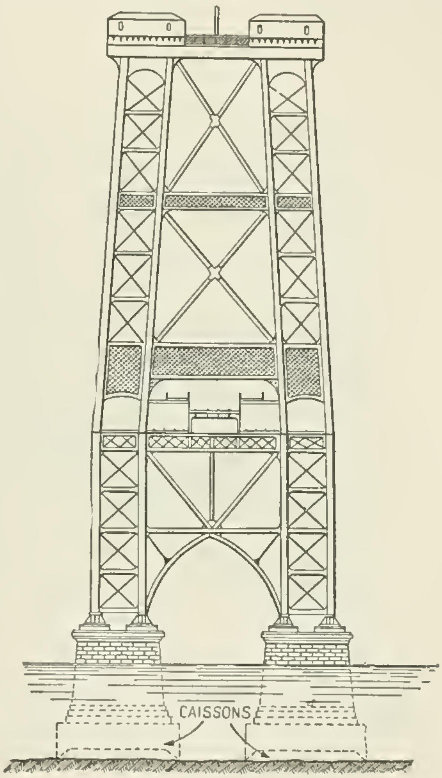


Fig. 9.

the walls was provided with a cutting edge, as shown by Fig. 10, which extended continuously around the whole caisson. This cutting edge was constructed of ½-inch steel plates, stiffened at intervals of 2½ feet of its length by knee braces. It extended two feet below the bottom of the lowermost timbers, and the lower 12 inches were stiffened with reinforcing plates, so that it had a total thickness of two inches. The cutting edge was not provided for the purpose of cutting through the bed of the river, but to enable the workmen to use their tools close to the outer edge of the walls of the caisson, which were nearly three feet in thickness, and also to facilitate the removal of obstacles, such as boulders, which could be dislodged with less difficulty from underneath the two-inch edge than the bottom of the three-foot wall. The roof of the working chamber was five feet in thickness, and consisted of several layers of 12 by 12-inch timbers laid alternately crosswise and covered with alternate courses of 3-inch planks laid diagonally. The roof, and in fact the whole caisson, was stiffened with eight massive steel-plate riveted-trusses, which extended across from wall to wall. All the timbers of the caisson and of the roof were drift-bolted together so as to give great rigidity to the structure, and to make it perfectly water-tight. Additional strength was given to the working chamber by two solid bulkheads, which extended entirely across and divided it into three compartments, openings being provided for the passage of workmen. A massive framework or gridiron formed of 16 by 16-inch timbers was bolted together and to the side walls at the level of the lowermost timbers with 1½-inch steel tie-rods. From each

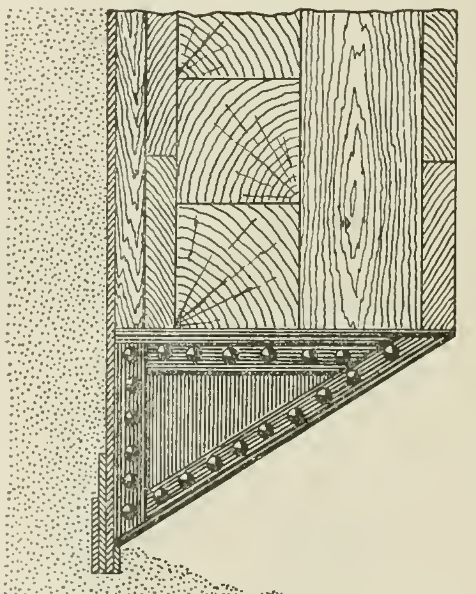


FIG. 10.

intersection of this framework vertical posts reached to the roof and were tied together and stiffened to resist lateral distortion, by diagonal struts and tie-rods, as shown in Fig. 11, practically forming two steel trusses nine feet three inches in depth, with a weight of 10 tons each. They were a novel feature in this class of work, but were rendered necessary on account of the shallowness of the caisson. The roof was pierced with seven shafts, each about three feet in diameter, for the passage of men and material, and several pipes ranging from one to five inches in diameter, for supplying air and water, blowing-out sand, and for carrying electric light wires. These shafts were of circular section, and were put in place in lengths of eight feet as the masonry work was carried upwards.

The piers on the Brooklyn side were constructed in a similar manner, with the exception that they were carried to a depth of 107 feet below high water. The last caisson to be sunk passed through 50 feet of water, 20 feet of sand, gravel and boulders, 30 feet of hard clay and hard-pan, and 12 feet of rock. The excavating of the rock was rendered necessary by the steepness of its slope.

The lower caisson measured 63 feet by 79 feet, and contained 74,700 cubic feet of timber, and 98 tons of iron, the greater portion of which was in the form of drift-bolts. Without the concrete filling it weighed 1,965 tons, and contained 6,000 yards of concrete above the roof of the working chamber. The upper caisson was 50 feet deep and contained 29,000 cubic feet of timber, and 32 tons of iron.

The sinking and concreting was accomplished in three months and six days, a very rapid piece of work considering the great depth to which the caisson was sunk. Down to the depth of 55 feet the men worked in eight-hour shifts. Below this depth the shifts were successively shortened as greater depths were attained. From 55 to 70 feet the shifts were six hours long; from 70 to 80 feet, four hours; from 80 to 90 feet, two hours; from 90 to 100 feet, one and one-half hours, and from 100 to 107 feet, 45 minutes. The pay of the men was increased in proportion to the depth at which they worked, and ranged from $2.50 for the eight-hour shift to $3.75 for the short shifts at the lowest levels. Although the air pressure at the depth of 107 feet was 46 pounds per square inch, there was very little sickness among the workmen, and only one serious case. The piers above the caisson foundation were built of limestone masonry up to low-water level, and, above that, of limestone with a granite facing.

Other notable examples of the pneumatic caisson method, both in the United States and in foreign countries, are the foundations of the centre pier of the Harlem River bridge, New York city; the Benares bridge over the Ganges River, India; the Poughkeepsie bridge over the Hudson River, New York; the Hawkesbury bridge, New South Wales, Australia; and the Jubilee bridge over the Hooghly River in Bengal. The centre pier of the Harlem River bridge supports the thrust of a 510-foot steel arch on each side of it, and stands on a timber caisson 54 feet by 104 feet, with a depth of 13 feet. It is divided into three compartments by vertical partitions, which not only served to strengthen the caisson, but protected the men during the blasting operations necessitated by the greatly inclined surface of the rock.

Foundations for piers or abutments of bridges, or for the main columns of high buildings, where the individual piece of work is of lesser magnitude than those already cited, are usually constructed by the use of cylinders of iron, as illustrated by Fig. 12. The arrangement consists of a cylinder of metal divided into two unequal parts by a horizontal partition — the upper and larger part, essentially a coffer-dam, being the caisson proper, and the lower part within which the excavating operations are carried on being the working chamber. It is provided with one or two shafts made of boiler-plate, which are connected with the air chamber on top adjoining the equilibrium chamber or air-lock through which the workmen and materials must enter. A pipe from the air compressor furnishes the air chamber with compressed air, which is subsequently introduced by a system of locks to the working chamber below.

Dredging in Wells.— Beyond the limit of the effective application of pneumatic methods, about 100 feet below the water surface, all excavating must be accomplished by dredging, and special care has to be exercised in planning the method of operations to prevent any contingency arising at the bottom that would require to be dealt with by the use of human labor, as diving operations are impossible. It is also important to observe that the skin friction, quite unimportant in a cylinder of moderate depth, becomes so great at lower levels that special means have to be employed to overcome it. In the Benares bridge mentioned in the foregoing paragraphs, the principal piers are sunk to the depth of 140 feet below the level of the water, and consist of oval brick wells each 28 feet by 65 feet in diameter, the bottom lengths being cased in iron, as it was necessary to begin operations in the water. Each well is divided into three vertical compartments in which the dredging was carried on. In constructing the Poughkeepsie and the Hawkesbury bridges, almost identical methods were employed. In the case of the former, the caisson is of timber; it measures 60 feet by 160 feet, with a depth of 125 feet. It is divided into 40 vertical cells, and was sunk to a depth of 130 feet by filling in some of the cells and excavating in others. In the case of the latter, the caisson is of steel and iron, of oval form, 20 feet by 48 feet diameters, and splayed out at the bottom an additional two feet all around. It is divided into three dredging wells set on the centre line and parallel to its length. They splay out at the bottom so as to meet each other and the outer skin, thus forming a cutting edge. It was sunk to a depth of 161 feet below the water level by dredging in the wells, and by filling the space between the wells and the outer skin with concrete. This is probably the greatest depth ever reached in the construction of a bridge foundation.

The foundations of the piers of the Hooghly bridge were constructed by the use of similar caissons. The outer skin of the caisson, however, is entirely vertical, and the three dredging wells extend right across the structure, occupying the semicircular ends and the central portion. The weight for sinking was obtained by filling the two 15-foot intermediate spaces with concrete, and by placing a brick lining around the semicircular ends. It will be understood that in all these cases the dredging wells were finally filled up with concrete when the proper depth was reached.

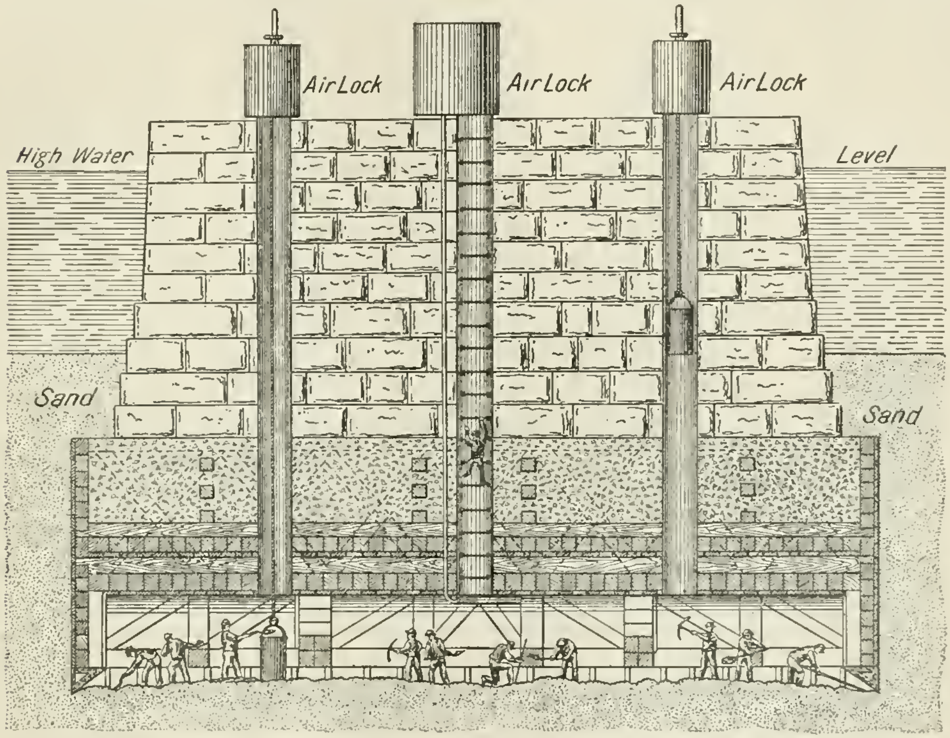


Fig. 11.

Pneumatic Forcing Method.— This is an improved method of constructing subaqueous foundations in sand or gravel substrata by converting it into a solid in the form of sand or gravel concrete. This is effected in place, without excavating operations, by forcing cement in the form of the dry powder in which it is furnished commercially, through a pipe by air pressure into the substrata. The charging pipe, called the lance pipe, has an internal diameter of 1½ inches, and is drawn to a point at the lower end, and perforated with three or more holes ⅜ of an inch in diameter. The upper end of the pipe is connected by means of a bend and rubber tubing with the air pressure supply pipe, suitable arrangements being provided to raise, lower, or move it while in operation. The air pressure supply pipe is provided with suitable branches fitted with stop-cocks to permit of its being connected to an injector device by which any desired quantity of cement powder may be fed into the current of air. In operation, the air pressure forces the cement powder through the small openings at the lower end of the lance pipe and drives it into the substrata of wet sand or gravel, with which it combines and forms sand or gravel concrete as the case may be. The lance tube may be sunk to depths of 16 or 19 feet in a comparatively short time, and in order to insure a uniform mixture in the foundation pit, the foundation area is divided into small fields 8 to 12 inches square, into each of which the proper quantity of cement is blown. The proper amount of the cement charge is determined by dividing the cubic contents of the field by the required proportion of the mixture. Usually, the saturation of the sand is so thoroughly accomplished that when the forcing operations are discontinued, the particles of sand, if allowed to come together, would adhere to each other with a great deal of energy, so much so that it is well known to all makers of concrete, whether by hand, mixer, or mill methods, that the volume of the resulting material is always less than the sum of the volumes of the ingredients in their free and uncombined state. Experience has demonstrated that the best proportions of the two ingredients are one part by volume of cement to five parts of sand, or sand and gravel, measured in the same manner. This method was first suggested by Fr. Neukirch, of Bremen, Germany, and is being extensively used in various ways other than the construction of foundations proper, for such purposes as the consolidation of the soil around brick sewers, in the building of quay-walls, and in many other cases where the driving of cofferdams would be dangerous or impracticable.

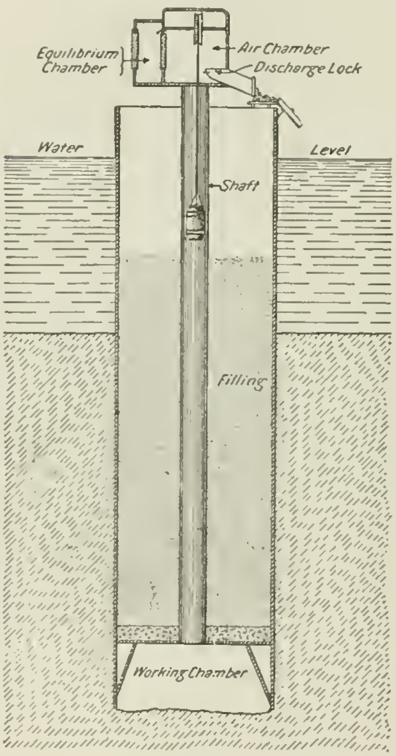


FIG. 12.

Another method by which bodies of cement or concrete may be placed in quicksand substrata employs pipes in the following manner: Two or more iron pipes are sunk through the quicksands to the desired depth, and water pumped into one of the pipes, thus converting the substrata into a condition of fluidity sufficient for the purpose of pumping it out through the other pipe. The cement is then introduced through the forcing pipe and filled into the agitated area at the bottom of the pipes.

Freezing Method.— This method is employed in the construction of subaqueous foundations, or of foundations in quicksand, or in soft water-bearing substrata, where the fluidity or lack of plasticity of the soil requires it to be artificially consolidated before excavating work can be instituted therein. In the Poetsch process, a large number of pipes are distributed as uniformly as the unstable conditions will permit, and are then filled with a strong freezing liquid which is maintained in a state of constant and active circulation until the substrata becomes solidly frozen. The excavation is then made in the frozen material, and the foundation put in and allowed to set firmly, after which the freezing operations are discontinued and the substrata allowed to thaw and assume its normal condition around the work. The method is not one that bears recommendation for works of magnitude. The thawing sands usually return to a state of unstable equilibrium not very conducive to the permanency and stability of the structures built therein, and besides that, the cost of the refrigerating plant, together with the accessory machinery and appliances, is so excessive as to be practically prohibitory in ordinary cases. It may be advantageously applied, however, in many special cases, especially in the construction of subaqueous tunnels and for making repairs to all classes of subaqueous structures.

Bibliography.— For further information consult: Baker, 'A Treatise on Masonry Construction' (New York, 1900); Buell and Hall 'Reinforced Concrete' (New York, 1904); Fowler, 'The Cofferdam Process for Piers' (New York, 1898); Patton, 'A Practical Treatise on Foundations' (New York, 1893); Taylor and Thompson, 'Concrete, Plain and Reinforced' (New York, 1905); and special articles on the subject in the various engineering magazines and periodicals.

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Founder, also called **Laminitis,** consists of inflammation of the vascular sensitive laminæ of the horse's foot. Occasionally the laminæ are strained from severe exertion; more frequently they suffer from the morbid effects of cold, which is especially injurious after excitement and over-fatigue. The shoes must at once be removed, and the toes, if long, reduced, but no further rasping or cutting is permissible. The feet must be enveloped in hot bran poultices, and kept off the hard ground by a plentiful supply of short litter. Purgatives, if required, must be used with extreme caution. See HORSE, DISEASES AND CARE OF.— *Care of the Feet.*

Founders and Patriots of America, The, a society founded in 1896, and incorporated 18 March, of the same year, the object stated in the articles of incorporation being «to bring together and associate congenial men whose ancestors struggled together for life and liberty, home and happiness, in the land when it was a new and unknown country, and whose line of descent from them comes through patriots who sustained the colonies in the struggle for independence in the Revolutionary War; to teach reverent regard for the names and history, character and perseverence, deeds and heroism, of the founders of this country and their patriot descendants; to teach that the purpose of the founders could have had no lasting result but for their patriot sons; to inculcate patriotism; to discover, collect, and preserve records, documents, manuscripts, monuments, and history relating to the first colonists and their ancestors and their descendants, and to commemorate and celebrate events in the history of the colonies and the republic.» The order admits to membership any male citizen of the United States above the age of 21 years who is lineally descended, in the male line of either parent, from an ancestor who settled in any of the colonies prior to 13 May 1657, and whose intermediate ancestors in the same line during the Revolutionary period adhered as patriots to the cause of the colonies.

Founding. The art of making molds in sand, loam, or plaster of Paris, with or without the aid of patterns. The molds thus made are filled with molten metal which is subsequently allowed to cool and solidify into a metal casting corresponding to the form of the mold.

The various founding processes are characterized by the kinds of metal employed in the castings, such as iron, steel, brass, bronze, etc., and by the class of work produced, such as water pipes, car-wheels, ordnance, statues, bells, etc., involving the applications of special methods in the work of molding; in the melting of the metal; in the filling of the mold with the molten metal; and in the manner in which the metal is allowed to cool.

Molding in Sand.— The process of molding in sand by means of patterns embedded in flasks containing sand, is substantially as follows: The flasks, which are box-like arrangements provided with suitable handles by which they may be lifted and moved around, are generally used in pairs — the upper flask being commonly designated the «cope,» and the lower one, the «drag» or «swivel.» The patterns, usually of wood, are made either in one piece when the design of the casting is simple, or in several pieces when the form of the casting is more complicated. In molding, the drag is filled with sand and the pattern embedded in it. The cope is then placed over the drag and the sand rammed in tightly around the pattern. The pair of flasks is then turned over and the loose sand taken out of the drag and replaced by sand firmly rammed in its place. The flasks are now returned to their original position; the cope is taken off and the pattern removed. The cope is then replaced upon the drag, and the mold is thus made ready to receive its filling of molten metal. This is accomplished by pouring the metal through suitably formed gates or holes which extend through the cope and connect with the molded spaces in the drag.

The use of a separate appliance for a drag is very often dispensed with, the pattern being embedded in a bed of sand upon the foundry floor. This method is especially applicable when a large number of small castings are made at each pouring. Also, very often the patterns are made in two parts, that is, divided in the middle horizontally, so that one half of the mold is made in the drag and the other half in the cope. In the case of hollow cylindrical castings such as water pipes and the tubes of heavy ordnance, a cylindrical core of the proper dimensions is suspended in the drag mold before the cope is placed in position, and the annular space between the core and the interior walls of the mold is filled in with the molten metal.

Molds are made either in green or in dry sand. Those in green sand are suitable for the making of small and simple castings; but molds in dry sand are employed in the production of castings of large size and great intricacy of design. In such cases, after the molds have been finished, they are placed in drying ovens until they are thoroughly dried.

Molding in Loam.— In this process, the molds instead of being made by the embedding of patterns in sand, are formed by means of cores of metal or of brickwork which are covered by several coatings of loam — mixed sand and clay, to correspond with the form and dimensions of the desired castings. An outer shell constructed around the core thus thickened, provides the annular space for the reception of the metal. The method is especially applicable to the founding of hollow cylinders, bells, and statues. See titles FOUNDRY AND FORGE SHOP TERMS, and ORDNANCE, in this Encyclopedia.

Foundling, a child abandoned by its parents, and found by strangers. Though infanticide was not punished among the ancient nations, with the exception of Egypt, where the child's corpse was fastened to the guilty parent's neck for three days and nights, yet natural feeling would prompt parents to expose their offspring, and leave their fate to accident rather than kill them. They usually selected places which were much frequented, where there was a greater chance of the child being saved. In Athens and Rome they were exposed in especially appointed places. In the 4th century under the Emperors Valentinian, Valerius, and Gratian, the practice was prohibited. The Bishop of Treves in the 6th century allowed foundlings to be placed in a marble basin in front of the cathedral, thus entrusting them to the care of the Church.

In 787 a foundling hospital was established at Milan; one was established at Paris in 1362, but among the most famous of modern institutions is the foundling hospital in Paris formally established in 1670. It receives not only foundlings strictly so called, that is, deserted children of unknown parentage, but also deserted children of known parents, and destitute children generally, as well as children pronounced incorrigible by the courts or declared to be so by their parents.

England has no foundling hospital properly so called; all exposed children are brought up at the expense of the parish in which they are found. The Foundling Hospital in London, established by Thomas Coram, a master-mariner, in 1739, was originally a hospital for exposed and deserted children. It was for a time extremely popular, and was repeatedly assisted by parliamentary grants; but the enormous increase of abandonments, and the expense which they occasioned, produced such an alteration in public opinion that the hospital was changed to what it now is, a hospital for poor illegitimate children whose mothers are known.

In the United States foundlings are usually consigned to the county poor farm, but Foundling and Maternity Hospitals exist in the principal cities. Foundling hospitals are said to diminish not only the exposing of children, but also to render infanticide and intentional abortion less frequent. The objection that they contribute to the corruption of morals, if they receive children indiscriminately, and that they encourage parents to rid themselves of responsibility, is the strongest which can be urged against such institutions, and is not easily answered. In Massachusetts foundling hospitals are legally forbidden. In New York city foundlings are sent to Bellevue Hospital, and formerly were transferred to the Infants' Hospital on Randall's Island or in the borough of Brooklyn, to Flatbush. The rate of mortality among them was alarming; in 1897 all children received at the Randall Island institution died before reaching the age of two years, chiefly owing to the change of food and neglect before and exposure during abandonment. At baby farms, private institutions where babies were boarded for gain, the same conditions also prevailed. The attempt to remedy these deplorable conditions has met with great success since 1899. The work is supervised by the Joint Committee on the Care of Motherless Infants under the control of the State Charities Aid Association and the New York Association for Improving the Condition of the Poor, and their fifth annual report for the year 1903 shows the rate of mortality has decreased to 11 per cent as compared with 55.9 per cent in 1899, the first year of their work. Foundlings of whose parentage nothing is known are baptized alternately Roman Catholic and Protestant, the Roman Catholic children being in charge of the Guild of the Infant Saviour, while the committee care for the Protestants. In connection with this admirable work is an agency for providing situations in the country for destitute mothers with infants. The *mothering* system has been long enforced in the Chicago Foundling Asylum, and is being adopted in similar institutions throughout the States. Consult: Folks, 'Care of Neglected and Dependent Children' (1901); 'Reports of the Joint Committee on the Care of Motherless Infants'; 'New York Association for Improving the Condition of the Poor' (1903).

Foundry and Forge Shop Terms. The following list of terms includes some of the most significant words and phrases commonly used in connection with foundry and forge shop operations.

Angles.— Strengthening pieces which run around the angular portions of castings.

Annealing.— The subjection of brittle and non-elastic metals to the action of long continued heat, which effects a rearrangement of the ultimate molecules, and makes the metal tougher or more homogeneous. Steel castings, old chains and rods, and other forms of hammered work, which have been used for a long time, are improved by annealing; but, newly rolled plates and bars, the fibrous condition of which has not deteriorated, are weakened in tensile strength by the process. Annealing is carried on by means of "annealing-ovens" into which the "annealing-pots" containing the articles which require to be annealed are run, and exposed to the action of the heat for periods ranging from several hours to several days as the circumstances may require. The function of the annealing-pots is the preservation of the contained articles from the action of the atmosphere during the process of annealing.

Bars.— The stays or bridges placed in molding boxes to support the sand which encloses the pattern. They are purposely cast as rough as possible in order to insure the adherence of the sand. Vertical or "cope-bars" have their edges kept about three-quarters of an inch away from the pattern and about the same distance from the joint of the box. "Flat-bars" or "drag-bars" are placed in the "drag" or bottom-half of the mold, and therefore, do not follow the outline of the pattern.

Battering-off.— The finishing of the surfaces of forged work by hammering while the metal is dropping to a low red or black heat.

Bead Slickers or Bead Tools.— Sleeking tools used by molders for smoothing the impressions of beaded work such as the ornamental fillet or strip curved around the edge of a casting.

Bedding-in.— The method of molding in which the pattern is embedded in a bed of sand on the foundry floor instead of being placed in a box mold and "rammed-up" with sand.

Binders.— Rosin, glue, wheat and rye flour, linseed oil, etc., employed for the purpose of giving strength to "core-mixtures."

Blackening.— Pulverized charcoal, coal, coke, and plumbago or graphite used by molders for sleeking over the surface of a mold in order to prevent the castings from becoming "sand-burnt."

Black Wash.— A solution used on loam-molds and dry-sand molds for the same purpose that blackening is used in green-sand molds.

Blast.— The volume of air artificially forced into furnaces and forges by means of bellows, blowers, and rotary fans, to accelerate the combustion.

Blowers.— Machines employed for the production of blast, ventilation, etc. The principal forms consist of blowing cylinders and pistons, and the rotary blowers or centrifugal fans which are operated by power driven belting. Ordinarily they deliver a blast ranging from four to six ounces, approximating to a pressure ranging from seven to ten inches as indicated by the water gauge.

Blowholes.— Hollow cavities in castings caused by the presence of bubbles of air, or gas in the mold due to imperfect venting. When of a bluish color, they indicate the presence of sulphur in the metal.

Bottom Board.— The board on which the joint of a pattern is placed when it is being rammed-up, either to sustain a weak pattern, or to make the molders' "sand-joint."

Bottom Part.— The "drag" or bottom-half of a mold. In "bedding-in" work, the portion of the mold in the foundry floor.

Burning-off.— A process of tempering springs. The spring to be tempered is first hardened by immersion in linseed oil. When cold, it is taken out and the adhering film of oil ignited and allowed to burn off, thus producing a temperature of at least 600° Fahr., which draws the temper of the spring and coats it with a black surface that makes it practically rust proof.

Burning-on.— The replacing of a broken-off or incomplete portion of a casting. A mold of the portion which is to be burned-on is placed in the proper position against the main casting, and the molten metal poured in. The metal is allowed to flow over the broken face of the casting and out through a gate at the side of the mold, until the broken face is in a state of local fusion. The gate is then stopped, and the metal allowed to coo'. Perfect amalgamation is attained by the method.

CASE HARDENING.—The treatment by which wrought-iron is hardened on the surface. It is first heated to a red heat in the presence of carbon, and absorbs enough of the carbon to transform it into steel on the outside. It is then chilled suddenly to harden the steel.

CHAPLET.— The metallic devices used for supporting the "core" of a mold. Chaplets are of various forms — the single-headed chaplets, the double-headed chaplets, the spring chaplets, and the adjustable chaplets. They are placed under the cores to support them, or above the cores to hold them down, or at the sides of the cores to enable them to resist the lateral pressure exerted by the flowing metal.

CHARGING.— The supplying of furnaces with fuel and ores. In a reverberatory furnace, the "charging-door" or the opening through which the charge is introduced, is located at the side; while in a blast furnace or cupola, it is located near the top at the level of the charging platform.

CHART METHOD.— A method for computing the weight required for holding down the cope and core against the raising effort of the head of flowing metal. It consists in the drawing to scale the outline of the form and size of the lifting surface, and the height of the fluid head, and computing from the figure thus obtained, the cubical contents, which multiplied by the decimal .26 gives the data for the necessary weight.

CHILLS.— Metallic molds into which specially mixed molten iron is poured for the production of chilled or surface hardened castings. They are made of a quality of iron of sufficient strength and ductility to allow for the alternate expansion and contraction to which they are subjected, otherwise they would not last longer than one heat. Chills used for casting chilled-rolls are made in sections. "Contracting-chills" are used for casting chilled car wheels, and are so constructed, that as the metal of the wheel cools and contracts, the chills close in and keep in constant contact with it.

CINDER-BED OR COKE BED.— The first layer of coke placed in a cupola previous to the introduction of the iron. Its weight bears a definite relation to that of the iron, but varies with the condition of the furnace. The term "cinder-bed" is also applied to the beds of cinders sometimes placd under the molds and with which the vents are connected.

CLAMPING.— The weighting down of the cope of a closed mold preparatory to "pouring," to prevent its raising by the lifting force of the metal. It is accomplished by means of various forms of clamps and weights, the latter consist of piles of pig-iron piled in separate pigs on the cope, or cast-iron bars ranging from 1,000 to 2,000 pounds in weight, which are hoisted into position by a crane.

CLEANING OR CLEANING-UP.— The smoothing of the surfaces of a foundry mold with trowel and cleaners, and blackening, preparatory to "closing" and "casting." Also, the removal of sand from castings by means of wire brushes and files, by means of tumbling-barrels, and by various pickling processes.

CLOSING-UP.— The placing on of the top-box or cope of a mold in readiness to pouring in the molten metal.

COLD SHUTS.— When cast metal pours thick, or when it is poured into the mold too slowly, it is liable to thicken and partly solidify in those portions of the mold where the casting is thin, thus preventing the metal which follows from properly amalgamating with it. The imperfectly united contact surfaces thus formed are called "cold-shuts," "cold-shorts," or "cold-shots."

COPE.— The top-box or upper-half of a green-sand mold.

CORE.— A body of green or dried sand placed in a mold to exclude the central or inner portion of a casting. They are made either in boxes called "core-boxes," or struck to shape upon a revolving bar, a mixture of loam being used for the body, and the required outline imparted to it by revolving it against the bevelled edge of a templet board called the "loam-board."

DRAWING OF PATTERNS.— The lifting of patterns from the sand. Also called "rapping," "delivery," etc.

DRAWING PLATES.— See Rapping.

DRAWING OF TEMPER.— The heating of steel to redness and then allowing it to cool slowly in the air. The reverse of "hardening" and "tempering."

DROP FORGING.— The method of forging iron by driving or pressing it into a die placed under a drop hammer. It is employed when a number of forgings of the same pattern are required. A great deal of this class of work is now accomplished by the use of steam-hammers and forging-presses.

FAGOTING.— The piling up of lengths of puddled bar-iron in fagots or bundles for the purpose of reheating and rolling.

FEEDING.— When molten metal cools, the outside portions will set first, while the inside portions will remain fluid for some length of time. As the inner portion cools, it will contract and shrink upon itself and leave a depression on the top face of the casting. To avoid this condition the heavier portions of the casting are fed with metal through a small rod called the "feeding-rod," inserted through the runner or the riser, which by its motion keeps a passage open for the inflow of the fresh metal introduced to compensate for the contraction. The metal used for this purpose is called the "feeding-head."

FLASK.— The box which holds the sand in which the pattern is rammed-up in the making of a mold. Flasks are made either of wood or of metal, and are parted horizontally into two or more sections. In a mold composed of two parts, the lowermost or the one which is molded first is called the "nowel" or "drag," and the uppermost or the one which is on top when the casting is poured, is called the "cope." When a flask consists of more than two parts, the sections between the cope and the drag are called "cheeks" or "intermediates." Flasks are provided with two loose covers called top and bottom boards, and they are designated as "two-part flasks," "three-part flasks," "four-part flasks," etc., according to the number of the component parts.

FLOOR RAMMER.— A flat-ended iron tool employed for ramming over large surfaces of sand.

FLUXES.— Substances used in a smelting, or in a melting furnace for combining with the earthy and other infusible matter present in ores, and which require to be separated from the metal, and which cannot be rendered fluid by itself at the temperature of the furnaces. The flux most widely used is a carbonate of lime in the form of limestone, clam and oyster shells, chalk, dolomite and calcite. Magnesia, fluorspar, feldspar, and calcspar are also suitable for this purpose. This by-product of the furnaces is called "slag."

FORGE.— The structure upon which a smith's fire is maintained. Forges are constructed of brick, of brick and iron combined, or entirely of iron. A forge consists of a hearth, tuyere, chimney, bonnet, and troughs for water and coal. The blast is produced either by bellows, or by rotary blowers and fans.

GAGGERS.— Short, conical projections cast upon the core-plates and the plates of loam-molds for the purpose of assisting the adhesion of the loam. The term is also applied to the hooks of cast-iron or of wrought-iron which are hung from the cross-bars of a molding box into the mold to prevent the sand from sliding out when the cope is lifted. They are necessary when the body of sand is more than sixteen inches square in area.

GATE.— The opening in the sand of a mold, which connects the "sprue" with the interior of the mold. The sprue is the orifice through which the molten metal is poured into the mold. Both terms are also applied to the bodies of metal which occupy the respective passages after the casting has been poured.

HARDENING.— The hardening of a metal is the result of an increase in its density. Few metals are capable of being hardened. The hardening of steel is effected by heating it to a cherry-red temperature and then chilling or cooling it suddenly by plunging it in water, oil, or other suitable solution, or by exposing it to a cold blast. The degree of hardness that may be attained depends upon the suddenness of the chilling. In hardening and tempering tools such as machine knives, taps, long twist-drills, reamers, milling cutters, etc., the danger of warping them by uneven heating, or by cold draughts, is avoided by heating them in special hardening and tempering furnaces. See Case Hardening and Tempering.

LIFTING.— The drawing out of a pattern from a mold. Also applied to the raising up or springing up of the cope or top-part of the mold caused by the pressure due to the head of the molten metal. This tendency is counteracted by the use of screw-bolts, clamps, and dead-weights. See Clamping.

LOAM WORK.— The making of molds in loam, as distinguished from that of molding in sand. The loam used in foundries consists of a mixture of clay, sand, and horsedung, ground up with water by means of a form of mortar mill called the "loam-mill." When cold, the loam has sufficient consistency to be struck up to any desired outline by means of a "loam-board." See Cores.

LYCOPODE.— A material used for "parting."

MATCH-PLATES.— A match-plate is a wooden board or plate of metal on the opposite faces of which two different portions of a pattern are attached. When the boxes containing the impressions are brought together, they constitute a complete mold. In some cases they are very useful for facilitating the making of joints, but they are generally used for making molds for castings having plain outlines, without sharp corners, cores, or projections.

Mold-boards.- Boards used for making molds for small castings having irregular joints. Their chief advantage consists in the saving of time and labor in forming the joints. They are made of various kinds of material. The wooden mold-board is carved out in the desired shape of the joint. The plaster of Paris mold-board is used in cases where the pattern is very crooked, and where the other types cannot be made as cheaply, or to fit with the same amount of accuracy. The sand-and-composition mold-boards are the kind generally used, and obviate the necessity of ramming the sand. The composition consists of twenty parts of fine dry sand to one part of litharge, tempered with linseed oil. The match-plate is a form of mold-board.

Molding or Founding.— The making of molds for metal castings. The molds are made in sand, loam, and plaster of Paris, with or without the aid of patterns. There are three classes of molding — green-sand molding, in which damp sand is used, and the castings are made in damp molds, or in molds the surfaces of which have been "skin-dried;" dry-sand molding in which the damp sand molds are thoroughly dried in an oven preparatory to casting; and loam molding. See Loam Work.

Molding Sand.— Sand is used for molding, in preference to all other materials, on account of its refractory nature, which enables it to resist the destructive action of molten metal at high temperatures; on account of its porosity, which allows the free escape of the gases generated in casting; and on account of its peculiarly compact and adhesive properties, which not only permits of its being molded to any desired shape, but also enables it to resist a great amount of pressure exerted by a liquid. The best molding sand is obtained from the coal measures, and the later red sandstone formations. Sand from the green-sand and chalk formations is also very satisfactory. The most suitable sand is that which contains a large percentage of silica, with alumina and magnesia present in small quantities. The various grades of molding sand are designated as green-sand, dry-sand, core-sand, facing-sand, and parting-sand, according to the purposes for which they are used.

Odd Sides.— See Mold-boards.

Parting.— The act of separating the different parts of a mold-box. Also applied to the process of making the sand-joint between two contiguous mold-boxes. Also to the joint itself.

Pouring.— The filling in of a mold with molten metal in making a casting.

Print.— A projection placed upon a pattern to indicate the position of a cored hole, and to form an indentation for the reception of the end of the core. "Pocket-prints" and "parallel-prints" are used at the sides of the patterns.

Rapping. The process of loosening a pattern from the sand previous to its withdrawal therefrom. This is effected by inserting the pointed end of the "rapping-bar" into the "rapping-hole" bored in the pattern or in a plate of malleable iron called the "rapping-plate," screwed on the face of the pattern. Small round-faced wooden mallets, called "rapping-mallets," are used in the actual process of withdrawal, which, unless carefully performed, will not only damage the pattern, but will enlarge the molds of small castings to a very appreciable extent.

Riddle.— A coarse sand sieve of about half-inch mesh, used for sifting coarse and old sand.

Riser or Air Gate.— A vertical opening which extends from the mold, through the cope, to the outer air. When it fills up with the molten metal it indicates that the mold itself is full.

Tempering.— In foundry work, it is applied to the process of mixing various grades of sand. In forge shop work, it signifies the imparting of a definite degree of hardness, or elasticity to steel. It is effected by either raising or letting down the metal to a certain temperature and then cooling it from that temperature by plunging it in water or oil. The degree of temperature is indicated by the various colors assumed by the steel during the heating part of the process. It may also be determined by the flashing point of a fat.

Venting.— The piercing or honeycombing of the sand of a mold by means of a long wire-rod, one-eighth or one-quarter inch in thickness, thrust in all directions, for the purpose of allowing the free escape of the gases generated by the decomposition of the moisture in the sand by the heat of the inflowing metal.

For further information relative to the various processes such as riveting, welding, boring, etc., which form an important part of foundry and forge shop work, see articles under the titles, Boiler Shop Terms, and Workshop Terms, in this Encyclopedia.

William Morey, Jr., C. E.
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Foundry Practice. *Casting.*— The casting of brass has been practiced from the earliest times and is mentioned in the oldest books of the Bible. Before the year 1300 wrought iron was made directly from the ore. It is nearly pure iron and cannot by ordinary methods be made sufficiently fluid to run into molds. By special methods in recent years it is made into steel castings (*q.v.*). At ordinary casting temperatures it is pasty and can be forged into various shapes. After 1300 cast iron was made which in addition to iron contains sufficient carbon and silicon to lower its melting point so that it can be made fluid. The presence of phosphorus, sulphur and manganese also influences the quality of cast iron. Until 1700 castings were generally made directly from the blast furnace in which cast iron was made from the ore.

The first casting known to have been made in America was a small round bottomed kettle with a cover. This was made at Lynn, Mass., in 1642 at the first blast furnace erected in this country. During the latter part of that century cast iron was remelted in crucible and in 1722 a French founder made the first primitive cupola in which the fuel and iron were placed in alternate layers. Foundry practice dates from that time. Before the beginning of the last century rarely more than a single casting was made from one pattern. Each new form required a different treatment.

The only foundry equipment until recent years was the cupola, a blower, a gib-crane, ladles, cleaning mills, sweeps for loam work and the molders individual tools: a shovel, bellows, rammer, and trowels, some of which are called slicks. By the duplication of castings from patterns in later years molders have become expert in special classes of work, especially when working by the piece. When large numbers of a single kind of castings are to be made a molding machine can be employed advantageously and these are rapidly coming into use. Machines can be operated with comparatively unskilled labor. Modern foundries are equipped with electricity and compressed air, travelling cranes and trolleys, which are used to transport materials, and to do the heavier part of the molder's work. While permanent metal molds are used for the softer metal castings, they have not been made successful for brass or iron.

Sand of various grades is used almost universally for molds and the founder's art consists in the making of sand molds. Molding sand is a mixture of silica sand and clay with from 10 to 15 per cent of impurities. It is strong if when dampened and pressed into shape it will not fall apart. Fine sand gives light castings a smooth skin. Heavy castings require a coarse open sand. The reddish color of molding sand comes from iron oxide. After the castings are removed from the sand it is shoveled into a row, then with the shovel, opened up and sprinkled evenly with water. The next morning beginning at one end the heap is cut over, giving each shovelful a twist to scatter the sand evenly over a new heap. About once a week enough new sand is added to make up for what is burned out.

Molding.— The different branches of molding have much in common. We will describe the simplest form and then show where the other forms differ.

Bench Molding.— The patterns for toys, hardware, small parts of stoves, light malleable iron, and many brass castings are made of metal, gated together so that the card of patterns is handled as a single piece. Melted iron is poured into a vertical sprue and runs to the mold through horizontal passages called gates. The card of patterns is bedded in a mold-board called a match which closely conforms to every parting or horizontal edge of the pattern.

The molder works standing, his match of patterns being placed on a frame or bench, with his heap of sand beneath and at the side. The mold is made in a snap flask, the lower part of which is the drag and the upper part the cope. These are guided together by flask-pins and both are hinged at the corner and hooked together at the opposite corners. The pattern is thoroughly brushed when the drag is inverted on the match. About half an inch of sand is riddled over the surface of the pattern. The drag is then heaped up with sand with a shovel. Then with a hand rammer, about 13 inches long, in each hand, the molder penes the edges of the drag twice around with the flat pene of the rammers, and levels off the surface with the side of the rammers. With the round butt ends the whole surface is rammed solid. The surplus sand is struck off with a straight edge, a little sand is sprinkled over the surface and a bottom board is rubbed to a fit. This with the drag and match are rolled over and the match is lifted off leaving the pattern bedded in the sand, when all loose sand is blown off with a bellows, and necessary repairs are made with a slick. The cope is put on, the sprue pattern is set on a pin in the gate pattern and a little parting sand is dusted over the surface. This burned parting sand cleaned from castings, prevents the cope from sticking to the drag.

The cope is rammed the same as the drag, the loose sand brushed off, the sprue removed and the hole smoothed with the fingers. The cope is lifted and placed on edge just behind the drag. The pattern is drawn and is held in the left hand while a bag of charcoal facing is shaken over the mold with the other. The pattern is printed back, rapped and drawn. The cope is then replaced on the drag, the flask is unhooked and the sand mold with its bottom board is set on the floor.

A molder in seven hours will make from 70 to 150 molds. They are stacked two or three high. Wooden frames or jackets are slipped over some molds to prevent the iron from bursting out at the sides. In pouring the molds, cast iron weights with slots in them to expose the sprue holes, are placed on the row of molds nearest the bench to prevent the iron from raising the cope. These weights are changed as fast as a row is poured.

Floor Molding. (Stove plate, etc.) — Each piece is molded in a wooden or in an iron flask. The cope is barred with cross bars six or seven inches apart, with the lower edges conforming to the shape of the inside of the pattern and about one inch away. If the bars are of iron they have holes cast in them and if of wood nails are driven in the lower edges to prevent the sand from dropping out. The pattern, usually of iron, is fitted to a wooden mold-board. The gates are generally separate from but set against the pattern. Whenever possible flat gates are used.

The molder's floor is perfectly level and generally of brick or cement. The sand heap extends the whole length and the flasks and mold-boards are piled at one side.

The pattern on its mold-board is placed on the front of the floor. The pattern is brushed, the drag is inverted on the board, sand is riddled on and then heaped up with a shovel.

The rammer for all floor work is about four feet long with a metal pene and butt. Sand is *pened* twice around the edge of the flask to prevent the iron running out and to make a hard parting. The sand is leveled with the hand and then stepping on the sand, by a series of backward jumps, the molder jumps it off, in rows lengthwise and crosswise. He then butts it all over, a little harder under the gates. He fits the bottom board, then removes it, cuts gutters across especially under where the gates will be and runs a vent wire one-eighth of an inch in diameter all over the drag nearly to the patterns. Then replacing the bottom board and clamping together the bottom board, drag and mold-board the mold is rolled over. After knocking the clamps off, the molder removes the mold-board, puts on the cope, and fastens it to the bottom board with clamps opposite each sprue. The sprue pattern is put in place, sand is riddled on, and then shoveled one quarter full. Then with a hand on each side of each bar, the sand is tucked with the fingers under the bar and around the sprues. The cope is heaped with sand and is pened around the sides of the cope and on each side of each bar. Then the sand is gathered by the hands between the bars and jumped off. The molder cleans the bars of sand and butts the sand all over, being careful not to hit the bars or the sand will not lift.

All loose sand is brushed off the surface of the mold and the sprue is removed. Metal wedges are pressed in between cope and drag at each corner, the clamps knocked off, and the wedges pushed clear in. The cope is rolled up nearly perpindicular and held there by an old file or piece of rod. The sprue is taken out and with a bellows all loose sand is blown from the drag and from the front and back of the cope. The sand is sponged at the edges of the pattern and the set gates.

After the pattern is drawn lead facing is dusted from a bag all over the mold to prevent the sand burning into the iron. Then charcoal facing is dusted on to prevent the lead sticking to the pattern. After printing the pattern back in the mold the set gates and pattern are drawn and the flask is closed and clamped. The iron should be poured as dull as possible to prevent the sand from burning into the iron. In the molding thus described the man molds the same piece over and over and becomes very expert, and generally working by the piece makes very good wages.

General Jobbing and Machinery Castings. (Roll Over Work.) — The previous description applies to this class also. Patterns are generally of wood and are made one-eighth inch per foot larger than the casting to make up for shrinkage. The pattern tapers at least one-eighth inch in a foot to help in drawing the pattern. Any overhanging parts of a pattern must be held by dowel-pins and such parts are drawn after the other part of the pattern is out.

It is better to have iron enter a mold from the bottom and for this purpose the sprue passes down to the bottom of the pattern and across to the mold through a hollow core molded into the drag. One or more risers are placed on the highest points of the mold through which the iron will rise after the mold is full. Dirt and gas will rise also and the riser may be large enough to allow churning with a rod to keep open a channel to the centre of the casting and through which melted iron may be poured to prevent spongy spots forming in the parts that cool last.

Flasks may be of three or more parts. Deep molds are rammed up in courses and harder in the lower portions to resist the head of metal. No soft spots, causing swells, or hard spots, causing scabs, must be made near the pattern. For heavy work about one inch of sand mixed with seal coal (ground bituminous coal) is riddled on all surfaces of the pattern to make a smooth casting.

When possible a pattern is made in two parts, divided at the parting line, allowing the drag part to be laid on a flat board. When an odd job is made without a mold-board a cope is inverted on a bottom board and rammed with sand and struck off. The pattern is roughly bedded in this sand.

Parting sand is thrown over the surface and the drag is rammed up. Then the mold is rolled over, the cope is taken off and the sand shaken out. The drag is then finished and the cope put on and the mold is finished.

Where there are deep places in the pattern the molder tucks sand around large nails with the heads down near the pattern, or sticks called soldiers, or gaggers, L pieces of rod or of cast iron the toe being near the pattern and the long end along the side of the bars. These must be tucked with the fingers and pened thoroughly. The molder then finishes the cope, venting thoroughly, especially around the sprues.

Molding by Bedding In.—In the foundry floor are pits filled with molding sand level with the floor. A hole is dug in this sand to take the pattern, around which the sand is packed. To allow for the escape of gas generated by a large quantity of iron, the hole is dug deeper than required for the pattern and a bed of very fine cinders is packed and connected by a pipe with the surface of the floor. The cinder bed is covered with sand. If the pattern is not deep or for open sand molds, the sand is leveled off even with the floor. Sand is packed in four small piles at the corners of the bed and two straight edges are leveled on these piles. Sand is tucked solid about these straight edges. Sand is then shoveled inside and outside and rammed hard outside the straight edges. The sand between is struck off.

After the molder has riddled sand three-quarters of an inch thick over the whole surface he places two strips about eight inches long and one-quarter to one-half inches thick on the ends of the straight edges. With a third straight edge on these strips he with his helper presses down first one end of the straight edge and then the other, moving across the bed, making all of an even hardness. He strikes off and vents all over the surface down to the cinder bed. Then with a fine sieve, a little facing sand is riddled over the whole surface and it is smoothed with a trowel. Strips of wood equal to the thickness of the casting are laid on the bed to represent the outside of the casting and the outside of the mold, and the gates are built up with sand. If pins or lugs are required on the lower surface, a pattern for them is pressed into the sand at the required points. A casting more than three inches thick is made with a cope.

Bedding In with a Cope.—If the upper surface of a casting is to be perfectly flat the cope with sprue holes may be rammed on any flat surface and can be set on the mold already bedded in the floor.

If a pattern with an uneven top surface has been bedded in the floor a cope is set in place and stakes are driven about it in the floor to insure its location, and the cope is then rammed. To raise the cope, flat boards are laid on the sand and with crowbars the corners are started, then it is lifted with the crane.

The cope is replaced and held down with iron weights so that the head of metal cannot raise it. Very large and complicated molds can be made in green sand. The mold may be formed by templets and by parts of patterns.

Sand may be built out from the sides by inserting anchors, or separate cores may be used. Such molds are faced by painting on lead facing with a camel's hair brush or by rubbing facing on with the hand.

Dry Sand Molds.—These are made from sand richer in loam than that used for green sand molds. They are made in iron flasks with iron bottom boards. The molding is substantially the same as green sand except that all joints are bevelled back from the mold so that when the cope is put on the edges will not crush. This causes a fin on the casting which is chipped off. The cope and drag are placed in an oven and thoroughly dried. Dry sand castings are more sound than if made in green sand.

Skin Dried Molds. (To obtain the advantages of dry sand molds, and of green sand bedded in work.)—Ordinary floor sand is used for the mold except the two inches of sand which faces the mold which is as rich in loam as for dry sand work. If the surface of an ordinary mold is to be only slightly dried, molasses water or thin clay water may be sprayed on the surface to make it strong when dry. A mold when finished is generally skin dried to a depth of one or more inches. Iron baskets filled with burning charcoal are hung in different parts of the mold or heated plates may be held near the surfaces or gas flames may be directed against the surfaces.

Loam Molding.—The body of the mold is built on iron plates with ordinary red brick laid in black mud, which is ordinary floor-sand mixed with clay wash. Some mix sawdust with the mud to make it porous and to help in drying the mold. Straw is sometimes laid in the joints for the same purpose. Pushing a vent wire between the joints also gives vent. This body is built about three-quarters of an inch away from the surface of the finished mold. On the brick surface is spread loam which is a mixture of sand, clay and water. This is faced off with trowels or sweeps. If the mold is circular such as a cylinder or a kettle, a spindle is located at the center of the mold. On this is fixed arms on which are fastened sweeps or templates. Made up cores are also used for giving shape to parts of the mold.

The outside or the inside of the mold with the bottom can be finished first as is most convenient. It is then taken to the oven by the crane. While this is drying the other part is built up and finished and dried. All parts are then put together, the bottom and top plates being bolted together with rods. A crib is built about the mold with steel or cast plates bolted together. Sand is rammed between the brick work and the casing, as hard as possible, forming also the gates for taking iron to the bottom of the mold. Water pipes and other specialty castings are made in iron molds fitted for the purpose and molding machines are used to a great extent for such work.

Every different pattern presents problems which require different treatment. Books on molding generally consist of descriptions of the making of molds for special castings and of difficulties encountered, but the ingenious methods familiar to all skilled molders are not described. One of the best descriptions of ordinary special processes is found in 'Appleton's Dictionary of Mechanics' under "Casting".

Cores are used in all classes of molds. An iron anchor may be coated with green sand and set in a mold. Dry sand cores are made of silica sand mixed with a binder such as floor, rosin or oil. When baked these binders make the core hard and strong, and the melted iron burns the binder so that the core sand falls out when the casting is cold. Cores are generally made in boxes. Wires or iron frames are molded in to give strength. Cores are vented by making channels with wires or by molding in a core and then drawing it out. For intricate cores cords of beeswax are molded in which melt out in baking. Cores are located by core prints in the mold left by the pattern and are held in place by chaplets of various shapes placed beneath to prevent sagging and above to prevent the iron from raising the cores. Nails forced into the mold are often used, the core resting on the heads. Tinning chaplets prevents rusting and helps the iron to fuse their surfaces.

Melting Iron.— Iron is melted in a cupola, a firebrick lined vertical cylinder in which is charged layers of coke and iron. A blower forces air through tuyers near the lower end. The melted iron is tapped out at the front into fire clay lined ladles and taken to the mold by hand ladles or by crane. For very large castings several cupolas are used and melted iron may be held in large ladles for some time while more is being melted. Air furnaces are also used for heavy castings.

Quality of Iron for Castings.— Silicon softens cast iron and decreases shrinkage, therefore a standard measure of shrinkage tells whether more or less silicon is needed. Strength depends very largely upon the size of grain, which is not wholly dependent upon the chemical composition. A thin portion of a casting shrinks more and sooner than a thick part which often causes fracture. It has been erroneously said that cast iron expands at the instant of solidification.

Iron becomes rigid at the surface of the mold while the central part is fluid. When all is solid, and just about as it ceases to be red hot, the casting expands more or less at the same time that carbon crystallizes into graphite. In a casting one inch square this expansion occurs about 15 minutes after the iron enters the mold but in a casting four inches square it occurs two hours after. This expansion at different times of parts of a casting of varying thickness, at the same time that the casting is shrinking unevenly from the loss of heat, produces severe strains which often fracture the casting. The remedy is to make all parts of equal thickness and to uncover thick portions as soon as solid.

William J. Keep,
Author of 'Cast Iron', etc.

Fountain, or **Artificial Fountain,** in hydraulics, a machine or contrivance by which water is violently spouted or darted up; called also a *jet d' eau.* There are various kinds of artificial fountains, but all formed by a pressure of one sort or another on the water, namely, either the pressure or weight of a head of water, or the pressure arising from the spring and elasticity of the air, etc. When these are formed by the pressure of a head of water, or any other fluid of the same kind with the fountain or jet, then will this spout up nearly to the same height as that head, abating only a little for the resistance of the air, with that of the adjutage or pipe from which the water spouts, etc., in the fluid rushing through; but when the jet is produced by any other force than the pressure of a column of the same fluid with itself, it will rise to such a height as is nearly equal to the altitude of a column of the same fluid, whose pressure is equal to the given force that produces the fountain. In ancient Greece every principal town had public fountains or conduits, some of which were of handsome design and of beautiful execution. The most famous of these were at Megara, at Corinth (the Pireñe and the Lerna), in the sacred wood of Æsculapius, at Epidaurus, and the two at Messina called Arisinoë and Clepsydra.

The ancient fondness for fountains still exists in Italy and the East. The French are celebrated for their fountains, but Italy, more particularly Rome, is still more so. The fountains of Paris and of the Tuileries, of the orangery at Versailles, at St. Cloud, and other places in the neighborhood, are splendid structures. The principal and most admired fountains at or near Rome are those in front of St. Peter's, of the Villa Aldobrandini at Frascati, of the Termini, of Mount Janiculum, of the gardens of the Belvedere, in the Vatican, of the Villa Borghese, which has also in the audience chamber a splendid fountain of silver, five Roman palms in height, ornamented with superb vases and flowers; the fountains of Trevi, the three fountains of St. Paul, of the Aqua Acetosa, etc.

In the United States the ornamental type of fountain is the one in common use. Large display fountains were attractive features of the Centennial Exhibition, and at the Chicago World's Fair and Buffalo Pan-American Exposition. Among these was the Fountain of the Republic of Chicago, which was designed by MacMonnies, and at Buffalo were costly examples dedicated to Man, Nature, Progress, etc. In Central Park, New York; Fairmount Park, Philadelphia; Lincoln Park, Chicago; Golden Gate Park, San Francisco, and other large parks, will be found numerous fountains of elaborate design. In all the larger cities drinking fountains for men and animals have been erected by individuals and local humane societies.

Fountain Pens. See LITERARY LABOR-SAVERS.

Fountains Abbey, one of the largest and best-preserved monastic edifices in England, in the West Riding of Yorkshire, 3 miles south-west of Ripon. Founded for Cistercians in 1132, it was not completed till the 16th century, and thus presents examples of every variety of style, from Norman to Perpendicular.

Fouqué, Friedrich Heinrich Karl, frēd'rĭh hīn'rĭh kärl foo-kā', BARON DE LA MOTTE, German poet and novelist: b. Brandenburg 12 Feb. 1777; d. Berlin 23 Jan. 1843. He was a grandson of H. A. Fouqué (q.v.); served as lieutenant of the Prussian guards in the campaign of 1792, and was present in 1813 at the most important battles in the War of Liberation. As a writer he is remarkable both for variety and fecundity, and has published poetry in almost all its forms — dramatic, epic, romantic, etc. Several of his short romantic tales in prose, such as 'Der Zauberring,' 'Aslauga's Ritter,' but more especially his 'Undine,' enjoy an extraordinary popularity. The last mentioned tale, a charming mixture of fairy ideality, the reality of humble life, and the glow of chivalry, has gone through many editions, and has been translated into every European language. It must be admitted that Fouqué, while possessing many of the virtues of the romantic school, was guilty of all its extravagances, and that the descriptions of chivalric and feudal life, in which he delighted, are mere fancy pictures.

Fouqué, Heinrich August, hīn'rĭh ow'goost, BARON DE LA MOTTE, Prussian general; b. The Hague, Holland, 4 April 1698; d. Brandenburg 2 May 1774. Fouqué possessed the confidence of Frederick the Great; and the 'Mémoires du Baron de la Motte Fouqué' (1788, by Büttner, the secretary of Fouqué), which contain his correspondence with Frederick the Great, are of great interest.

Fouquet, foo-kā, **Nicolas,** French statesman, VISCOUNT DE MELUN AND DE VAUX, AND MARQUIS OF BELLE ISLE; b. Paris 1615; d. Pignerol 23 March 1680. He received in 1650 the important appointment of procureur-général to the parliament of Paris, and three years later was advanced to be superintendent of finance. His rapid advance made him ambitious of succeeding Mazarin as first minister, but he had a formidable rival in Colbert. Fouquet's plans were, however, brought to naught; for in the first place Louis himself took the reins of power into his own hands when they slipped from the grasp of the dead cardinal, and in the second place, instigated thereto by Colbert, he suddenly arrested Fouquet in September 1661. After a trial extending over three years, Fouquet was sentenced to perpetual exile and the loss of all his property, but the sentence was afterward altered to life-long imprisonment. From the circumstance of his imprisonment at Pignerol, Fouquet, in spite of the fact that he died in 1680, has been identified with the Man With the Iron Mask (q.v.), who, however, lived till 1703.

Fouquier, foo-kē-ā, **Henry,** French publicist: b. Marseilles 1 Sept. 1838. After study of law and medicine he became a journalist in Paris, general-secretary of the prefecture of Marseilles (1870), and director of the press in the ministry of the interior. He wrote much for the *Figaro* and *XIX. Siècle,* but particularly for *Gil Blas,* under the pen-names "COLOMBINE" and "NESTOR," and was a founder of the *Echo de Paris.* In 1889 he was elected deputy for Alpes-Maritimes. His articles have been collected in several volumes under such titles as 'Etudes Artistiques' (1859); 'Au siècle dernier' (1884); 'La sagesse parisienne' (1859).

Fouquier-Tinville, Antoine Quentin, äṅ-twäṅ kĕn-tăṅ foo-kē-ā tăn-vēl, French revolutionist: b. Hérouelles, near St. Quentin, 1747; d. Paris 7 May 1795. As a member of the revolutionary tribunal he distinguished himself by his alacrity in pronouncing the verdict of guilty, and attracted the attention of Robespierre, who gave him the office of public accuser before this tribunal. The victims now became numberless. Fouquier drew up the scandalous articles of accusation against the queen, Marie Antoinette. His thirst for blood seems to have been increased by gratification, until it became a real insanity. He proposed the execution of Robespierre and all the members of the revolutionary tribunal 9th Thermidor, 1794, was himself removed on the 14th Thermidor (1 Aug.), 1794, and arrested. He died under the guillotine. There does not appear to be a trait in the life of this monster which can entitle his crimes to the same palliation as those of Robespierre, who considered the extermination of the aristocracy as a necessary evil. Consult Domenget, 'Fouquier-Tinville, et le tribunal révolutionnaire' (1878).

Four-eyed Fish, a fish of the genus *Anableps.*

Four-horned Antelope, or **Chousingha,** the genus *Tetraceros* of the antelope group, native to India, and differing from all other living ruminants in that the male generally bears two pairs of horns. It is closely related to the African duikerbok (q.v.), which it resembles in the position of its larger horns, and the shape of its eyes, as well as in other ways. The smaller horns rise from just above the eyes. This antelope is a pretty, brownish creature, standing about 25 inches at the withers, and is found from the foot of the Himalayas southward over India, in wooded hill-country, but it avoids dense jungles. It drinks daily, and hence never wanders far from the water. It is exceedingly shy, and escapes, when discovered, in a series of jerky, though very rapid, bounds, into the cover of long grass or low bushes.

Four Lakes, a chain of lakes in Dane County, Wis.; known respectively as First, Second, Third, and Fourth lakes. First Lake, the smallest and lowest of the chain, is about 3 miles long by 2 miles wide; Second Lake is 3½ miles long by 2 broad; Third Lake is 6½ miles long by 2 miles wide; Fourth Lake, the largest and most beautiful, is 6 miles long by 4 wide. The waters of these lakes are navigable for small steamers. The two last are now called lakes Monona and Mendota.

Four-o'clock. See FRIAR-BIRD.

Fourcroy, Antoine François de, äñ-twän fräñ-swä dė foor-krwä, French chemist: b. Paris 15 June 1755; d. 16 Dec. 1809. Having adopted the profession of medicine he applied himself closely to the study of the sciences connected with it, especially to chemistry, and published in 1776 a translation of Ramazzini's 'Treatise on the Diseases of Artisans.' He was professor of chemistry at the Jardin du Roi, 1780-1805. He organized the central school of public works, out of which the polytechnic school afterward sprang, and co-operated in the establishment of the normal schools. In 1799 Bonaparte gave him a place in the council of state, in which place he drew up a plan for a system of public instruction, which, with some alteration, was adopted. His works are numerous, among which the following are the most important: 'Leçons Elémentaires d'Histoire naturelle et de Chimie' (1791); 'Système des Connaissances chimiques, et de leurs Applications aux Phénomènes de la Nature et de l'Art' (1805); 'Philosophie chimique'; 'Tableaux synoptiques de Chimie' (1805); and 'La Médecine éclairée par les Sciences physiques.'

Fourdrinier (foor-drĭ-nēr') **Machine,** a paper-making machine, the first to make a continuous web. It was invented by Louis Robert, of Essonne, and patented by him in France. A Mr. Gamble and the brothers Fourdrinier improved it. The machine was perfected by others.

Fourier, François Charles Marie, fräñ-swä shärl mä-rē foo-rē-ā, French social economist: b Besançon 7 April 1772; d. Paris 10 Oct. 1837. He studied at the college in his native town, and obtained a mercantile position at Rouen; he later entered into business on his own account at Lyons, having inherited a small fortune from his father, but the siege of the city by the troops of the convention in 1793 and the subsequent disorders were fatal to his prosperity; he was arrested and kept a prisoner for some time, and afterward served two years in the Revolutionary army. When he was 19, while employed at Marseilles, his employers retained a cargo of rice in order to keep up the price, and when it became unfit for use ordered Fourier to throw it into the sea. This experience led him to question the righteousness of the existing industrial system and to develop his own social theory known as Fourierism (q.v.). He first published 'Theorie des quatre Mouvements et des Destinées generales' (1808), in which he explained the basis of his system, which he developed more completely in 'Traite de l'Association domestique agricole' (1822), republished under the title 'Theorie de l'Unité universelle,' and in 'Le Nouveau Monde' (1829-30). See Pellarin, 'Charles Fourier, sa vie et sa théorie' (5th ed. 1871; American translation, 1845).

Fourier, Jean Baptiste Joseph, zhŏñ bäp-tēst zhō-zĕf, BARON, French mathematician: b. Auxerre, France, 21 March 1768; d. 16 May 1830. He was an active Jacobin during the French Revolution. His later energies were divorced from politics and given up to science. 'Analytical Theory of Heat' (1822) is his most noted work; but in mathematics his speculations and methods are of high permanent utility.

Fourierism, foo'rĭ-ėr-ĭzm, the social system advocated by F. M. C. Fourier (q.v.). It was based on the theory that the social order depends upon fixed moral and intellectual laws, and that man must discover and live according to these laws. According to Fourier society must be so organized as to give freedom to the passions or desires of man, since these are naturally capable of harmony, and, if developed under proper conditions, would, in accordance with the law of attraction, lead to a perfect society. In this society industry should be carried on by phalanxes, each phalanx to be divided into series, and the series combined in groups; each group was to have charge of one kind of work, and each series of one special branch of that work. In the distribution of products a certain minimum was to be assigned to each member of the society, whether capable of labor or not; the remainder to be shared in certain proportions to be previously determined among the three elements, labor, talent, and capital. The capital of the community might be owned in unequal shares by different members of the community; inheritance was to be permitted, and the individuals could expend the remuneration they received as they pleased. The government was to be republican, with elective officers. Fourierism, though socialistic, is not properly socialism, and is related to modern socialism by its sharp criticism of existing conditions, rather than by its plan for the future of society.

Fourierism won many converts in France; among those who advocated the theory were Victor Considerant and Mennier; an association was formed; a periodical, the 'Phalange,' was published for a short time; and a number of communities were organized in accordance with the Fourieristic plan, none of which long survived. Fourierism was introduced into the United States in 1842, by Albert Brisbane, who for a time published 'The Phalanx,' in New York. He was welcomed by the members of the Brook Farm community, and the Fourieristic organization was adopted there. For a time the 'Brook Farm Phalanx' published 'The Harbinger,' the most important periodical published by the Fourierists in the United States. An organization, known as the American Union of Associationists, was formed for the "popular diffusion of the principles of the associative sciences as discovered by Charles Fourier, with a view to their ultimate realization by the establishment of phalanxes." Horace Greeley (q.v.) became its president, and George Ripley (q.v.) secretary. A large convention of the "associationists" was held in New York in 1844. In 1847 'The Harbinger' was transferred to New York under the charge of this association, and was published till 1849. About 34 communities were organized by the Fourierists, of which the most important (besides Brook Farm) were the North American Phalanx, which lived 12 years, and the Wisconsin Phalanx. Most of them existed but a short time, and by 1850 the Fourierist movement had practically come to an end. Consult: Brisbane, 'Social Destiny of Man'; Ely, 'French and German Socialism'; Noyes, 'History of American Socialisms'; Shaw, 'A Forgotten Socialism' ('New England Magazine,' new series Vol. VIII., p. 773). See BROOK FARM; COMMUNISM; NORTH AMERICAN PHALANX; SOCIALISM.

Fourier Series, in mathematics, a trigonometric series first extensively employed by the French mathematician Jean Baptiste Joseph

Fourier, in connection with the theory of the movement of heat in a solid body. It was primarily intended for effecting the development of an arbitrary periodic function in the form of a series whose terms are sines and cosines of increasing multiples of the variable. The subject is too technical for discussion in a general encyclopædia. Consult: Fourier, 'The Analytical Theory of Heat' (translated by Alexander Freeman); and more especially, Byerly, 'An Elementary Treatise on Fourier's Series, and Spherical, Cylindrical, and Ellipsoidal Harmonics.'

Fourth Nerve, one of the pair of cranial nerves, and the chief motor nerve of the superior oblique muscle of the eye. It originates in a group of cells in the floor of the medulla and runs outward over the superior elevator muscle of the eyelid, and is distributed to the orbital surface of the superior oblique.

Fourth State of Matter. See ELECTRON; MATTER; RADIUM.

Foussa. See FOSSA.

Fouthill Abbey. See BECKFORD, WILLIAM.

Fouke (originally Smith), Gerard, American archæologist: b. Maysville, Ky., 25 June 1855. In 1885–8 and 1891–3 he was connected with the United States Bureau of Ethnology in surveys and explorations of aboriginal remains in the eastern part of the country. Further research by him includes explorations for the American Museum of Natural History, New York, on the lower portion of the Amur River, Siberia, and on Vancouver's Island, British Columbia; and excavations of so-called Norse remains in the vicinity of Boston, Mass. His published writings comprise essays on archæological subjects in the bulletins and reports of the Bureau of Ethnology and elsewhere.

Fowl, a word originally synonymous with bird, now used in a stricter sense to designate the genus *Gallus,* of which the common domestic fowl (cock and hen) is a familiar example. The general form and characters of the bill, feet, etc., agree with those of the pheasants, but the crown of the head is generally naked and furnished with a fleshy comb, the base of the lower mandibles also bearing fleshy lobes or wattles — characters which are most conspicuous in the males. The jungle fowl of India (*Gallus ferrugineus,* or *bankiva*) is regarded as the source of domestic poultry; it is known also in southern China and throughout the Malay islands. The male closely resembles the game-cock. The comb and wattles are of the brightest scarlet, the long hackles of the neck and lower parts of the back are fine orange-red, the upper part of the back is deep blue-black, and the shoulders ruddy chestnut. The long, arched, and drooping tail is blue-black, glossed with green, and the breast and under parts black. The word is also commonly applied in such combinations as wildfowl, waterfowl, seafowl, and the like. For the characteristic of domestic fowls, see POULTRY.

Fowler, Charles Henry, American Methodist clergyman: b. Burford, Ontario, Canada, 11 Aug. 1837. He was graduated at Genesee College in 1859 and at the Garrett Biblical Institute in 1861; studied law; was pastor for 11 years in Chicago, Ill.; president of the Northwestern University in 1872–6; and corresponding secretary of the Missionary Society in 1880. He was elected a bishop of the Methodist Episcopal Church in 1884; visited Japan, Korea, and China in 1888; organized the Peking and Nanking universities; was stationed for eight years on the Pacific coast; founded the Maclay College of Theology in Southern California, and assisted in founding Wesleyan University in Lincoln, Neb. He was sent as a fraternal delegate to the Wesleyan Conference in Great Britain in 1898.

Fowler, Ellen Thorneycroft, English novelist. She is the daughter of Sir Henry Fowler, secretary of state for India 1894–5. Her published works include: 'Verses Grave and Gay' (1891); 'Verses Wise and Otherwise' (1895); 'Concerning Isabel Carnaby' (1898); 'A Double Thread' (1899); 'The Farringdons' (1900); 'Love's Argument' (1900); 'Sirius, and Other Stories' (1901); 'Fuel of Fire' (1902).

Fowler, Frank, American artist: b. Brooklyn, N. Y., 12 July 1852. He studied at Florence as pupil of Edwin White, at Paris with Carolus Duran and in the Beaux-Arts, established a studio at New York in 1880, and became known as a portrait painter. His subjects include S. J. Tilden, Archbishop Corrigan, C. A. Dana, and other notabilities. He was elected a National Academician, and has published manuals of art: 'Oil Painting'; 'Drawing in Charcoal and Crayon'; 'Portrait and Figure Painting.'

Fowler, SIR John, English civil engineer: b. near Sheffield 1817; d. London 20 Nov. 1898. In 1844 he was appointed to superintend the construction of the Manchester, Sheffield, and Lincolnshire system, a connected group of railways, and other works of vast extent and complexity. He subsequently was employed on many civil engineering works both in England and elsewhere; but the work with which his name will probably be most lastingly connected is the great bridge across the Forth, of which he was chief engineer, having as his colleague Sir Benjamin Baker. (See BRIDGE.) On its completion in 1890 he was made a baronet.

Fowler, Joseph S., American lawyer: b. Steubenville, Ohio, 31 Aug. 1820; d. 1902. He became professor of mathematics at Franklin College, Tenn., and was president of the Howard Female College in Gallatin, Tenn., in 1856–61. Subsequently he was State comptroller under Andrew Johnson, and was a United States senator 1866–71. In 1871 he retired from political life and engaged in law practice in Washington, D. C.

Fowler, Lorenzo Niles, American phrenologist: b. 1811; d. 1896. He was a brother of Orson Squire Fowler (q.v.). From 1863 he resided in England. He was a publisher of the 'Science of Health' (originally the 'Water-Cure Journal') and the 'American Phrenological Journal,' and wrote 'Phrenology and Physiology' (1844).

Fowler, Montagu, English Anglican clergyman: b. London 12 Nov. 1858. He was educated at Harrow and Cambridge; took orders in the Established Church, was vicar of St. Lawrence, Isle of Thanet, Kent, 1889–93, and has been rector of All Hallows, London Wall, from 1900. He has published: 'Christian Egypt'; 'Some Notable Archbishops of Canterbury'; 'Church History in Queen Victoria's Reign.'

Fowler, Orson Squire, American phrenologist: b. Cohocton, Steuben County, N. Y., 11 Oct. 1809; d. Sharon, Conn., 18 Aug. 1887. He was graduated at Amherst College in 1834, and opened a phrenological office in New York in 1835. In 1836 he and his brother Lorenzo wrote and published 'Phrenology Proved, Illustrated and Applied,' and in 1838 issued the first number of the 'American Phrenological Journal.' Subsequently he lectured on his specialty and allied subjects in the United States and Canada, and wrote and published numerous books, including 'Self-Culture and Perfection of Character'; 'The Self Instructor in Phrenology'; 'Human Science'; etc.

Fowler, Thomas, English philosopher: b. Burton-Stather, Lincolnshire, 1 Sept. 1832. He was educated at Merton College, Oxford, and from 1873 to 1889 was professor of logic in the university. Since 1881 he has been president of Corpus Christi College. His published works include: 'Elements of Deductive Logic' (1867; 10th ed. 1892); 'Elements of Inductive Logic' (1870; 6th ed. 1892); an edition of Bacon's 'Novum Organum,' with introduction and notes (1878; 2d ed. 1889); a little work on 'Locke' (1880); an edition of Locke's 'Essay on the Conduct of the Understanding' (1881; 3d ed. 1890); 'Francis Bacon' (1881); 'Shaftesbury' (1882); 'Hutcheson' (1882); 'Progressive Morality: an Essay in Ethics' (1884; 2d ed. 1895); 'History of Corpus Christi College, Oxford' (1893); 'Principles of Morals' (Part I., introduction written with J. M. Wilson, 1885; Part II., the body of the work, by Prof. Fowler alone, 1887; both in one volume, revised 1894); and 'Popular History of Corpus Christi College' (1898).

Fowler, William Warde, English ornithologist: b. Somerset 1847. He was educated at Marlborough College and Oxford, and has been sub-rector of Lincoln College, Oxford, from 1884. He has published: 'A Year With the Birds' (1886); 'Tales of the Birds' (1888); 'Life of Julius Cæsar' (1892); 'The City-State of the Greeks and Romans' (1893); 'Summer Studies of Birds and Books' (1895); 'The Roman Festivals of the Republican Period' (1899); 'More Tales of the Birds' (1902).

Fowler, William Worthington, American author: b. Middlebury, Vt., 24 June 1833; d. Durham, Conn., 18 Sept. 1881. He was the author of 'Ten Years in Wall Street' (1870); 'Fighting Fire' (1873); 'Woman on the American Frontier' (1877); 'Twenty Years of Inside Life in Wall Street' (1880).

Fowler's Solution. See Arsenic.

Fox, Charles James, English statesman: b. London 24 Jan. 1749; d. Chiswick, Surrey, 13 Sept. 1806. He was the son of Henry, 1st Lord Holland, and was educated at Eton and Hertford College, Oxford. His father procured him a seat for the borough of Midhurst in 1768 before he was of legal age, and in 1770 the same interest procured him the office of one of the lords of the admiralty, which post he resigned in 1772, and was appointed a commissioner of the treasury.

After being a supporter of the administration for six years, Fox was ejected owing to a quarrel with Lord North, and was thrown into the ranks of the Opposition. The adoption of the disastrous measures which terminated in the independence of the American colonies enabled him to take this part without opposing any of the policy which he had previously supported. During the whole of this eventful contest he spoke and voted in direct opposition to the ministerial system, and, in conjunction with Burke, Barré, Dunning, and other eminent parliamentary leaders, displayed the highest talents both as a statesman and orator. On the final defeat of the administration of Lord North and the accession of that of the Marquis of Rockingham, Fox obtained the office of secretary of state for foreign affairs. But the death of the Marquis of Rockingham suddenly divided the party, and on the Earl of Shelburne becoming first lord of the treasury Fox retired and soon after a union took place between his friends and those of Lord North, under the name of the coalition. The temporary success of this party movement served only to render popular disgust the more general; and the dismissal of the coalition excited general satisfaction. Though in the new Parliament Pitt had a decided majority, Fox headed a very strong opposition, and political questions were for some years contested with a display of talent on both sides which the House of Commons had seldom previously exhibited.

In 1790 and 1791 Fox regained a share of popularity by his opposition to war with Spain and Russia, and also by his libel bill, regulating the rights of juries in criminal cases and rendering them judges both of the law and the fact. On the breaking out of the French Revolution he was disposed to regard it as likely to prove extremely beneficial. The contrary views of Burke, and the extraordinary manner in which that ardent politician on that account publicly renounced his friendship, is one of the most striking incidents in parliamentary history.

The opinions formed of this eminent leader as a practical and theoretical statesman have been as various as the shades of party difference. That he was a sincere friend to all the broad and generous principles on the due development of which rest the freedom and best interests of mankind, is not to be doubted, and that they were alloyed by great latitude on the subject of party and political expediency is equally clear. As a powerful and purely argumentative orator he was of the very first class; though as to eloquence and brilliancy he perhaps yielded to Pitt, Burke, and Sheridan; nor were his voice and manner prepossessing, though highly forcible. Of his amiability in private life, after making allowance for a dissipated youth, all accounts agree. Friends and foes equally testify to his ingenuous and benign character. As an author, besides some Latin poetry and a Greek dialogue, by which he highly distinguished himself at Eton, and a few numbers of a paper, entitled 'The Englishman,' he published nothing during his lifetime but 'A Letter to the Electors of Westminster' (1793). To his nephew, Lord Holland, the world is indebted for his posthumous publication, entitled 'The History of the Early Part of the Reign of James II.' It is written with unpretending simplicity, but disappointed expectation, and has never been popular. See Lord John Russell, 'Life and Times of C. J. Fox' (1859–66); Wakeman, 'Life of Charles James Fox' (1890); Trevelyan, 'Early History of Charles James Fox' (1881).

Fox, George, English religionist, founder of the Society of Friends: b. Drayton, Leicestershire, England, July 1624; d. London 13 Jan. 1690. While yet a boy he was distinguished by his gravity and exemplary conduct. When in the 20th year of his age, and for some two or three years afterward, Fox describes himself as having been in a distressed state of mind, but from this condition he was at length delivered by that which he regarded as the voice of God in his soul, directing him to Christ as alone able "to speak to his condition." Very soon after this he commenced his public ministrations at Dukinfield, Manchester, and the neighborhood. From the first his preaching seems to have made many converts and excited much opposition. Fox's first imprisonment took place in the year 1648, in consequence of his opposing the preacher in "the great steeple-house at Nottingham," on a point of doctrine. In 1650 he was imprisoned at Derby under a false charge of blasphemy. One of the committing justices, Bennet, acted with great violence on this occasion, and it was he who on Fox's bidding him "tremble at the word of the Lord" first applied to him and his friends the name of Quakers. Fox lay in prison at Derby for about a year, the time having been lengthened in consequence of his refusal to accept a commission as captain of one of the regiments then being raised by Parliament. To his belief of the unlawfulness of all war, which prompted this refusal, was added at the same time a clear view of the enormity of the punishment of death for crimes affecting property only, and he exerted himself to save the life of a poor woman then in jail for theft. Within 10 years of Fox's appearance as a preacher, meetings of the Friends were established in most parts of England. At the same time, so actively were they persecuted, that for many years there were seldom less than 1,000 of them in prison. Cromwell, though himself favorable to liberty of conscience, seems to have been unable to curb the excesses of popular hostility launched in all quarters against a sect which denounced all state interference with religion and maintained that the gospel should be preached without fee or reward. About a month after the restoration of Charles II., Fox was committed to Lancaster Castle, "on the charge of being a common disturber of the peace, and of endeavoring to make insurrection and embroil the whole kingdom in blood." After lying in jail some months, a habeas corpus was obtained, and the authorities showed their disbelief of these grave charges by allowing Fox himself, unbailed and unguarded, to convey to London the sheriff's return to the writ. The hopes entertained by the members of the young society that they would be allowed a breathing-time from persecution were dispelled at the commencement of 1661 by the atrocious measures which followed the mad attempt of Venner and his Fifth-Monarchy men. The act empowering magistrates to tender the oaths of allegiance and supremacy to any person whom they thought fit to suspect, also operated with great severity against the Friends; under its provisions Fox was committed to prison at Lancaster in the beginning of 1664, whence he was removed to Scarborough Castle, where he lay till the autumn of 1666. In 1669 Fox married Margaret Fell, the widow of one of the judges of the Welsh courts. The year 1670 witnessed the passing of the most stringent of the Conventicle Acts, forbidding under heavy penalties the assembling for religious worship, in any house, of more than four persons besides the family, except according to the usages of the Church of England. Soon after his recovery from a severe illness he sailed for Barbadoes, where he exerted himself greatly in the interests of religion and humanity. It was while in this island that Fox drew up a statement of his own and his friends' belief in all the great doctrines of Christianity — a statement clearly disproving their alleged sympathy with Socinian tenets. After a considerable time spent in Barbadoes, Jamaica, and the North American continent, he returned to England in 1673, where further persecutions awaited him. He underwent 14 months' imprisonment in Worcester jail, and was at length liberated by the Court of King's Bench on account of the errors in his indictment. In 1677, in company with Penn and Barclay, who had joined the Society about 10 years before, he paid a visit to Holland and some parts of Germany, where his services seem to have been well received. The last 15 years of his life were tranquil as regards personal molestation, but he continued to be actively engaged in various ways in promoting the welfare of his brethren. Their persecutions continued throughout the reign of Charles II. In the first year of William and Mary was passed the bill which nullified the Conventicle Acts, and allowed the Friends to make a solemn declaration in lieu of taking the oaths, and Fox had the gratification of seeing the public worship of the Society legally recognized before his death. (See FRIENDS, SOCIETY OF.) His works were issued in three volumes 1694–1700. Consult: Sewell, 'History of the Quakers'; Lives by Marsh (1848); Janney (1853); Watson (1860); Tallack, 'George Fox, the Friends and the Early Baptists' (1868); Bickley, 'George Fox and the Early Quakers' (1884).

Fox, George L., American actor: b. Boston, Mass., 3 July 1825; d. 24 Oct. 1877. He first appeared at the Tremont Street Theatre in the 'Hunter of the Alps'; became known as a low comedian at the National Theatre, New York; was a lieutenant in the Union army at Bull Run, and later became manager of the New Bowery Theatre. Here he gained for himself a distinct position by his burlesque imitations of favorite tragedians of the time, and his pantomimes, the best of which was 'Humpty Dumpty,' in which from 1867 to his retirement in 1876 he appeared as the clown.

Fox, Gustavus Vasa, American naval officer: b. Saugus, Mass., 13 June 1821; d. New York 29 Oct. 1883. He was appointed to the United States navy in 1838, in which he served till 1856, when he resigned with the rank of lieutenant. He was subsequently appointed assistant secretary of the navy, and held this post till the end of the Civil War. He planned a number of operations for the navy, including the capture of New Orleans; and was sent by the government on the Monitor Miantonomoh to convey the congratulations of Congress to Alexander II., on his escape from assassination. His visit to Russia materially aided the acquisition of Alaska by the United States, and was the longest voyage then made in a monitor.

Fox, John William, American novelist: b. Bourbon County, Ky., 1863. He was graduated from Harvard 1883 and has published: 'Hell for Sartain and Other Stories' (1897); 'A Mountain Europa' (1899); 'The Kentuckians' (1898); 'Crittenden' (1900); 'Blue Grass and Rhododendron' (1901); 'The Little Shepherd of Kingdom Come' (1903).

Fox, Margaret, American spiritualist: b. Bath, Canada, 1836; d. Brooklyn, N. Y., 8 March 1893. She was about 12 years old when her family were startled by mysterious rappings. All endeavors to trace them to any physical source proved unavailing. Various experiments were tried, but the "occult" power refused to act save in the presence of Margaret and her sister Leah. The family moved to Rochester, N. Y., but the raps followed and heavy bodies were moved without appreciable agency. In 1849 the sisters appeared in a public hall; when the same phenomena were freely manifested and tested. In 1850 the two girls went to New York, the "manifestations" became the subject of public discussion, and "mediums" sprang up all over the country. In 1888 Margaret made a public exposure of her pretended "manifestations," which she subsequently contradicted.

Fox, William Carlton, American diplomatist: b. St. Louis, Mo., 20 May 1855. He first came into prominence as United States consul at Brunswick, Germany (1876–88). Subsequently he was United States vice-consul-general at Teheran, Persia. He organized the American Missionary Hospital during the cholera epidemic there in 1892, and established and edited the only strictly diplomatic and consular journal ever attempted in the United States.

Fox, William Freeman, American forester: b. Ballston Spa, N. Y., 11 Jan. 1840. He was graduated at Union College in 1860; studied engineering; served in the Civil War; and subsequently took charge of the Department of Forestry of New York State. He is the author of: 'Regimental Losses in the Civil War'; 'The Adirondack Spruce'; 'State Forestry Reports' for 1885–1901; and magazine articles on forestry, etc.

Fox, William Johnson, English orator and political writer: b. near Wrenthaum, England, 1786; d. London 3 June 1864. A weaver's son, he early showed signs of ability and was picked out to be educated for the Independent ministry. Once ordained, his rationalistic opinions cut him off from all the denominations. He became a radical active in politics, and spoke and wrote with persistent vehemence against the Common Laws. He was elected to Parliament in 1847, but was twice defeated at subsequent elections. His vigorous pen and eloquent voice aided the cause of popular social and political progress in England at a critical time in her history.

Fox, one of a group of small, long-eared, bushy-tailed animals of the dog-tribe (*Canidæ*), mostly included in the genus *Vulpes;* specifically, in literary usage, the red fox (*V. vulgaris*), called *renard* by the French and *reinicke fuchs* by the Germans. Foxes differ from wolves and jackals in being smaller, having shorter legs, longer, more furry and pointed ears, a more slender elongated muzzle, and a longer and more bushy tail; and they incline to that yellowish red color called "foxy." But these distinctions are difficult of limitation (see FENNEC; FOX-DOG), and some naturalists refuse to recognize a separate genus for them. One fixed character is found in the pupil of the eye, which when contracted becomes elliptical in the foxes but remains round in other dogs. All the typical foxes are inhabitants of northerly latitudes, and well represented by the common red fox, which may be regarded as distributed throughout the whole northern hemisphere, though variously named in different countries, where local diversities exhibit themselves; thus the American variety is called *V. pennsylvanicus,* but it is not essentially different from those of the Old World. Its variations are as great here as in Europe and Asia, especially among those of the Far North, where certain color-phases have superior value in the fur-trade. Thus a fox marked with a dark line along the spine and another over the shoulders, is called a "cross" fox, and fine specimens are worth an extra price. Wholly black ones are uncommon; but the rarest and most valuable pelt is that of a "silver" fox, that is, a black one in which so many hairs are white-tipped that a hoary or silvered appearance is given to the skin. The red fox is fostered for the sport of fox-hunting (q.v.) in Great Britain, and in some parts of Eastern America, but in most countries he is regarded merely as a fur-bearer, or a poultry thief or worse, and is trapped, shot and poisoned continuously. Nevertheless, the animal survives and multiplies in the midst of civilization, by virtue of its power of comprehension of and adaptation to new conditions; so that he has acquired, very justly, a reputation for alertness, wit and cunning in contrivance for food and safety. In America this species is constantly extending its range southward at the expense of the gray fox. Another species yielding a valuable fur is the Arctic or blue fox (*V. lagopus*), which is found on all Arctic coasts, and although brownish in summer, becomes in winter pure white; but the under fur is always bluish, and in those of Alaska this color prevails over brown in summer. Certain of the Aleutian Islands have lately been devoted by local fur companies to the rearing of these foxes in semi-captivity, where they are cared for, and a selected number annually sacrificed to trade. North America has two other well-marked species. One is the swift or kit fox (*V. velox*) of the plains, which is only 20 inches long, exceedingly swift of foot, expert in digging and cunning at concealment. It has reddish-yellow fur in summer, but becomes dull gray in winter, with black patches each side of the nose. The other species is the gray fox, which was once generally distributed over the United States but has become extinct in the northeastern part since the general clearing and settlement of the country. It is a woodland animal, still numerous in the South and West. Its hair is stiffer and duller in color than that of the red fox, and it is so peculiar in structural respects (among others in having a concealed mane of stiff hairs on the top of the tail) that it has been classified in a separate genus as *Urocyon argenteus.* Several well-known species dwell in Asia, the best-known of which is the familiar fox of northern India (*V. bengalensis*).

Foxes everywhere are burrowing animals or else adapt to family needs holes in rocks, hollows of old stumps, and similar conveniences. They hide by day and go abroad at night in search of small prey, stalking and catching birds on their nests, or at roost on the ground. ground-squirrels, mice, frogs, and insects, and also eating largely of certain roots, fruits and other vegetable food. They are hardy, hunt all winter and climb mountain peaks. They never hunt in packs, as do wolves; and their voice is nearer a bark than a howl. They do not readily submit to domestication, and seem to have contributed little if anything to the composition of domestic breeds of dogs.

Consult for information on Old World foxes, the writings of Bell, Brehm, Blanford, Mivart and Beddard, well-summed up in Lydekker's 'Royal Natural History,' Vol. I. For American foxes, read Richardson, Hearne, Audubon, Merriam, the writings of Nelson, Turner and Murdoch on the natural history of Alaska, and the general remarks in Cram and Stone's 'American Animals' (1902).

Fox Bats. See Flying-fox.

Fox Channel, in the Hudson Bay, Canada, named after Luke Fox, who explored the region in 1631. The channel lies between Southampton Island and Baffin Land.

Fox-dog, a name given by certain naturalists to the wild dogs of South America, because of their fox-like appearance. Among these are the crab-eating dog (*C. cancrivorous*); the zono, or Azara's dog (*C. azaræ*), of which the "colpeo" of the pampas and southward is probably a local variety; the small-eared Brazilian dog (*C. microtis*, of Mivart), and two other aberrant Brazilian dogs (*C. urostictus*, and *C. parvidens*) for which a separate genus (*Nothocyon*) has been proposed by Wortman. All these animals have a striking external resemblance in color and form to the foxes, and connect them with the typical dogs. They are not well known, however. Consult: Mivart in the 'Proceedings' of the Zoological Society of London (1890); Beddard, 'Mammalia' (1902), and writers upon the zoology of South America. See Bush-dog.

Fox-hound, a breed of hounds, concerning whose origin practically nothing is known, save that they were probably first bred in Great Britain. This, perhaps the handsomest and most perfect of all hounds, is essentially a field dog, presenting an eminently powerful, well-built appearance, with his clean-cut, compact body, and giving evidence of muscular strength and endurance in the hunt. The head is full, with a broad brow, a long, wide muzzle, and open nostrils. The ears are set low and lie close to the cheek. The eyes are soft and brown. The chest is broad, and the ribs are deep, so as to afford plenty of breathing space. The muscular body is set on legs as straight as a post, and very strong; and the feet are round and cat-like. The color varies from black to tan and white, and the coat is hard, smooth and glossy. The American breed is lighter and finer in lines than the English fox-hound, has longer, thinner, and more pendant ears; a slightly narrower chest, and a rougher coat. He is used in fox-hunting as is the English fox-hound; but is also employed in hunting the moose, and other large game, especially in the Canadian forests. See Dog.

Fox-hunting, the chase of the fox with horses and hounds, as a recreation. This sport arose in England with the Restoration, when changes in customs and agricultural conditions caused the disappearance of falconry, and has become surrounded by codes of social usage and of legal enactments. It flourishes most in the south-central counties of England, and in Ireland, and some of the principal organizations or "hunts" as the Belvoir, Quorn, Pytchley and Cottesmore, were founded early in the 17th century. A "hunt" is an association for the promotion and regular practice of the sport in a certain district. It acquires a pack or several packs of fox-hounds (q.v.), kennels and perhaps a club-house, is directed by a "master of fox-hounds," and served by paid employees, the principal of whom are the "huntsman" who arranges and leads the sport for the day, and the "whippers-in," who see that the dogs work properly. These officials, and the sportsmen themselves wear "pink" (that is scarlet) coats when in the field. The expenses are paid theoretically by annual subscriptions, eked out by casual subscriptions for temporary privileges, but usually they must be supplemented by a patron,— probably the "M. F. H.," who has inherited the dignity and its responsibilities from ancestors who founded the hunt. Anyone may join in the chase, and at Melton Mowbray and other famous "meets" large numbers of outsiders are often present. In these districts foxes are carefully preserved, and the abode and habits of each family of them are studied with reference to the autumnal and winter sport. At the appointed time the hunters, men and women, mounted and accompanied by a pack of from 25 to 40 hounds, are led by the huntsman toward the place where he expects to "find" a fox. There the dogs are loosed, and range about searching for the scent-traces in the air or on the ground left by the recent passage of the animal. When one finds a trail he gives tongue, the others come to his aid and the pack dash away following the scent. With a bugle-signal or cry of "Gone away!" the hunt follows as straight and fast as possible, keeping to roads, lanes, and gates where possible, but jumping fences and riding over grain-fields and meadows where needful, the hunt paying such damages as follow. This requires a horse of great speed and leaping power, and has developed the English thoroughbred hunter. When anyone catches sight of the fox he shouts "View! halloa!"; and the ambition of all riders is to keep close to the racing animals and be on the spot, or "in at the death," when the fox is seized. It is then the duty of the huntsman, or the nearest rider, to save the body of the fox from the dogs, cut off its "brush" (tail), "pads" (feet), and "mask" (head) to be given as trophies to the foremost riders. The remainder of the fox is cut up and given to the dogs on the spot. Instead of running "straight away" and leading a long chase the fox will often take refuge in a drain or other hole, unless it has been "stopped." This is called "going to earth," and he must then be ousted by the aid of a fox-terrier.

Fox-hunting has been carried wherever Englishmen have settled, but has found few parts of the world favorable to it. In some countries, as on the North American prairies, in California, and in the Argentine Republic, similar methods are adapted to the chase of other animals, as wolves or kangaroos. In the southern and eastern United States, however, where foxes abound, true fox-hunting has flourished ever since colonial days, when each man brought his own hound or hounds to the assembly; and

RED FOX

FOXES.

1. Cape Fox or Lalande's Dog. 2. Arctic Fox. 3. Side-striped Jackal or Quaha.
4. Silver Fox. 5. Corsac.

is still pursued by several established clubs in Virginia, Maryland, and southern Pennsylvania, where the nature of the country and the agricultural habits of the people favor it. These clubs employ a modified form of hound better adapted to the faster and rougher work required of it than would be the English breed. A special strain, the Magnes hound, has been fostered by the Maryland clubs, the foremost of which is the Elkridge. More nearly conforming to the English models is the establishment and hunting of the Meadowbrook Hunt, on Long Island, N. Y., where, in a level open country, largely occupied by extensive estates and within easy reach of New York, the sport has flourished since about 1876, and is likely to be long maintained.

An extensive and pleasing literature has grown up about this subject, and many thousands of titles would be required for its bibliography. A good general view may be obtained by reading the volumes devoted to the sport in the English 'Badminton Library' and in the American 'Sportsman's Library.'

Fox Indians (French name Renards, «foxes,» from their fox-totem; their own name Musquaki, «red-earthers»; Ojibwa name Outagami, «other-siders»), an Algonkian tribe originally on Lake Superior; driven by the Ojibwa and French south of the Wisconsin River, where their losses forced them about 1760 to unite with the Sacs or Sauks. Hence from early in our acquaintance with them the joint tribe has been known as «Sacs and Foxes,» and they have practically coalesced. They joined the British in the Revolution, and again in the War of 1812; their lands gradually taken away, they moved westward into Iowa, were involved in the Black Hawk war and gave up more land, finally gathered on the Des Moines, and in 1842 were removed to the Osage.

Fox Islands. See ALEUTIAN ISLANDS.

Fox River, a river of Wisconsin, called by the Indians Neenah. It rises in Marquette County, near the centre of the State, and after a course of about 200 miles passes through Lake Winnebago; it enters the head of Green Bay. A canal has been cut from Fox River to the Wisconsin, which is a navigable affluent of the Mississippi, and the channel of the river below Lake Winnebago has been cleared to admit steamboats from Lake Michigan and Green Bay. A grant of land was made by Congress to assist the work.

Fox Shark, or Sea-fox. See THRESHER.

Fox-snake, a large harmless snake (*Caluber vulpinus*) of the northern Mississippi valley, light brown in color, marked on the back with small chocolate spots bordered by black, and with a series of smaller spots along the sides and on the yellowish abdomen. It reaches a length of three feet, is irritable and pugnacious, and feeds upon small mammals, especially gophers, mice, and other pests of agriculture.

Fox-sparrow, a large American sparrow (*Passerella iliaca*), notable for its foxy red plumage, and gay song. It is a spring-and-fall migrant in the United States, breeding only north of the Saint Lawrence. See SPARROW.

Fox-squirrel, the largest of the true squirrels (*Sciuriss niger*). These rusty-coated squirrels are denizens of woods. They live in hollow trees or high among the branches, in nests of dry grass, and feed upon fruits, berries, mushrooms, and seeds of various trees. They have been hunted until they have become somewhat scarce in the woods north of Virginia; but southward, they are far more numerous. The flesh is esteemed as food — especially in Florida. Though safe from the depredations of preying birds, because of their size and strength, fox-squirrels are attacked by the foxes and wildcats, which kill and eat them.

Fox-terrier, a small terrier dog modified from the old-fashioned English white terrier of uncertain origin. It has a dense smooth coat white, with black or black-and-tan markings; and a small black nose; and it generally weighs between 15 and 20 pounds, when in good condition. The fox-terrier has a narrow, tapering face, and small, deep-set eyes, usually gentle, but capable of an expression of keen animation; the jaws are strong and well-shaped; and the V-shaped ears droop forward close to the cheek. The compact little body is set on straight, supple legs, and the tail, usually docked, is carried in a rather jaunty fashion. The dog's appearance is one of alertness; and, though originally bred to run the fox to earth, fox-terriers have, latterly, become popular not only as vermin-destroyers about stables, but as house-dogs,— their cleanly, sprightly, and affectionate ways rendering them extremely amiable and entertaining as companions. One variety, the «wire-haired,» has a rather long coat, of rather shaggy appearance. In all other points this is like the smooth-coated variety. See DOG.

Foxe, John, English martyrologist: b. Boston, Lincolnshire, 1516; d. London April 1587. In 1543 he was elected a fellow of Magdalen College, Oxford. Applying himself to theology with great assiduity, he secretly became a convert to the principles of the Reformation. This tendency being suspected, a charge of heresy followed, and by the judgment of his college he was, in 1545, expelled. In the reign of Mary he went abroad, and gained a livelihood by correcting the press for an eminent printer at Basel, where he laid the first plan of his 'Acts and Monuments of the Church.' On the accession of Elizabeth he returned to his native country, and was received in the most friendly manner by his former pupil, the Duke of Norfolk, who maintained him as long as he lived, and settled a pension on him at his death. Cecil also obtained for him a prebend in the Church of Salisbury. His principal work is the 'History of the Acts and Monuments of the Church' commonly called 'Foxe's Book of Martyrs,' first printed in 1563, in 1 volume folio: reprinted in 1632 and 1641 in 3 volumes folio. In 1684 it had reached the ninth edition.

Foxglove. See DIGITALIS.

Foy, fwä, **Maximilien Sebastien,** French military officer: b. Ham, France, 3 Feb. 1775; d. Paris 28 Nov. 1825. He entered the army at 15, and made his first campaign under Dumouriez in 1792. He received his 15th wound on the field of Waterloo, but refused to quit his post till the close of that engagement. He was afterward employed as inspector-general of infantry; and in 1819 was elected a member of the Chamber of Deputies, where he distinguished himself as an orator, and was a great public favorite.

Fra Angelico, än-gĕl'ē-kō, the common appellation of Fra Giovanni da Fiesole, one of the most celebrated of the early Italian painters: b. Vecchio, 1387; d. Rome, 18 March 1455. He entered the Dominican order in 1407, and was employed by Cosmo de Medici in painting the monastery of St. Mark and the Church of St. Annunziata with frescoes. These gained him so much celebrity that Nicholas V. invited him to Rome to ornament his private chapel in the Vatican, and offered him the archbishopric of Florence, which was declined. His works were considered unrivaled in finish and in sweetness and harmony of color, and were made the models for religious painters of his own and succeeding generations. See Cartwright, 'The Painters of Florence' (1901).

Fra Diavolo, frä dē-ä'vō-lō, real name **Michele Pezza**, Neapolitan brigand: b. Itri, Calabria, 1760: d. 1806. He became a monk, but was expelled on account of misconduct. He then became leader of a troop of brigands. The government set a price upon his head; but when Cardinal Ruffo undertook to compel the French to evacuate Naples, Fra Diavolo was pardoned, was employed by the cardinal, and received a colonel's commission. At the head of his band he harassed the French, took refuge in Calabria after the conquest of Naples by Bonaparte, and incited the people against the French. He fell into their hands at San Severino in 1806, and was executed.

Fracastorio, Girolamo, jē-rō'lä-mō frä-käs-tō'rē-ō, Italian poet and physician: b. Verona 1483; d. Tacassi 6 Aug. 1553. He was patronized by Cardinal Bembo, to whom he addressed the most celebrated of his works, a Latin poem entitled 'Syphilis.' In the latter part of his life he wrote a poem on the adventures of the patriarch Joseph, but his poetic fire seems then to have been exhausted, and the virtues of the hero were less happily celebrated than the horrors of the disease. Among the moderns who have exercised their talents in the composition of Latin verse, few have obtained higher reputation than Fracastorio.

Frackleton, Susan Stuart Goodrich, American artist: b. Milwaukee, Wis., 5 June 1848. She received a private education, and became prominent as a ceramic artist. She has won many prizes in American, European, Canadian, and Mexican competition; invented a gas-kiln for firing decorated china and glass; and was the founder and first president of the National League of Mineral Painters. In 1901 she received a medal at the Paris Exposition for her exhibit of pottery. She published 'Tried by Fire,' a work on china decoration (1885).

Fraction, a part of any integer (whole number), or unit. For example, "two and a fraction" means two units and that part of a unit which can be distinguished, as one half, two fifths, and so on. In the fraction $\frac{1}{3}$ in arithmetic, or $\frac{a}{b}$ in algebra, the figure 1, or a, is the numerator, and 3, or b, is the denominator; and they represent that, if a whole number is divided into three or b parts, only one or a parts are taken. In the addition of fractions, the fractions must be brought down to the same denominator, and their numerators (as expressed in the value of their new denominator) must then be added, when we have one whole fraction. Thus, if we want to add $\frac{1}{3}$ and $\frac{2}{5}$, we must find the least common multiple of 3 and 5, which is found to be 15; then, as 3 goes 5 times into 15, and 5 goes 3 times into the same number, we multiply the numerators of the different fractions by these respective quotients, and then add the two quantities together. Thus, $\frac{1}{3}$ added to $\frac{2}{5}$ will be equal to $\frac{5}{15}+\frac{6}{15}=\frac{11}{15}$. The true definition of a fraction may be thus summed up: It is the division of its numerator by its denominator; as seven eights are equivalent to the whole number 7 divided by 8 — whence a fraction is obtained. Decimal fractions simplify calculations greatly, as they are constructed on the principle of having one common denominator — a multiple of 10; and thus fractions can be added, subtracted, and divided without repeating over and over the tedious process of bringing them down to a common denominator. See ARITHMETIC; DECIMALS.

Fracture, a break or solution of continuity in a bone, caused by sudden application of violence from without or by sudden muscular strains. Bone diseases and the changes in bone incident to old age predispose to breaks. Compound fractures are those in which a wound allows a communication between the injured bone and the body surface. A fracture is said to be multiple when there is more than one line of cleavage; when the lines of cleavage are joined, the fracture is spoken of as comminuted. Pain in the affected part and more or less loss of function are usually present. Examination reveals a deformity either as a swelling or a deviation from the normal line of the part; palpation elicits exquisite tenderness on direct pressure at the point of injury and on moving the fragments; the bony irregularity may be felt beneath the skin; frequently an abnormal point of mobility may be discovered; crepitus is present as a peculiar grating sensation transmitted to the examining fingers if the ends of the bone can be rubbed together.

Repair of the injury takes place through certain blood-cells organizing the clot of blood and forming a fibrous callus. Later this callus is absorbed and a bony callus formed, the lime-salts being laid down in orderly arrangement by special cells. Nature is assisted in this process by fixation of the fragments in their normal position. This reduction of the deformity requires surgical skill, and all unnecessary manipulation of a bone supposed to be fractured should be avoided. Where removal of the injured from the scene of the accident is necessary, further damage may be prevented by the careful restriction of motion of the part. This can be done by the application of splints or by otherwise securing the part.

Compound fractures are serious because of the great possibility of infection gaining access to the injured bone, with resulting inflammation and necrosis. Measures of fixation are modified to allow of careful aseptic wound-dressing.

The diagnosis of fracture is frequently a matter of great difficulty, so closely may it resemble in its signs a bruise or dislocation. The X-rays render great service in differentiation and study of the kind of break.

Pott's fracture is the name given to a fracture of the lower extremity of the leg-bones, usually accompanied by a turning out of the foot. The ankle-joint is commonly injured and the ligaments ruptured so that more or less permanent disability is usual. Colles' fracture is a break of the lower end of the radius, having generally a characteristic deformity. The upper fragment is jammed down toward the rest and overrides the lower fragment, which is pushed forward. Falls upon the open hand are often apt to cause this injury. Fractures of the patella or kneepan are difficult to treat, owing to the constant pull of the strong muscles on the upper fragment. Entire apposition of the fragments and bony union is rarely possible unless wiring is resorted to. This injury is frequently a result of sudden muscular strain. The upper end of the femur or thigh-bone is frequently fractured in the aged. When the patient is old or feeble the long-continued rest in the recumbent position which is necessary to proper union so lowers the vitality that deformity is frequently accepted through fear of a fatal termination.

Fractures of the skull-bones present some unique features because of the peculiar structure of the bones in two tables, the globe-like arrangement of the skull as a whole, and of the juxtaposition of the easily injured brain. Lines of fracture may travel far from the actual point of injury, and a breaking force may travel to an opposite pole of the skull. The ordinary signs of fracture are absent except the deformity which usually is found as a crack or depression. The element of depression of the fragments is of the greatest importance, usually necessitating the operation of trephining for the relief of cerebral pressure. This operation consists in the removal of the fragments or of the indented area. Hemorrhage from a fracture may cause pressure and necessitate similar relief. Fatal termination is common, particularly where the inaccessible base of the skull is involved.

Fra'denburgh, J. N., American Methodist clergyman: b. Gouverneur, N. Y., 4 March 1843. He was graduated from Genesee College, was professor of mathematics in the Genesee Wesleyan Seminary (1868–9), of ancient languages in the Fredonia Normal School (1869–73), and principal of the Mansfield (Pa.) Normal School (1873–5). After pastorates at Cleveland, Ohio, and elsewhere, he was settled in 1896 at Clarion, Pa. He has published: 'Witnesses from the Dust' (1885); 'Beauty Crowned' (1887); 'Living Religions' (1888); 'Departed Gods' (1891); 'Fire from Strange Altars' (1891); 'Light from Egypt' (1897); 'Life's Springtime' (1900).

Framingham, Mass., a town in Middlesex County, on the Sudbury River, and on the New York, N. H. & H., and the Boston & A. R.R.'s; about 20 miles west of Boston. It comprises the villages of Framingham, South Framingham, and Saxonville. It has a large industry in woolen goods, and an assessed property valuation of nearly $9,000,000. Pop. (1900) 11,302.

Franc, a French silver coin, containing 10 décimes and 100 centimes. Value in American money 20 cents.

Français, François Louis, frän-swä loo-ē frän-sā, French painter: b. Plombières, department of Vosges, 17 Nov. 1814; d. 1897. He was a pupil of Corot and Gigoux at the Beaux Arts, first exhibited at the Salon in 1837, obtained a medal of the first class at the Salon of 1848, and was admitted a member of the Institute in 1890. He became best known as a landscapist, particularly for his views of the Paris environs and glimpses of the Seine. His finest work, 'Daphnis and Chloë,' is in the Luxembourg, together with three other canvases, 'Evening,' 'Orpheus,' and 'The End of Winter.' His style is peculiarly individual in its combination of realism and idealism.

France, fräns, **Anatole.** See THIBAULT, JACQUES ANATOLE.

France, Joseph, French publicist: b. Lorraine 1787; d. 1869. Having entered the French army in 1815, he had become a colonel in 1834, and in 1836–46 was commander of military police in the island of Martinique, West Indies. The publication of his 'La vérité et des faits' (1841), a work descriptive of the ill-treatment of negro slaves in the island, caused his removal from his post and trial for sedition. He was deprived of his commission, but subsequent to the abolition of slavery in the French colonies (1848) was elected from Martinique to the Constituent Assembly, and from 1852 was a member of the council of the island. His publications include: 'Les corsaires français dans les Antilles' (1857); 'Questions coloniales' (1860); 'Statistique de la Martinique' (1861).

France, fräns, **Lewis Browne,** American author: b. Washington, D. C., 8 Aug. 1833; d. Denver, Col., 8 June 1907. He was educated at Georgetown College, and entered the practice of law in Colorado, of whose supreme court reports he edited volumes III.-XI. He wrote: 'Rod and Line' (1884); 'Mountain Trails and Parks in Colorado' (1886); 'Over the Old Trail' (1894); 'Pine Valley' (1897).

France, in ancient times called Gallia, a maritime country in the west of Europe, since 1870 the largest and most prominent republic in Europe, and the second largest in the world. France is situated between lat. 42° 20' and 51° 5' N.; and lon. 4° 50' W. and 7° 40' E., and is bounded north by the German Ocean and the Straits of Dover; northwest by the English Channel; west by the Atlantic, more especially that part of it called the Bay of Biscay; south by Spain and the Mediterranean Sea; east by Italy, Switzerland, and the German territory of Alsace; northeast by German Lorraine, Luxembourg, and Belgium. The longest lines which can be drawn across France are two diagonals, which intersect each other — the one from the southeast to the northwest extremities, 670 miles, and the other, from the southwest to the northeast extremities, 555 miles. Measured on the meridian of Dunkirk, the greatest length is 600 miles, and measured on the parallel of 48° 20', the greatest breadth is 547 miles. The breadth near the centre is 400 miles, and along the parallel of 46° 15', where it is narrowest, does not exceed 340 miles. The total area of France is 207,054 square miles.

Topography.— While protected by great natural barriers at most parts where it is connected with the continent, a long line of coast on the west and northwest gives it immediate access to the great ocean thoroughfare, while on the south its harbors in the Mediterranean secure to it a large share in the traffic of that most important of all inland seas. France is traversed from southwest to northeast by several chains of mountains forming the general water-shed of the country. This water shed has two slopes, the one toward the west and north, carrying its waters to the Bay of Biscay, the Atlantic Ocean, the English Channel, and the German Ocean; the other toward the east and south, carrying its waters to the Mediterranean. The ranges of mountains and hills forming this water shed include the western and central Pyrenees, the western Corbières in the department of Aude, the Cevennes, the mountains of Vivarais, Lyonnais, Beaujolais, and Charollais, the Côte d'Or, the Plateau de Langres, the Faucilles Mountains, and the Vosges. This general water shed is met toward the northeast by the eastern mountain ranges of France, namely, the Jura range and various Alpine ranges, one of the peaks of which is Mont Blanc, which may be regarded as the culminating point of the European mountains, although not absolutely the highest mountain in Europe. Near the centre of France, and separate from the great water shed of the country, are several groups of volcanic mountains known by the general name of the Mountains of Auvergne, the chief peaks of which are the Plomb du Cantal in the southernmost group, the Puy de Sancy in the central group, and the Puy de Dôme in the northernmost group. The spurs thrown off by the great water shed divide France into six principal basins, five of which are on the northwestern slope, and one on the southeastern.

Rivers and Lakes.— The great rivers of France are the Seine, Garonne, Loire, Charente, Adour, Meuse, and the Rhône. In the basin of the Garonne are its affluents, the Ariège, Tarn, Lot, and Dordogne on the right bank, and the Gers on the left bank. To the north of the basin of the Garonne is that of the Loire and its tributaries, the Nièvre and the Maine on the right bank, and the Allier, Loiret, Cher, Indre, Vienne, and Sèvre Nantaise on the left. To this basin also belong the secondary basins of the Vilaine and the Blavet. In the basin of the Seine are its tributaries, the Aude, Marne, and Oise on the right bank, and the Yonne, Loing, Eure, and Rille on the left bank. The secondary basins are that of the Somme in the north, and those of the Orne and Oise in the south. In the basin of the Meuse are its tributaries, the Sambre on its left bank, to which is added the secondary basin of the Escaut or Schelde. The basin of the Rhône occupies the whole of the territory of France which lies to the southeast of the great water-shed. The tributaries of the Rhône are the Ain, the Saône, the Ardèche, and the Gard upon the right bank, and the Isère, Drôme, and Durance on the left. The secondary basins are those of the Var, Argens, and Arc on the east, and those of the Tet, Aude, and Hérault on the west. France has in all more than 212 navigable streams, with a total navigation of 5,700 miles. The lakes are few in number, and individually limited in extent. The largest, Grand-Lieu, in the department of Loire-Inférieure, covers an area of only 27 square miles, and is altogether devoid of interest. The next largest, St. Point, in the Jura, does not cover three square miles. Others of still less dimensions become more interesting from their localities in the lofty regions of the Pyrenees, or in the deep hollows of ancient craters in Auvergne.

Geology.— France possesses all the geological formations in a greater or less degree of development. The mountains generally have a nucleus of granite, which accordingly forms a prevailing rock in the Alps, on the east frontier, and their branches south to the shores of the Mediterranean, in the Pyrenees, the Cevennes, and the elevated plateau of Langres. In the Vosges it is more sparingly developed, its place being often occupied by porphyry; and in the Jura, where limestone occurs in such enormous masses as to have given its name to a peculiar formation. The other crystalline rocks, consisting chiefly of trachytes and basalts, have received a magnificent development in Auvergne, where whole mountains are composed of them, and where the effects of remote volcanic agency are still presented to the eye in extinct craters and lava streams. The granite is overlaid by primitive stratified rocks of gneiss, and of micaceous and argillaceous slates, succeeded, particularly in the Pyrenees, by mountain limestone. The secondary formation, commencing with this limestone and continued in ascending series up to the chalk, always possesses peculiar interest, because within it valuable mines of lead and iron, and all the workable seams of coal, are included. It is largely developed in many parts of France, and furnishes a considerable number of coal and mineral fields. The Tertiary formation, including all the limestones, sands, and clays, above the chalk, occurs continuously in two great divisions, and partially in a number of isolated spots, and covers a vast extent of surface. The larger continuous division is in the southwest, where it commences at the foot of the Pyrenees, and occupies a very large portion of the basins of the Garonne and of the Adour. The lesser but better known division takes the name of the Paris basin, and has been made familiar to the scientific world by the labors of Cuvier and other distinguished naturalists.

Climate.— The climate of France is greatly diversified, and cannot be described accurately without dividing it into different regions. With a very limited exception, it lies wholly within the more moderate portion of the temperate zone. France may be divided into four climatic regions according to the different vegetable products which different districts are able to mature. Within the first, and warmest, the olive is successfully cultivated. It forms the southeast part of France, and is chiefly confined to the departments which border on the Mediterranean. The second region is characterized by the general cultivation of maize or Indian corn. The third region reaches north to the extreme limit of the profitable culture of the vine, and may be considered as determined by a line stretching between the mouth of the Loire and the town of Mézières, in the department of Ardennes. All the country beyond this line is included in the fourth region. In the northwest the prevalence of winds from that direction often produces a superfluity of moisture, which manifests itself in mists or in frequent and heavy showers of rain. At the opposite extremity, the southeast, a contrary effect is produced, and a sultry, stifling wind wrinkles up


FRANCE
SCALE OF MILES
Population of places is indicated
by different lettering, thus
500,000 and over PARIS
200,000 to 500,000 Lyons
50,000 to 200,000 Toulon
Smaller Places
Railroads
Canals
PARIS AND VICINITY
ATLANTIC OCEAN
ENGLISH CHANNEL
BAY OF BISCAY
GULF OF LIONS
MEDITERRANEAN SEA
LIGURIAN SEA
GULF OF GENOA
ENGLAND
BELGIUM
GERMAN EMPIRE
SWITZERLAND
AUSTRIA-HUNGARY
ITALY
SPAIN
CORSICA
Paris
Lyons
Marseilles
Bordeaux
Toulouse
Nantes
Rouen
Havre
Lille
Brest
Nice
Toulon
Strassburg
Brussels
Geneva
Turin
Milan
Genoa
Longitude West from Greenwich
Longitude East from Greenwich

the skin, and not unfrequently spreads fever in its most malignant form. But it is only to a few exceptional districts that these remarks apply. After allowing for them, more than four fifths of the surface remains, under an atmosphere remarkable, more especially in its central districts, for salubrity, serenity, and brightness.

Political Divisions.— Before the revolution of 1789 France was divided into general governments, the number of which has varied at different epochs. Under Francis I., by whom they were instituted, there were 9. Under Henry III. there were 12. Under Louis XIV. the number was fixed at 32, to which a 33d was added by the acquisition of Corsica, under Louis XV. In 1789, when the love of change became paramount, the provinces were not permitted to escape; and it was then determined that the whole of France, including the island of Corsica, should be parceled out into departments, and each department subdivided successively into arrondissements, cantons, and communes, an arrangement which was actually carried out in 1790. This division has since maintained its ground, each department being named after the most important physical feature which it contains. The number of departments was originally 83, but it has been at different times increased and decreased. There are now 87 departments, the last formed being Haut-Rhin (Belfort). As the old provinces, though no longer recognized in legal and other formal documents, continue so familiar to the French themselves, and are so frequently mentioned, not only by earlier writers, but in the geographical, historical, and statistical works of the present day, a table is here given exhibiting these provinces in alphabetical order, and in parallel columns, the chief town in each, and the departments most nearly corresponding to them:

Provinces	Departments	Capitals of Provinces
Alsace	(Now German, except Belfort, or dep. Haut-Rhin)	Strasbourg (German)
Anjou	Maine-et-Loire	Angers
Artois	Inland or southeastern portion of Pas-de-Calais	Arras
Aunis	Maritime part of Charente-Inférieure	LaRochelle
Auvergne	Puy-de-Dôme and Cantal	Clermont
Béarn-et-Navarre	Basses-Pyrénées	Pau
Berry	Cher, Indre	Bourges
Bourbonnais	Allier	Moulins
Bourgogne	Ain, Côte-d'Or, Saône-et-Loire, Yonne	Dijon
Bretagne	Côtes-du-Nord, Finistère, Ille-et-Vilaine, Loire-Inférieure, Morbihan	Rennes
Champagne	Ardennes, Aube, Marne, Haute-Marne	Troyes
Corsica	Corse	Ajaccio
Dauphiné	Hautes-Alpes, Drôme, Isère	Grenoble
Flandre	Nord	Lille
Foix	Ariège	Foix
Franche Comté	Doubs, Jura, Haute-Saône	Besançon
Gascogne-et-Guyenne	Aveyron, Dordogne, Gers, Gironde, Lot, Lot-et-Garonne, Landes, Hautes-Pyrénées, Tarn-et-Garonne	Bordeaux
Ile de France	Oise, Seine, Seine-et-Oise, Seine-et-Marne, southern part of Aisne	Paris
Languedoc	Ardèche, Aude, Gard, Hérault, Haute-Garonne, Haute-Loire, Lozère, Tarn	Toulouse
Limousin	Corrèze, Haute-Vienne	Limoges
Lorraine	Meuse, Vosges, Meurthe-et-Moselle (and German Lorraine)	Nancy
Lyonnais	Loire, Rhône	Lyon
Maine	Mayenne, Sarthe	Le Mans
Marche	Creuse	Guéret
Nivernais	Nièvre	Nevers
Normandie	Calvados, Eure, Manche, Orne, Seine-Inférieure	Rouen
Orléanais	Eure-et-Loire, Loiret, Loir-et-Cher	Orléans
Picardie	Somme, maritime part of Pas-de-Calais, N. part of Aisne	Amiens
Poitou	Deux-Sèvres, Vendée, Vienne	Poitiers
Provence	Basses-Alpes, Bouches-du-Rhône, Var, eastern part of Vaucluse	Aix
Roussillon	Pyrénées-Orientales	Perpignan
Saintonge and Angoumois	Charente and eastern or inland part of Charente-Inf.	Angoulême
Touraine	Indre-et-Loire	Tours

The following territories have been acquired since 1790:

Territories	Departments
Avignon and Venaissin (including Orange previously acquired)	Part of Vaucluse
Nice	Alpes-Maritimes
Savoie	Savoie, Haute-Savoie

Agriculture.— About nine tenths of the soil of France is productive, and about one half of the whole French territory is under the plough. In regard to the management of arable land, the French are still far behind the English, but have nevertheless made great advances during the 19th century. During the last 50 years the production of cereals in France has increased by nearly 70 per cent, while the extent of land under cereals increased by only one quarter. This is equivalent to saying that the productiveness of the soil has increased in that time by fully one third. The cereals forming the great bulk of the cultivated crops are wheat, oats, rye, and barley. The crops next in importance to these are meslin or mixed corn, potatoes, hemp, rape, maize, buckwheat, flax, and beet. This last plant is cultivated extensively in some departments, especially in that of Nord, for the manufacture of sugar. The most valuable crops of which the cultivation on a great scale is not general, but confined to particular districts, are madder, tobacco, saffron, and hops. The cultivation of tobacco is monopolized by the government, and is confined to certain departments. It yields an annual gross revenue to the government of about $75,000,000, but from this total there falls to be deducted the expense incurred in the cultivation and manufacture of the tobacco. In France the grass is on a much more limited scale than the arable husbandry, the land in permanent meadow being in extent only one sixth of that under the plough. The breeding of stock, notwithstanding the stimulus afforded by the establishment of numerous societies, general and local, for its encouragement, is, in France, if not imperfectly understood, very indifferently practised. The races of oxen, instead of being confined to a few of the more perfect types, are almost as various as the different districts into which the country is divided, and include a few good breeds, particularly in the rich plains of Lower Normandy. The rearing of sheep is more successful, and much wool, scarcely inferior to that of the merino, is raised. The general employment of cattle for agricultural purposes gives little encouragement to the rearing of draft horses; but the warlike propensities of the nation have always created an extensive demand for horses. Asses and mules, generally of a superior description, are much used in France. The cultivation of the vine is one of the most important branches of French agriculture. The total quantity of land in vineyards is nearly a twenty-fifth of the whole surface; but as there are extensive and continuous districts where there are no vineyards, the proportion which vine-land on the districts properly adapted to it bears to the whole land under cultivation, attains a much higher ratio. The various first-class wines, under the name of Champagne, Burgundy, Bordeaux, etc., are in high repute and general demand over all Europe. In 1901 France produced 1,784,854,500 gallons of wine. A large part of the wealth of France consists in its fruits. Among the most important fruit-trees are the apple, the fruit of which, in the northern districts, particularly in Normandy, is largely used for the manufacture of cider; the chestnut, which, in barren districts yields an article of food which takes the place of the cereals among the poorer classes; the mulberry-tree, cultivated in 8 or 10 departments in the southeast, both for its fruit and its leaves, the leaves being used as food for the silkworms, on which the French silk manufacture depends; the olive, which grows in the same districts as the mulberry; the pear, plum, cherry, apricot, peach, orange, citron, fig, almond, etc. The forests of France occupy about one seventh part of the whole territory. Their principal localities are the Ardennes, Vosges, and Plateau de Langres, in the northeast; the Jura in the east; and the mountains of Auvergne in the centre. The chief constituents of French forests are the oak, the elm, the pine, the fir, the larch, the birch, the beech.

Mineral Resources.— The coal-fields of France are so numerous that coal-pits exist in no fewer than 33 departments; but most of these are very limited in extent. Several of the smaller fields occur in the northwest, and also in the south, where both anthracite and lignite are found; but the fields whose importance entitle them to particular notice are only two — that of Valenciennes in the northeast, forming the western extremity of the great Belgian coal-field, and that of St. Etienne, to which the manufactures of that town, Lyons, and the surrounding districts, are indebted for much of their prosperity. The annual output is over 30,000,000 tons, but falls so far short of the annual consumption that a large import takes place from England and Belgium, and wood continues to be the common fuel throughout France, at least for domestic purposes. The coal-fields contain seams of iron, which are extensively worked, and furnish ore to a great number of blast-furnaces. Though the number of mines actually worked is great, the quantity of foundry pig annually produced is only about 2,500,000 tons. Few countries have been said to be so rich in lead as France. It occurs in greater or less quantity in a great number of districts, and is generally argentiferous. Manganese is very widely diffused, but is worked only in a few mines. Gold exists both in the sands of rivers and *in situ* in thin streaks embedded in quartz. Attempts have been made to work it, but not with success. A vein of quicksilver was opened about the middle of the 18th century, and was worked successfully for 12 years, and then abandoned. Zinc, copper, arsenic, nickel, and cobalt exist, but not in such quantities as to be workable to profit. The principal saline substances are alum and common salt. The great sources from which salt is derived are the lagoons and salt marshes which line many parts of the coast. Of these the produce is about 300,000 tons. A large revenue is also derived from quarries, and beds of common clay, potter's earth, and kaolin.

For information concerning History, Government, Socialism, Education, Religion, Language and Literature, Art, Music, Drama, Army and Navy, Railways, Industries, Commercial and Banking System, Colonies, see the following special articles.

France — History from the Revolution to the Establishment of the Empire, 1796–1804. This period is one of the most important in French history, and from beginning to end its events centre about one man — Napoleon Bonaparte. From the outset Napoleon was hampered by popular unrest, for the people had only recently emerged from a bloody revolution and were clamoring for they knew not what; petty jealousies, conspiracies, plots and counter-plots dominated politics; suspicion and distrust of everybody and everything pervaded the atmosphere; the finances were in a disgraceful condition; commerce and industry were in a state of stagnation; the laws were unsatisfactory and, poor as they were, remained unenforced; the army was ill-fed, poorly paid, and lacked a controlling hand; and relations with foreign nations were strained to such an extent that war threatened on every side. The first significant step in his path toward power was the placing of the armies of France under Napoleon's command and at his disposal. Thus the opportunity was within his grasp and the means provided whereby he could carry out his personal ambitions and at the same time promote the progress and welfare of the entire nation. Whether or not his love for the country or his commiseration for the pathetic state in which he found her were secondary in his mind to his personal aggrandizement matters little; it is certain that from that time the destiny of France was indissolubly linked with his rise or fall; upon his success or failure depended the continuance of the French entity; from that time his master mind and subtle genius and mighty hand were the most potent factors in raising France from the pit of anarchy and degradation to the heights of pride as the most powerful nation of the world; from that time his history was French history — Napoleon was France.

In order to understand the conditions existing at this time and to follow the steps by which Napoleon attained his remarkable position, we must go back into the reign of Louis XVI. and study the events which resulted in the Reign of Terror, the Revolution, and the establishment of democracy.

Louis XVI., son of the Dauphin and grandson of Louis XV., ascended the throne on the death of the latter, 10 May 1774. Hardly had he been crowned when war broke out with England, in consequence of the support afforded by France to the revolted American colonies of Great Britain. A treaty of commerce and alliance with the United States was signed 6 Feb.

1778, and was followed by an immediate declaration of war by England. The war was successful in its immediate object, and was terminated by the Treaty of Versailles, 3 Sept. 1783. Three years afterward a commercial treaty was concluded with England. The first difficulty of Louis' government, however, and the rock upon which it split was the hopeless and unmanageable condition of the public finances. Maurepas, Turgot, Malesherbes, Clugny de Nuis, Necker, Joly de Fleury, d'Ormesson, Charles-Alexandre de Calonne, Loménie de Brienne and others signally failed to ward off impending disaster and resigned or were dismissed, and finally the King was forced to convoke the States-General at Versailles 5 May 1789. Owing to disputes between the three parties represented — the nobility, the clergy, and the Third Estate — the attempt to solve the difficulties was abortive. The King assumed a hostile attitude and committed several acts which angered the public, the chief of which was the dismissal of Necker who a second time had been called to the financial portfolio, and in June 1789 it became necessary to bring foreign troops to Paris to overawe the assembly. The people demanded arms and the Hotel de Ville at Paris supplied them; blood was shed there on 12 July; and on the 14th the Bastile was captured and destroyed. The *garde bourgeoise*, formed by the municipality, was now transformed into the national guard with Lafayette as commander. The spirit of insurrection in the meantime had, since the beginning of 1789, been spreading in the provinces, sections of the country were swept by a panic called the "Great Fear," and the urgency of affairs induced the assembly, on 4 August, to take a decisive step. On the basis of a future compensation all privileges were abolished. A banquet given to the foreign troops at Versailles at a time when the populace was threatened with famine excited another insurrection. Versailles was attacked by the mob, and the King brought a prisoner to Paris (5 and 6 Oct. 1789).

In December 1790, the King began to correspond secretly with foreign powers, and a secret convention had been made with Austria, Prussia, Piedmont, Spain, and Switzerland, to advance their troops to the frontiers with a view to a simultaneous occupation of the territory. Louis then made his escape from Paris (20 June 1791), and endeavored to reach Montmédy; but he was recognized on the road, arrested at Varennes, and brought back to Paris escorted by the commissaries of the assembly. A demonstration in the Champ de Mars, in favor of his deposition (17 July), was put down by force by Lafayette and Bailly, under order of the assembly.

On 30 Sept. 1791, the assembly brought its work to a finish, after having redeemed its oath of 20 June. The constitution was sworn to by the King on 14 September, after which he was reinstated in his functions. The constitution embraced all those civil reforms which, afterward incorporated in the code of Napoleon, survived the political changes of the Revolution. It deprived the King of arbitrary powers, and voted him a civil list; it provided liberty of worship, freedom of the press, of commerce, of industry; the laws of primogeniture and entail were abolished, and equal division of property among children made compulsory; confiscation of property for offences was abolished, and personal punishment substituted; titles were abolished; the clergy were reduced to public functionaries, salaried by the state; the territory of France was declared free through all its extent, and a redivision of it was effected (15 Jan. 1790) into 83 departments. This division afterward proved an admirable instrument of centralization, and in repeated emergencies enabled Napoleon at once to lay his hand with ease upon all the military resources of France. One of the measures already mentioned in particular demands further details, as it was the means of meeting the financial difficulty, and at the same time of arming the enemies of the Revolution, at whose expense it was effected. On 2 Dec. 1789, the domains of the church were, in the euphemism of the assembly, put at the disposition of the nation. The minister was authorized to sell these estates to the extent of 400,000,000 livres. Until the sale was effected he was authorized on the security of these national domains to issue a paper money having a forced circulation and a preference in the purchase of them. In 1792 the estates of the emigrants were confiscated in like manner. Thus was created that seemingly inexhaustible treasury of assignats which brought France so speedily into a financial anarchy worse than any she had yet experienced. Among other reforms was the reorganization of the administration of justice. The parliaments were dissolved by indefinite prorogation, and judicial functions were separated from the administrative, district courts were created and judges appointed for 10 years. The assembly closed with an attempt to recall the émigrés, and it prohibited the reelection of its members. Mirabeau, the greatest orator of the assembly, and one of the boldest leaders of the Revolution, had died prematurely 2 April 1791, from the excesses of his life. The constituent assembly was, according to the constitution, immediately followed by the legislative assembly, which began its sittings on 1 October, but before the period assigned by the constitution it gave place to the convention. In the legislative assembly there were two parties of political importance, the Girondists, who led it, and the Montagnards, who subsequently became all-powerful in the convention. The royalists were already powerless. The assembly was compelled at once to take a decisive course. By the declaration of Pilnitz the Emperor of Germany and the King of Prussia threatened an armed intervention to restore Louis to his rights. The King was compelled in March to accept a Girondist ministry, and on 20 April 1792, war was declared against the empire. The first attempts to assume the offensive were unsuccessful, and the French armies were not even able to prevent the enemy from invading home territory. To make matters worse the King maintained a treasonable correspondence with the allies and refused to sanction the decrees of the assembly. Paris grew restless as the enemy advanced; unscrupulous politicians urged the mobs to violence and on 20 June, the people invaded the assembly and the Tuileries, and summoned the King to sign the decrees. He refused, but satisfied them for the moment by allowing himself to be crowned with a red bonnet. On 26 July the Duke of Brunswick issued his celebrated and impolitic manifesto, threatening, if the King were insulted, to deliver Paris to a military execution. The sections of Paris retorted by signing a petition demanding the deposition of the King before the close of the day (9 August). At midnight the tocsin sounded. The Tuileries, after a sanguinary combat, were taken and sacked. The King took refuge with his family in the assembly, which was invaded and compelled to submit to the dictation of the victors by assenting to the suspension of the King and the convocation of a national convention. The convention was an extraordinary assembly, summoned for an emergency, and thus recognized the fact that France was again without a constitution. The war now assumed a more favorable aspect. The victory of Valmy, 20 Sept. 1792, caused the Germans to fall back discomfited; the siege of Thionville was abandoned; and France was freed of her invaders. Savoy, Nice, and Villafranca were seized and occupied by the French; the army of Alsace under Custine took Speier (30 Sept. 1792), Worms (5 October), and Mainz (21 October); Frankfort capitulated to Houchard; and the victory of Dumouriez over the Austrians at Jemappes, 6 Nov. 1792, led to the occupation of Belgium.

The first act of the new assembly, 21 Sept. 1792, was to proclaim the republic. Thus the Year I of the republic began. On 3 December the King was cited to appear before the assembly. On 20 Jan. 1793, he was, by four successive votes, sentenced to death within 24 hours, and on the 21st the sentence was executed. This violent inauguration of the republic shocked public opinion throughout Europe, and armed the neutral states against France. England, Holland, Spain, and the empire joined the coalition. A levy of 300,000 men was ordered. It was necessary to send some of these new levies to suppress the Chouan insurrection in Mainz, Anjou, and Brittany. Nearly all the officers of rank had emigrated, and Dumouriez feeling that hostility was rising against him in Paris resolved to regain his prestige by a bold stroke — the conquest of Holland. He was defeated in the attempt, however, by the Prince of Coburg who administered a crushing defeat at Neerwinden, 18 March 1793. Dumouriez then secretly agreed to evacuate Belgium and turning against the convention deserted to the allies on 4 April. Mainz was also lost by Custine. At home the army lost confidence in its heads and became disorganized. Mutual suspicion and distrust reigned in the convention itself. The convention took measures suited to the gloomy aspect of affairs. A revolutionary tribunal was appointed to try offences against the state, a committee of public safety, with sovereign authority, was appointed (6 April), and the convention renounced the inviolability of its members. The period thus inaugurated is known in history as the Reign of Terror. The struggle between the Girondists and the Montagnards became violent. The latter, defeated in the convention, armed the sections of Paris. The convention, under pressure, ordered the arrest of 31 Girondists (2 June). Some of them escaped and excited insurrection in the provinces. A new constitution was adopted by the convention 23 June, called the Constitution of the Year I, the Republican Calendar being adopted on 5 Oct. 1793. The energy of the dominant party had risen to the danger, but it was accompanied by a ferocity without example. The revolutionary tribunal had already filled the prisons with victims. On 10 Oct. 1793 the constitution was suspended and the government declared revolutionary, a term which included unlimited power. Both in Paris and the provinces executions and massacres followed each other daily, and as new parties succeeded each other in the convention the leaders of the defeated parties were added to the usual list of suspected royalists or reactionaries. Thousands of paid committees were formed throughout France. The Queen was executed on 16 Oct. 1793; the Girondists (against whom public anger had been more deeply aroused by the assassination of Marat on 13 July by Charlotte Corday) on 31 October (10th Brumaire) the Hébertists on 24 March 1794, the Dantonists on 5 April. Robespierre had a new law passed on 22 Prairial (10 June) to facilitate these executions, and from this date to 27 July about 1,400 persons are supposed to have perished. At length the Reign of Terror came to an end by the revolution of the 9th Thermidor and by the execution of Robespierre and his associates on 27 and 28 July 1794.

In the meantime the majority of the southern towns declared against the convention, the French territory was invaded both on the north and south and to all these dangers was added famine. Condé was taken by the allies 12 July 1793; Mainz surrendered 23 July; and Coburg took Valenciennes on the 28th. The convention fixed a maximum price for the sale of provisions. A decree was passed excluding English manufactures from France. A levy was ordered of 1,200,000 men, and Carnot organized 14 armies. The revolted provinces were speedily reduced. At this time Napoleon first became prominent in France. In September 1793 he was commissioned lieutenant-colonel of artillery and sent to Toulon to assist in the reduction of that city which was then in the hands of the English. By his strategy this was accomplished on 19 December, and Jourdan, in the north, was enabled to give his undivided attention toward driving the principal forces of the coalition from the country. During the balance of 1793 and in 1794 the campaigns resulted favorably to the French arms. Jourdan defeated the Prince of Coburg at Wattignies 15 and 16 Oct. 1793. Hoche, after losing the three-day battle of Kaislerlautern (28 Nov.–1 Dec.) and winning the battle of Wissenberg (26 December), wintered in the Palatinate. In Italy and Spain the French had also been able to carry the war beyond their own frontiers. In the spring of 1794 the French armies took the offensive. An attack on Lille by Coburg's forces was repulsed with great loss on 18 May; Jourdan crowned a series of victories by the capture of Charleroi in June; and by the victory of Fleurus (26 June 1794) recovered Belgium, and Pichegru by the beginning of 1795 had completed the conquest of Holland. A treaty of peace was signed 16 May. Holland, under French influence, constituted itself into the Batavian Republic. Tuscany concluded peace with France 9 February. By the successes of Jourdan the allies were driven across the Rhine, and Spain was invaded. These successes induced Prussia and Spain to lay down their arms. By the treaties of Basel (q.v.) signed by the former on 5 April, by the latter on 12 July (ratified 22) 1795, and by Hesse-Cassel on 28 August, these countries acknowledged the French Republic (See PEACE TREATIES). The English during this time had been successful at sea and had made extensive captures among the French colonies. Meanwhile (in February 1794) Napoleon had been promoted to the rank of brigadier-general of artillery and later in the same year was sent to Genoa to study its defences and the political disposition of its inhabitants.

In 1795 the convention gave the republic a new constitution called the "Constitution of the Year III," a chamber of Five Hundred to propose the laws, a chamber of Ancients to approve them, an executive of five members, one elected annually, called the directory. This tame bequest of that once terrible assembly marked the progress of a strong reaction. The royalists conceived sanguine hopes of a restoration. Pichegru was gained, a royalist insurrection organized, and 30,000 men marched on the Tuileries, where the convention sat. Barras intrusted the defence to Napoleon who had lately returned. He with 5,000 men and his artillery, though he had only a single night in which to prepare, not only repulsed the insurgents but poured such murderous discharges of grape into their ranks that within an hour after actual fighting began he had secured victory for the convention. This event is called the affair of the 13th Vendémiaire (5 Oct. 1795). In recognition of his services Napoleon was now appointed by the convention to the command of the army of the interior. The convention was dissolved on 26 October.

With the suppression of the revolution at Paris by Napoleon, the subjugation of the Vendeans and Bretons by Hoche, the crushing of the "Conspiracy of Babeuf," and the pacification of the other sections of the country, came a distinct lull in political passion. For the first time in many years the armies of France were idle and so the directory planned further foreign conquests. Carnot, the "organizer of victory," who was one of the five members of the directory, was depended upon for the military success of the campaigns. He planned an attack on Austria and resolved to strike from three separate points. In 1796 he sent out three armies which were to hem in the Austrians on all sides and descend upon Vienna simultaneously. Two of these armies, each 70,000 to 80,000 strong, were to enter Germany to reach the valley of the Danube, one under Jourdan — the army of the Sambre and Meuse — by way of the valley of the Main, the other under Moreau — the army of the Rhine and Moselle — by way of the valley of the Neckar, both then to descend upon Austria. Napoleon with the third army — the army of Italy — 40,000 strong, was to menace Italy. Let us follow this last army.

One object of the campaign was to make the armies live on foreign territories. Bonaparte's lieutenants in Italy were already experienced generals. He assembled them and unfolded his plans, which silenced the jealousy naturally caused by his appointment. To the soldiers he issued the first of his rousing proclamations: "You are ill-fed," he said, "and almost naked; the government owes you much, and can give you nothing. I am about to lead you to the most fertile plains in the world, and to opulent cities where you will find honor, glory, and riches." During four years the army had been struggling against the Sardinian and Austrian troops, without decisive success, on the southern slopes of the Alps and Apennines. The Sardinians stretched from the Bormida to the Stura, with an entrenched camp at Ceva. The Austrians were cantoned in the neighborhood of Alessandria and Tortona, commanding the roads to Genoa and Milan. Napoleon threatened an attack on Genoa by Voltri, but made his real advance through the valley of the Bormida. Toward the end of March 1796 he set out from Nice and after defeating the allies at Montenotte (11 April) seized that town and thus placed himself in their centre. Having first repulsed the Austrians he pursued the Sardinian army, beat it at Millesimo (13–14 April) and at Mondovi (22d), and drove them before him to Cherasco, where an armistice was concluded (28 April), which was converted, on 15 May, into a definite treaty, by which Sardinia renounced the coalition and ceded Savoy and Nice to France. In the interim Napoleon sent Masséna and La Harpe against the Austrian army and they defeated it at Dego, 14–15 April. Napoleon then by forced marches to Piacenza compelled Beaulieu to retreat toward the Tyrol. He crossed the Po at Piacenza, stormed the Bridge of Lodi (10 May) which was held by the Austrians to cover their retreat, and entered Milan on 15 May. Brescia was entered on the 28th, the passage of the Mincio forced at Borghetto on the 30th; and the Austrians, after garrisoning Mantua, retired into the Tyrol. The English were dislodged from Leghorn and Corsica; and Venice, Genoa, and Piedmont gave in.

Napoleon followed up his successes by negotiations with the Italian princes and the Pope, upon whom he levied contributions. The King of Naples signed an armistice on 5 June. Besides money, so much wanted by the directory, Napoleon provided a pleasing tribute to French vanity by stipulating for the surrender of pictures, manuscripts, and works of art. On Lombardy he levied a contribution of $400,-000,000: the Pope promised $420,000,000. He sent $200,000,000 to the directory, which had not been able to defray the expenses of his campaign. While he besieged Mantua, a fresh army of Austrians under Wurmser advanced against him in three divisions. Here Napoleon's ability to grasp a situation quickly and to discover the critical point in a campaign were remarkably displayed and served him well. He raised the siege of Mantua, beat one division under Quosdanovich at Salo and Lonato, 3 Aug. 1796 and another under Wurmser at Castiglione, on the 5th. Wurmser, reinforced to 50,000 men, again attempted to relieve Mantua. Napoleon, who had entered the Tyrol and had reached Trent on his way to Innsbrück, after defeating 25,000 Austrians under Davidovich at Roveredo, on 4 September and winning the battle of Calliano, descended the valley of the Brenta after Wurmser, defeated him at Bassano (8 September) at La Favorita and at Saint George and about the middle of that month shut him into Mantua.

On the other hand the same success had not attended the armies of the north. The Archduke Charles had defeated Jourdan, and forced Moreau, who had penetrated into Bavaria, to retreat by the Black Forest to Alsace which he reached in October. Thus any relief for Napoleon was checked. At this time also a great expedition to Ireland under Hoche failed and that general was recalled to France to serve with one of the other armies. These events enabled the Austrians to send a fresh army after Napoleon, consisting of 50,000 men, under Alvinczy and Davidovich. In vain, however. After sustaining repulses at Rivoli and Caldiero, he outmanœuvred Alvinczy and defeated him at Arcola 15–17 November. In January 1797 Alvinczy, with large reinforcements, again advanced from Roveredo to the relief of Mantua. The French were driven in at La Carona but Napoleon defeated him on the 14th at Rivoli and on 2 February received the surrender of Mantua from Wurmser. On the same day he put an end to his armistice with the Pope and invaded the States of the Church, defeating the papal troops at Senio, and in rapid succession capturing Faenza, Ancona, Loretto, and Tolentino. A speedy understanding was come to by the Treaty of Tolentino (19 Feb. 1797); the Pope surrendered Avignon, Bologna, Ferrara, and the Romagna to France; these were added to the provinces of Modena and Reggio, taken from the Duke, and formed the Cispadane Republic, as, after the battle of Lodi, Lombardy had been proclaimed as the Transpadane Republic.

The Austrians, however, were preparing for another invasion of Italy under the Archduke Charles, and Napoleon resolved to anticipate them before they should receive their reinforcements from the armies on the Rhine. He therefore entered the Tyrol, driving the Archduke before him, and, crossing the Noric Alps and penetrating as far as Leoben in Styria, he had reached Judenburg, a few days' march from Vienna, when an armistice was accepted (7 April 1797) and preliminaries were signed at Leoben on the 18th, ceding the Austrian Netherlands and Lombardy to France, and indemnifying Austria with Venetia. These preliminaries were confirmed by the Treaty of Campo Formio, signed 17 October. While Napoleon was carrying on these stupendous operations, Hoche and Moreau had conducted equally glorious but less successful campaigns against the Austrians in southern Germany and had pushed them back into the Black Forest when they received the news from Leoben and suspended active operations.

In the meantime the condition of affairs at home was becoming worse. The Reign of Terror had been followed by an excessive dissolution of manners. Brigandage prevailed in the provinces. Barras, a member of the directory, and other high officials, had been guilty of malversation and private jobbing in the public funds. The returned royalists were intriguing for a counter-revolution. The reactionary party had triumphed in the elections of May 1797, and had succeeded in electing Pichegru president of the Five Hundred, and Barbé Marbois, another royalist, president of the Ancients, and had replaced Letourneurre in the directory by Barthélemy. The majority of the directory, relying on the support of Bonaparte, resolved to anticipate them. Hoche had been recalled with his army from the Rhine and from Italy Napoleon sent Augereau, his trustworthy aide, and with these the directory carried out the *coup d'état* of the 18th Fructidor (4 Sept. 1797). On that night Augereau introduced 12,000 men into Paris, surrounded the halls of the councils, and arrested the leaders of the reactionary party. The minorities of the two councils, assembled on the invitation of the directors, condemned 53 deputies to transportation; annulled the elections in 48 departments, and repealed the laws which had been passed in favor of priests and emigrants; and other violent measures were also taken. Moreau, who had betrayed the intrigues of Pichegru, was himself suspected, and deprived of his command; and Hoche in consequence received command of the two armies of the Rhine. Soon afterward, however, he was taken suddenly ill (some say he was poisoned) and died.

It seems to have been the purpose of the directory at this time to invade England and with this object in view a large army had been gathered together. Napoleon was placed in command of it and though at first he professed to favor the design, he readily saw its impracticability and finally persuaded the directory to abandon the project. As an alternative he proposed to ruin the English Indian empire by the conquest of Egypt. His plan was approved; an army consisting of 36,000 men was equipped; and in a fleet commanded by Brueis the expedition embarked at Toulon on 19 May 1798. In passing they took Malta from the Knights 9–10 June. The fleet a few days later set sail for Egypt and reached Alexandria 1 July. Napoleon sent Kléber forward to take that city and then advanced on Cairo but before he reached his destination he encountered a large force of Mamelukes. A long and bloody struggle ensued known as the battle of the Pyramids, but on 21 July Napoleon emerged victorious. He then entered Cairo in triumph. Napoleon thinking himself secure set about reorganizing the civil and military government of the country, among other things establishing on 22 August the Institute of Egypt; but before he had accomplished much in that direction fortune delivered a terrible blow. While he was thus occupied in the interior, Nelson, in command of the English fleet, had pursued the French fleet, found it moored in the Bay of Abukir, defeated and nearly destroyed it in what is called the battle of the Nile, 1–2 Aug. 1798. The French were thus cut off from escape. To make matters worse the Sultan declared war against Napoleon. Beside this in October the people in Cairo revolted and then occurred the fearful massacres when 2,000 people were put to death. Napoleon, however, instead of attempting to return to France resolved to conquer Syria. Early in February 1799 he started with 13,000 men to cross the desert. El-Arish, Gaza, and Jaffa quickly succumbed and he then laid siege to the city of Acre which was defended by a Turkish garrison under Djezzar Pasha, assisted by the English commodore Sir Sydney Smith. It was probably at this time that he heard of the disorders in France and the disasters to French armies. This fact combined with his inability to capture the city undoubtedly influenced his decision to return to France. He therefore on 20–21 May, after a 60-day siege, relinquished the attempt to capture the place and returned to Egypt, laying waste the country by fire and having lost over 4,000 men in the expedition. Napoleon re-entered Cairo on 14 June but not a month had passed before it was announced that a Turkish expedition of 10,000 men was marching against him. On 25 July Napoleon attacked and almost annihilated this force, which the Sultan had landed at Abukir. On 22 Aug. 1799 he transferred the command of the Egyptian army to Kléber and embarking in a frigate landed at Fréjus 9 October after several narrow escapes from capture by the English Mediterranean cruisers.

While Napoleon was conducting these operations in Egypt a second coalition in violation of the Treaty of Campo Formio had been formed against France, embracing England, Russia, Austria, and other German states, Naples, Portugal, and Turkey. To meet this danger the councils passed the law of the conscription (5 Sept. 1798), and ordered a levy of 200,000 men. The campaign of 1799 was disastrous to the French. Jourdan, who had crossed the Black Forest, was defeated by the Archduke Charles at Stockbach in Swabia on 25 March, and forced to retire beyond the Rhine. Schérer, who was intrusted with the command of the army of Italy, was defeated at Magnano on 5 April. Moreau, who superseded him, sustained further reverses; and MacDonald, who came to his assistance with the army of Naples, was totally defeated in the battle of the Trebbia, 17–19 June. Turin, Alessandria, and Mantua were captured. Joubert, who succeeded Moreau, was defeated and killed at Novi 15 August. On the other hand, the Anglo-Russian campaign in Holland failed; and Masséna, after a brilliant campaign in Switzerland, defeated the Russians and Austrians at Zurich on 25 September, which induced the Emperor Paul I. to make peace.

Napoleon, on his return, found the government in great embarrassment. Its credit was wholly gone. It was obliged to fund the interest of its debts or pay it in worthless paper money. It was ill-obeyed by its generals. A revolution had taken place in the government (18 June), but the new directors were as incompetent as the old. In these circumstances was accomplished the revolution of the 18th and 19th Brumaire (9–10 Nov. 1799) by which the directory was abolished. The councils being alarmed with rumors of a Jacobin plot, the Ancients gave orders that both bodies of the legislature should be transferred to Saint Cloud under the conduct of Bonaparte, who was intrusted with the command of the troops. Bonaparte had already secured the co-operation of Moreau and the other generals present in Paris. On the 10th Napoleon entered the Council of the Ancients assembled at Saint Cloud, and insisted on the necessity of a new constitution. On proceeding to the Council of the Five Hundred he was received with cries of *à bas le dictateur.* Gen. Leclerc, by his orders, entered and dispersed the assembly. The members of the two councils who were favorable to Bonaparte then appointed a provisional government of three consuls — Bonaparte, Siéyès, and Roger Ducos, and a committee consisting of 25 members, of each council to draw up a new constitution, which was proclaimed on 15 December, and called the "Constitution of the Year III." The three consuls were appointed for 10 years, and re-eligible. The first had all the executive powers, the others only a consultative voice. This constitution was submitted to the approbation of the people, and accepted by 3,011,107 suffrages against 1,567. The departments were put under prefects directly responsible to the minister of the interior. The prefects, subprefects, and maires of communes had their councils, which were merely consultative, the whole executive power being in the hands of the officer responsible to government.

Bonaparte chose Cambacérès and Le Brun as second and third consuls. He then undertook the task of reforming civil affairs. He recruited the national treasury, repealed many of the more violent laws that had been promulgated during the Revolution, and reopened the churches. He wrote letters to the King of England and the Emperor urging, in theatrical terms, the restoration of peace, but these overtures were refused, and his next business was to prepare for war. He gave Moreau the command of the army of the Rhine, and determined himself to proceed to Italy. Masséna, with the remains of the French army, was shut up in Genoa. On 13 May 1800 he began his memorable march across the Alps and on 2 June to the surprise and consternation of the allies entered Milan. After several unimportant skirmishes he attacked and decisively defeated the Austrians at Marengo on 14 June 1800. He thus for a second time secured to the French possession of all the Piedmontese fortresses. By the Convention of Alessandria, signed on the 16th, Melas abandoned all Piedmont and Lombardy to the Oglio. Napoleon then committed the command to Masséna and returned to Paris. Meanwhile Moreau defeated the Austrians in several engagements during May, and forced them to take refuge in Ulm. For a while Napoleon's time was divided between campaigning and negotiating. The English, however, finally persuaded the Austrians to continue the struggle and late in the year hostilities once more began in the valley of the Upper Danube. Moreau again defeated the Austrians under the Archduke John on 3 December in the important battle of Hohenlinden and after a series of brilliant combats drove the Austrians back till Vienna was in terror. Brune, who succeeded Masséna, extended the Italian conquests in Tuscany and Venetia. Negotiations were then entered on by Austria, and the Peace of Lunéville concluded 9 Feb. 1801. The Rhine was recognized as the boundary between France and Germany. The Adige was to be the boundary of Austria and Italy. The independence of the Batavian, Helvetian, Cisalpine, and Ligurian republics was guaranteed. A treaty was also concluded with Spain at Madrid on 21 March; and by the Treaty of Florence, 28 March, Naples agreed to renounce the coalition, and received French garrisons. Treaties were also signed with the Pope, Bavaria, Portugal, Russia, and Turkey. Russia, Prussia, Denmark, and Sweden then formed an armed neutrality in opposition to the naval privileges claimed by England, which now maintained the war single-handed. This led to a brief war between England and the northern powers, except Prussia, which was terminated by the death of Paul I., and the battle of Copenhagen.

During all this time, the French army in Egypt, though greatly weakened, was unsubdued. On 8 March 1801 an English fleet under Abercrombie debarked 18,000 troops at Abukir; on 13 March this force attacked and defeated the French; on the 17th Sir Sydney Smith reduced the forts at Abukir; and on the 20th 15,000 English again attacked 9,000 French and forced them back to Alexandria and Cairo. Gen. Kléber had been assassinated and so on 30 August Gen. Menou, by a capitulation with the English, agreed to evacuate Egypt. Both England and France were now anxious for peace. Preliminaries were signed on 1 October and the Peace of Amiens was concluded 27 March 1802. France retained her continental conquests. Ceylon was ceded to England by Holland, and Trinidad by Spain; all the other conquests of Great Britain were restored. Malta, which had been taken by the English, was to be restored to the Knights of Saint John. This lull in active warfare allowed Napoleon time to crush an insurrection of the blacks in Santo Domingo.

Napoleon exhibited his wonted vigor in home administration. By means of the senate he silenced the opposition of the tribunate and the corps législatif. He assembled the most noted lawyers in France under the presidency of Cambacérès to draw up a new code of civil laws now known as the «Code Napoleon» (see CODE). He entered into a concordat with Cardinal Consalvi for the re-establishment of the Catholic religion. He undertook public works, constructed roads and bridges, encouraged industry and commerce. On 2 Aug. 1802, Napoleon and his colleagues were made consuls for life.

The external policy of Napoleon was not calculated to conciliate the jealousies caused by the extension of French dominion. The independence of the new republics was merely nominal. The island of Elba was occupied and incorporated with France in August 1802, Piedmont 11 September, and Parma in October; while in the same year Piacenza was united to the country and an armed intervention changed the government of Switzerland. Holland was also treated as a part of France and received a constitution from Paris. By the Treaty of Lunéville the German princes dispossessed by the advance of the French boundary were to be indemnified beyond the Rhine. The process of compensation was not carried out with sufficient promptitude for Napoleon. By his interference, in conjunction with that of the Emperor of Russia, the indemnification was effected by the extinction of the two electorates of Cologne and Trèves, and the secularization of the ecclesiastical estates. Napoleon on 30 April 1803 sold Louisiana to the United States for $15,000,000.

The discontent excited in England by this aggressive policy made it evident that the peace could not be maintained, and the government refused to evacuate Malta. On 16 May 1803, two days before the declaration of war, an embargo was laid on all French and Dutch vessels in English harbors. Napoleon retaliated for this lawless proceeding by seizing as hostages all English travelers in France and Holland, and Gen. Mortier took military possession of Hanover. Russia and Prussia attempted to intervene, but on terms unacceptable to France. Spain and Portugal had to purchase their neutrality from France; but as this purchased neutrality placed the former at the disposal of France, England declared war with Spain. Naples was occupied by French troops, and vast preparations were made ostensibly for the invasion of England. While these events were occurring a conspiracy for the overthrow of Bonaparte and the restoration of the Bourbons was discovered in 1804, in which the British government was implicated. The most distinguished of the conspirators were Cadoudal, Pichegru, and Moreau. Cadoudal was executed, Pichegru destroyed himself in prison, Moreau was pardoned, and retired to the United States.

The legislative bodies were now completely subservient to Napoleon, and the conspiracy of Cadoudal was made a pretext for offering him the empire. The *senatus-consultum* for the regulation of the empire, drawn up by Napoleon himself, was passed 18 May 1804. The empire was confirmed by a popular vote of 3,572,329 against 2,569. The coronation took place at Notre Dame on 2 Dec. 1804, and the empire was established.

Bibliography.— There are numerous and excellent histories of France and other general histories which cover this period both in outline and in detail. Among them are: Lavisse and Rambaud, 'Histoire Générale' (12 vols., Paris 1893–1901); Fleury, 'Histoire de France' (1891); G. W. Kitchin, 'History of France to 1793' (3 vols., Oxford 1882); Crowe, 'History of France' (5 vols., London 1858); Mackenzie, 'The Nineteenth Century' (London 1882); Guizot, 'Histoire de France' (Paris 1870); Duruy, 'Histoire de France' (trans. by Carey, New York 1889); Martin, 'Histoire de France' (Paris 1855–60); White, 'History of France' (1890); Yonge, 'Three Centuries of Modern History' (London 1872); Edwin Emerson, Jr., 'A History of the Nineteenth Century Year by Year' (New York 1901); Thornton's, 'Continental Rulers' and Oscar Browning's 'Wars and Military Development' in vols. VI. and XVII. respectively of 'The Nineteenth Century' (Toronto and London 1902); also for the institutions consult Taine's 'Modern Régime' (Paris 1891–4; trans. by Durand, New York 1894). The 'Cambridge Modern History' (Vol. VIII. 'The Revolution' and Vol. IX. 'Napoleon,' Cambridge 1904–6), beside treating the history of this period in detail cites an enormous number of works, original documents, etc., on each period and on every phase of the subject which the student may consult with profit.

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DEPARTMENT OF

FRENCH HISTORY AND MODERN DEVELOPMENT

France:

HISTORY AND MODERN DEVELOPMENT.

1. **French Civilization.** Nationality does not consist in a race, still less in the use of a common language, but in the possession of a corporate tradition. A nation is a body of men distinguished from other bodies around it by the possession of an organic tradition which so moulds the habits of life of those subjected to it as to define them clearly from their neighbors.

The territory the larger part of which is now called France, and the ancient name of which was Gallia, has, since the beginning of recorded history, been inhabited by many million men possessed of and influenced by such a corporate tradition which has given unity to their commonwealth even in its most anarchic or barbaric periods, and which permits us therefore to speak of the French people as of a permanent historical phenomenon in Western Europe. Compared with this solid and recognizable truth, guesswork upon complicated racial origins and still vainer guesswork upon the evidence of language, are negligible.

The characteristics which the Gauls have developed in this national tradition of theirs and which in turn their national tradition has imposed upon them and confirmed them in, are easily recognized by the modern traveller or by the student of the detailed history of the last 300 years. This tradition comports energy working at a very high potential, a potential so high as sometimes to fuse its communications, and so high as to suggest to those unused to it a necessary absence of volume. It comports in philosophy a combination, somewhat paradoxical in character, by which material and tangible things are chiefly regarded and yet treated by the methods of pure thought. Thus no nation has expressed political theory in terms more general than the French, yet none have had less inclination for metaphysics.

In the political sphere the national tradition of which I speak is essentially military, and in the various forms of its expression has never ceased to be so,—by which is not meant that the French are perpetually under arms, or chiefly concerned with making war, but that their conception of the organization of a State is always a military conception: and that as the art of war changes and develops, now tribal, now municipal, now based on castles and at last national, so has Gaul been a loose hierarchy of tribes, a web of Roman municipalities and garrisons, a tangle of feudal relations, or a highly centralized and bureaucratic body. The whole trend and determination of the French mind in civics may be expressed in the formula «Without authority there is no life.» It is on this account that throughout French history promptitude and power are demanded from Government, and that among a people to whom the Oriental ideal of collectivism is highly repugnant, so much is demanded from the State and so many of a citizen's actions are considered only in the light of his relation to the State, as though the duties which he owed to the State were in some way more sacred than the rights which the State should guarantee to himself.

The minor and more superficial characteristics that go with this general picture, are a vivacity and often an excellence in oratory, an exact and somewhat excessive precision in daily life, accompanied by an excessive neglect of such details as are considered unimportant, which neglect is repulsive to those who carry a less precise order more generally over the whole of life; a considerable artistic faculty, waning and waxing with various periods, but fairly constant in dramatic art and in architecture; a lack of appetite for individual adventure (a trait in which the Frenchman contrasts very sharply with the Scandinavian and the Islander of the North, whether Irish, Highland, English or Dane); and finally, a curious power of common action often suddenly inflamed and always extreme, in which the Frenchman contrasts not only with the Scandinavian spirit upon the North of him, but also with the various Germanies, the Spaniards, and Italians of his frontiers, and indeed with every other European community. It is to this trait that France owes the many popular risings and massacres to be discovered in her history, the extreme rapidity with which a leader is chosen and again rejected, the lack of judgment in foreign affairs which cannot but accompany the confused action of a great number of men, and the startling military successes which that common action often produces. Of these of course the main historic examples are the great Eastward march of the Gauls in the third century before our Lord, which led them to the sack of Rome and of Delphi, and to a permanent colony in Asia Minor; the march of the Crusades, and the wars of the French Revolution. But beside these enormous swarmings of the French, innumerable minor phases of the same type are to be discovered in the 2,000 years of Gallic history. It is to be noted also that just as the French are unique in expeditions of this kind, so are they unique in the multitude of their civil wars.

The good or evil of these characteristics I do not propose to examine, nor can they I think be determined; for they will vary according to the very various ethical systems which abound in the modern world, and every reader will determine for himself whether he approves or disapproves of the Gallic temper. It is such as I have described it.

It will next be remarked that the French, such as they are, have had since the fall of the Roman Empire, a very large and disproportionate influence upon the mind of Europe. This truth is so generally appreciated that it needs no expansion here, but a few examples will make it evident to all. French has been the language of a governing class from the River Tyne to the River Euphrates, and from the Atlas Mountains to the mouths of the Rhine.

Feudalism and the whole structure of mediæval society, was Gallic in its origin. The Gothic architecture is a Gallic invention, as is the collegiate university. The systems of military fortification in the 12th, in the 16th, the 17th and the latter 19th centuries, are French; the French framed the first code of laws since the fall of Rome—it became at once the basis for every code throughout Europe. The French road is the model of the German and the Italian road, and to-day the weights and measures of European civilization are French; while, to mention a detail of no great importance, the French language becomes, with every year, more and more the medium of international communication and especially the medium in which is expressed the general result of European thought.

This permanent and, as it would seem, undue preponderance of the French mind, is in part no doubt due to the mixture of excessive energy with excessive precision which is the vice, or virtue, of the French. But a very large part, and the more easily ascertainable part of this influence, must be laid to causes of another kind,—causes more material and dependent upon the sequence of history outside the frontiers of Gaul, and the geographical position of the quadrilateral which the French inhabit; as also to some extent to the influence of soil and climate.

In order to appreciate these measurable causes of French preponderance, let us examine the boundaries of that quadrilateral, and estimate its physical qualities and its historical position.

The French, as I have said above, inhabit *nearly* all the territory anciently known as Gaul, and the boundary which may be set to the Gallic temper runs as follows:

Taking first a point upon the shores of the Bay of Biscay some twenty miles north of the Spanish frontier, the Atlantic Coast is the boundary until the Bay of Quiberon is reached; from that point upon the coast of Brittany the line drawn vaguely north and south to the coasts of the channel, excluding to the East the highly different Armorican type which, if place names and folklore are any guide, has probably lain permanently beyond this boundary since a period prior to the Roman invasion. From the point upon the channel so determined, the boundary proceeds eastward and northward along the coast (including the Channel Islands and their dependencies) to a point about half way between Calais and Dunquerque. Thence it strikes inland, including such places as Tournai, Mons, Charleroi, Namur, Liege, but a few miles east of the latter town and somewhat west of the old castle of Limburg the boundary turns sharply to the south and in a somewhat undulating form, after striking the Belgian frontier at Gouvy, runs a trifle west of that line, passes a mile or two east of Arlon, about half way between that town and the frontier, and so reaches the point where France, Luxembourg and Belgium meet, a point in which artificial and political boundaries curiously correspond with real divisions of men.

The limit of which I am speaking next follows the short Luxembourg boundary, and cuts in a line less defined than most parts of its course from the top corner of Lorraine to within a march or so of the Rhine.

This section is difficult to define, from the fact that the population is not possessed of sharply marked characteristics. Between the Gallic belt of Belgium and the non-Gallic, a boundary as sharp as that made by a river or a wall, can be discovered by the most superficial observer. There is more difference between Liege and Maestricht than there is between, let us say, an Irish and an English town. But in Lorraine no such sharp differentiation of architecture, manners and general way of life is to be discovered. Language is no guide here, the habits and aspect of a German-speaking village are the same as those of a French-speaking village, and one can only speak of a gradual transformation from the purely French town of Metz to the purely German belt which extends, as I have said, to within about one day's march of the Rhine. The belt between can only be described as mixed.

An exact boundary begins again in the neighborhood of Saverne, and follows the crest of the Vosges Mountains, the valleys and Alsatian plain to the east of which seem never to have been impressed with the Gallic type of culture; but whether under the dominion of the Government at Paris, or autonomous, or under the dominion of the Government of Berlin, or of foreign or of native lords and bishops, to have been other than Gallic in temper, and resembling in historic times any one of the minor subdivisions of tribal Germany.

Across the gap of Belfort the line runs just barely including that fortress a few hundred yards to the east of whose town boundaries everything, from the aspect of agriculture to the gait of the peasants, ceases to be French.

The line next proceeds to the peculiar isolated peak known as the Mont Terrible, runs down the middle of the Jura valleys, and from the end of that range of mountains can again with difficulty be determined; the great mass of mountains which lies between the gap of Geneva and the Mediterranean, may justly be regarded as less French in character than the Italian valleys upon the farther sides. French influence and culture and the march of French armies have more deeply affected the Val d' Aoste for instance, than such remote villages of Savoy as Lagrave. But one may say in general that it is safe to exclude Geneva and to include most of the mountain mass lying south of that town until the Mediterranean is reached. The shores of that sea continue the boundary so far as the neighborhood of Perpignan, and though the Catalan language and the Provençal, the highly differentiated climate and the long Roman tradition of this belt make it a thing somewhat apart in France, yet we must recognize the sea as the boundary of Gaul with the exception of a still remaining foreign influence in the town of Marseilles.

In the neighborhood of Perpignan as I have said, and a little before the Pyrenees are reached, the limit which we are defining turns westward and follows the northern base of the hills. So thorough has been the work of French governments since the Revolution, that the valleys running up from that base to the crest of the Pyrenees are, with one exception, now completely transformed in their superficial aspect and seem as French as any other part of the country; but no one well acquainted as is the present writer with the Pyrenean chain can question the identity of the inhabitants upon either slope. Beneath the surface of the modern French system, the manner and cultivation of these valleys is a foreign thing. And the line which we are following may be said, for instance, to include the Canigou and Mont Louis, but not the French Cerdagne; Aix, but not the sources of the Aiège; Bagnieres but nothing beyond it; Tarbes, and perhaps Lourdes but nothing south of Lourdes, and so on all along the chain until, a few miles after the passage of the Adour, the total separate Basque country is reached, where the line strikes northeast and reaches the point upon the Bay of Biscay from which we began to trace it.

It will thus be seen that the political boundaries of France to-day do not exactly correspond to the territory which we are considering, and which as a whole represents the physical basis of the French nation. That territory overflows the political boundaries towards Belgium and Germany, and is within those boundaries in much of its southern and southeastern part as also in the Armorican peninsula. And this lack of identity between the political and the real boundaries of Gaul has existed throughout recorded history. Thus the Romans took the convenient line of the Rhine upon the East, although the German tribal customs, dialect and general traditions have always existed in a wide belt upon the left bank of that river; and again the nominal suzerainty of the King of Paris (though that is hardly a test) for long excluded Bar-le-Duc, which is as French as Canterbury is English.

When the student sees upon the map of Europe the position occupied by this quadrilateral, he may wonder how that position can be called in any way preponderant. It is apparently but a fraction of the great European area, a fraction thrust far to the West, and occupying no central radiating position. The modern map, uninterpreted by history, and by the known effect of climate, leaves inexplicable the material cause of French preponderance. But an examination of these historical and climatic conditions goes far to explain it, and of the two the historical, which is the more important, should be taken first.

European civilization is not a material spread out evenly from the Ural Mountains to the Atlantic and from the Frozen Sea to the Mediterranean; it is an influence whose general expression is Roman, whose permanent seat is within the old boundaries of the Roman Empire, and which while it has radiated eastward and northward of those boundaries through the influence of the Christian missionaries, loses its intensity as a general rule the further it proceeds from its original seat.

This Roman unity was broken by the Adriatic into two halves, originally widely differing and as the centuries proceeded differing yet more widely. In the eastern half (the Balkan peninsula, Egypt and the Levant and Asia Minor) old and stable civilizations, had accepted the hegemony of Rome. The language of the generality of men was Greek, their interests were those of a very aged and perhaps a somewhat exhausted civilization, whose origins went back to the remotest eras, and whose high art and exquisite literature was already in perfection in epochs long anterior to the furthest records of history.

In the West, Latin was the general tongue, though for long the educated and wealthier classes were bi-lingual. And there the Roman genius taught and produced a new civilization common to the Iberian, the Gaul and the Briton, to the Kabyle of the Atlas Mountains, and to the German of the Rhine Valley, introducing to all these people a common art, a common tongue and law, and a common happiness. The boundaries of this Latin unity are very clearly determined: A line drawn from Glasgow to Edinburgh including both those cities shows us what part of the British islands enjoyed this benefit, Wales, the Lowlands and England. The Netherlands, south of the Rhine delta, all the lower left bank of the Rhine, and in its upper reaches both banks,—all the valley of the Upper Danube and the mountains of the Tyrol. All North Africa, from the Bight of Tunis to Tangiers; all Spain and all Gaul,—had in common the vine, the mass, the arch, the column, the municipium, the military way, and were one thing.

Now if this boundary be drawn upon the map it will at once be perceived that Gaul was the centre of gravity, so far as mere area was concerned, of the whole system. And to this mere material fact, important though it was, there was soon added a series of historical accidents which very greatly emphasized this central position.

In the same period which saw the flowering of Roman thought into a definitely Catholic civilization, the long transformation of the Roman army was accomplished. It had become an hereditary and a mercenary thing, drawn largely from those populations which did not enjoy the full civilization of Rome and which were therefore ready to accept a wage more easily than would the free citizen of the Empire. Through the agency of these armies, in a most confused manner, the barbarian pressed more and more upon the civilized area, and he pressed upon it, though never in large numbers yet always with an energy that varied from an infiltration like that of the Franks or the Burgundians to a savage incursion like that of the pirates who overran the eastern part of Britain.

A little later than the first series of these catastrophes the Mohammedan religion suddenly united the non-Roman desert tribes to the South and these destroyed the civilization of Northern Africa which had already been weakened by an anarchy of wandering Germans, revolted slaves, and what not, and finally, by the 8th century the principal islands of the Western Mediterranean, nearly all the Iberian and the ports of Southern Italy were occupied by the Saracens.

The test of Roman, that is of civilized, continuity, is the authority of the town, with its bishop as the successor (he had once been the coadjutor) of the civil authority. And side by side with this test is a secondary one, namely, the authority of the Palatine Writ: of the Writ issued in Latin from the palace (a word borrowed from the Palatine Hill at Rome) wherein resided the centre of government. Now if we take a map of Western Europe as defined within the old Roman limits, and shade with a pencil those Roman municipal areas which lost such a continuity of episcopal government and Palatine, Latin, authority, we shall find that this shading will leave us nothing but Northern Italy and Gaul; and indeed, but for the exception which Northern Italy presents, the vast area of Gaul may properly be regarded as the only survival of Roman civilization in the West. From this survival, as from an unsubmerged rock in a flood, a platform could be made upon which the damaged conditions of civilization might be rebuilt and from which the influence of civilization could again radiate.

The transformation of Roman society when the recivilization of Western Europe began, had made it what is called «feudal.» The slaves had become serfs organized in co-operative agricultural communities; the great Roman landlords had become fighting nobles; from this type of society, in all its changes, onward until the Revolution, and through the Revolution to our own day, Gaul through every vicissitude has remained the pivot upon which the mind of Western Europe has turned. And if at the present moment French armor plating, French road making, the French system of fortification, the French organization of local government, French weights and measures, French field artillery, French submarines, French motor cars, French historians, and the dual polarity of French philosophy, Catholic and anti-Catholic, have imposed themselves upon Europe, this modern accident is but in the general and normal tradition of an historical condition necessary to Western Europe.

Apart from these human and therefore most important factors, certain merely material, limiting and therefore inferior factors must be considered. These will be discovered no less than those to conspire in favor of this permanent position of France.

Of material influences in Europe the two most considerable contrasts are the contrast between the Northern and the Southern type of climate, and the contrast between the tidal ocean and the nontidal Mediterranean.

A vast number of characteristics may be connected with either of these physical contrasts, and with either portion of each. That materialism which was the dominating note of the last generation and which is but slowly passing, regarded climate and such material considerations as we are now discussing as the principal cause of all the differences that could be discovered by the historian. No man would now lend himself to such crudities. The tribal system does indeed roughly contrast with the municipal, in the same way that North does against South, and those who use such terms as «Latin peoples,» etc., conceal beneath their ignorance an appreciation of certain obvious truths which may be roughly connected with climatic conditions. But apart from such speculations, certain very definite material results follow from the pair of contrasts I have mentioned. Thus, the rivers of Northern Europe are highways; they are usually placid and broad and fairly deep, and are penetrated by the tide far within the plains of that region. Even Scandinavia, which has no such rivers, enjoys the corresponding presence of fjords. The Rhone, the Ebro, the Chelif, the Tiber, the Po, the Adige, are not highways. The Seine, the Rhine, the Thames and the Trent, are. Again, the seaport in a tidal sea, to be of value must be chosen in a more particular locality than in a tideless one. Again, the North gives us longer if not fiercer storms. Again the beach in a heavy tide is less suitable for landing; a heavier type of vessel tends to develop, and with it the possibility of further adventures.

It is evident also that with difference of climate a different architecture, a different agriculture and different social habits will arise; and my point is that the contrast between the two zones in Europe is normally a sharp contrast. Nowhere does one feel it more strongly than in the passage from Switzerland of the German sort over or through the St. Gothard to Airolo. Between the two points which are but nine or ten miles apart, the whole of life appears to change.

Now Gaul affords the obvious link between these halves of civilization, and, typically enough, Paris, the capital, is in its aspect now a Northern and now a Southern town. It was southern under the Roman occupation, gradually grew northern again during the Dark Ages, and during the Middle Ages was purely Gothic without a vestige of the South about it (except that it was just on the limit of the wine-drinking country). Then again with the Renaissance it became again gradually the Southern thing which it is to-day.

Again, on a modern battleship, if it be German or English, you will have only the Northern type of man, accustomed as a rule to the tidal sea, with all the quality of seamanship developed under those conditions, while on an Italian battleship you will have men brought up as boys with the latine sail, the absence of tidal currents, the steeper seas, the sudden gust, and the long calms of the Mediterranean. On a French battleship you will have both types of men.

Consider again climate not by meaningless scientific terms of measurement, but as it is expressed in the common experience of life. In the South frost is rare, snow is rare; the long months of cold which render life difficult are not known save in the mountains. The south of Gaul is in this condition. It builds with a flat roof, it knows nothing of skating nor of the preservation of plants through the winter, nor of the isolation which cold elsewhere has produced in the past through long periods of the year. In the North all those conditions are as common a part of life as they are in Holland or in England.

In Northern Europe the sun is the grateful climate; in Southern Europe shade and coolness. In the Southern Europe a low relief was sufficient for plastic art; in Northern Europe a high relief. You find them joined in the art of Mediæval France.

Again, consider food. Wheaten bread is the staple of Roman civilization. To the north of it, oats, rye, and other poorer cereals; to the East, rice; and at this day France grows more wheat than any other of the western European states. France grows more wheat than Italy, England and Spain combined. She grows more than half of Europe, outside Russia. Next to wheat the vine has been the staple of French civilization in the matter of food, but the vine is not easily grown northward of a certain limit (though in the Middle Ages that limit extended far into Britain). Gaul, though mainly wine-drinking, includes a north-eastern belt which has the custom of Eastern Britain and the German tribes, and drinks beer, while it has a larger northwestern belt which follows the custom of Western Britain and drinks cider.

So the northern use of butter, the southern use of olive oil meet in Gaul. The use of and the partial abstinence of flesh—which is largely a matter of climate—depend upon zones which also meet in that territory. Meat cannot be kept in a southern summer; a northern winter cannot healthily be passed without it.

The list of such contrasts could be drawn out indefinitely by any man of average travel and reading; and in nearly every one of them he would find that French territory was a common ground upon which either type met.

It is in the light of the foregoing general considerations that we must regard the history and character of the French people. They will continue to influence the future as they have influenced the past, and they are the major constants in every far-reaching problem of European importance. But a few closing words upon the immediate conditions of the French will perhaps enable the reader better to appreciate the articles that follow.

In general, those immediate conditions consist in this, that upon the general material of a people welded into their unity by ancient customs, and by a method of thought which they are incapable of abandoning, two considerable discussions are at work. Neither can ultimately affect the profound mass and structure of Gaul, but the victory of one of the two parties in either of these discussions, will considerably affect the form or mould into which that mass shall be thrown, and therefore inevitably will affect the general structure of surrounding Europe.

These two discussions are, the discussion upon the purely democratic state, and the discussion upon the authority of the Christian religion.

They are often confused, and nowhere more so than in France itself. But the connection between them is quite accidental, and no accurate conception of the position can be arrived at until each is regarded quite separately from the other.

The modern French experiment in democracy is, in the main, a reversion to the ideal of the old civilization of the Mediterranean. It contains no part of that anarchic ideal of individual liberty common in more rudimentary states: an ideal that inevitably ends in oligarchy and usually in plutocracy. The French experiment in republicanism is an experiment which presupposes a highly organized, a highly centralized and a powerful state, capable of crushing by a common effort all sporadic and particular energies which may be antagonistic to or even separate from the common life. And the experiment is an experiment and not an achieved one, because the machinery for such a state is so difficult to construct. The experiment has never been tried before and it may well fail. Democracies have existed in small city states usually dependent upon slave labor; they have endured indefinitely in small isolated agricultural states; they have never permanently existed in large states under conditions of high civilization. So long as the French experiment endures, so long the conception of democracy at least, and, to some extent, its forms and ideals, will be observed in Western Europe. And it is a matter of intense interest to watch the succeeding phases of the experiment, the moments when it seems nearly approaching success and the moments when the whole conception seems too unworkable for the complexity of the modern world. I repeat, the issue is by no means decided.

The religious question is a more profound and a more vital one. The whole fabric of French life and tradition is so closely interwoven with the Catholic Church that men who should put no credence in the divine origin of that Church would find their easiest temporal explanation for its existence in the action and nature of the French people. Its high centralization, its military defence throughout a thousand years, its rigid conception of dogma, its deductive philosophy, are Gallic, not Italian.

The French cannot therefore respect any revealed religion save Catholicism.

Wherever this conception of religion exists, its counterpiece and converse is rationalism. Rationalism had completely dominated the thinking part of the nation and the leaders of its action in the 18th century; indeed it is only since the middle of the 19th that the arguments against that position have gathered strength among the more cultivated classes of the country. Coincident with the maximum of this rationalistic wave, the French Revolution quarrelled in its first year with the political organization of the clergy; next the Revolution became identified with all the patriotism and all the energies of the people in the course of a long war, and by the time of the Restoration, a great body of French thought and French energy was definitely cut off from and antagonistic to the National religion. The quarrel between the two still endures. The attitude of many a French statesman towards the Catholic

Church in France is not one of neutrality, but one of active enmity proceeding from a conviction that the Catholic Church is not only the permanent enemy of human happiness and liberty, but also of the particular State which it is his function to guide. Conversely, more than one cleric, though of French extraction, has learned to regard the liberal institutions of his country as the necessary and permanent enemies of religion. There is no logical connection between the two ideas: there is but a chance historic association, but that association has acquired great strength with the passage of time and with the succession of some five generations of men who have seen the quarrel continually growing, and no perceptible end to it approaching.

Such are the main combatants in this struggle. But two other factors of importance are present, the Jew and the Huguenot. Neither of these bodies are numerous, but they happen each of them to be extremely wealthy and this wealth with all that it connotes, of education and of power in the Press, is thrown into the scale against Catholicism. It is impossible at this moment to say what the end of the struggle will be. It is only certain that if Catholicism is grievously wounded in France, it will have received a blow far more serious than that which it received in the 17th century. And conversely, if upon the whole the influence of the Church should henceforward grow among the French people, it will be difficult for the forces adverse to Catholicism to prevent the continued increase in political power, both of those populations which are ardently and those that are only nominally Catholic, from Ireland to the Desert. See CHURCH AND STATE.

Upon this struggle, much more than upon the other, depends, one may assert, the future fate of Europe. Each is in active progress, and the combination of the two presents by far the most absorbing spectacle of our time.

HILAIRE BELLOC.

2. France.—History B.C. 58 to A.D. 1796. The quadrilateral of Gaul has possessed a geographical and political unity from prehistoric times, and the inhabitants of that quadrilateral have inherited and transmitted certain political, rather than racial, qualities uninterruptedly throughout the historical period. But the first state in which we find them, when the great mass of them were but barbarians, exterior to the civilization of the Mediterranean basin, was, of course, far different from that strictly organized and disciplined unity which two thousand years ago and again to-day were associated with the territory in question.

The Gallic tribes were a set of loosely organized clans dependent one upon the other in a sort of semi-feudal organization. It would seem that no one clan ever rose to a complete hegemony over the rest, and again that any small or dwindling clan, long before it permitted itself to be absorbed, would seek defence by recommending itself to some superior neighboring clan. The classic instance of such a dependence is the association of the Parisii who inhabited the neighborhood of Paris, with the large and powerful neighboring clan of Senones, whose capital was Sens on the Yonne higher up the Seine valley. It is curious to note that ecclesiastical arrangements, always the most conservative of institutions, preserved a relic of this relation as late as the early 17th century, for until the See of Paris was raised to an Archbishopric in 1622 the Bishops of Paris were suffragan to the Archbishops of Sens.

The languages spoken by these clans we know little of. We know that the civilized observers of antiquity regarded Gaul as presenting three very clearly marked divisions, which the Romans called (going from East to West), Belgic, Celtic, and Aquitanian Gaul. It has been conjectured that the tribes of the first spoke a variety of Teutonic dialects. It may be asserted without fear of error that those of the second spoke a variety of Celtic. As to the Aquitanian or southwestern portions, some will have it that the Basque language once extended throughout its territory; others that its original language was Celtic like that of the central portion. On all this nothing can be certainly known. As to the origins of this stock we are again in complete ignorance, and it would be idle to linger upon the many conjectures of migrations on an «Aryan race» (the very existence of which is but an hypothesis) or of a «Mediterranean race,» a piece of pedantry converse to and only one degree less futile than the last.

The inhabitants of Gaul have in common from the earliest times a National character and a religion which, though they may have sprung from twenty different remote racial sources, gave them a common aspect. This character, which has been sufficiently dealt with in the introductory essay, may chiefly be defined as military. In the earliest, as in the latest of European history, the Gaul appears marching eastward in quest of military adventure. The religion professed by these people is a more precise matter. It was of a definite and highly organized kind, although its mysteries specifically forbade its propagation by anything but oral tradition. It had for its organs a hierarchy of priests known as druids, and professed, as Gaul has always professed in a manner which seems a necessity to her people, specific dogmas the adherence to which was guaranteed by penalty and the expression of which was exclusively confined to the priestly caste. Among these dogmas the immortality of the soul, the necessity for sacrifice and, we may presume, a universal God, were prominent. A sacrament of bread and wine distinguished this cult and a ritual holiness attached to certain objects and shrines, as the mistletoe among vegetables, and the Grotto of Chartres among places.

The reader must here note the surprising continuity of French institutions, a continuity the like of which is not to be discovered in any other part of the Western world. Indeed it would seem as though the prodigious revolutions in philosophy which in ancient times made Gaul Christian and in modern times have moved her to a great though perilous experiment in democracy, did little but re-color the substantial framework of the nation, and that under every regime national unity, a priestly caste, affirmed dogma, and the sanctity of special shrines distinguished the nature of this people.

From very early times the shore where the Gallic quadrilateral touches the Mediterranean had been colonized by the merchants of the East, Greek and Semitic; and indeed the aspect of this fringe, its climate and produce, apart from its exceptionally political history, differentiated it from the rest of the country. Again, the Gallic hordes had overflowed the Alps and largely occupied the valley of the Po. Again, there were presumably spots (as the Plain of Alsace) where the quadrilateral was intercepted by invaders of another stock. But as we have seen in the preliminary essay, the quadrilateral of Gaul is the permanent habitation of the population with the history of which these notes deal, and that population first attains historical importance with the invasion and conquest of Julius Cæsar. This conquest occupied eight years, from 58 to 50 B.C. It was marked by many vicissitudes, the climax of which was the great revolt of Vercingetorix, which was finally crushed at Alesia. Had Cæsar failed in this attempt one can not say that the Roman power would have been diminished or that of the Gauls extended; it was fundamentally never more than a struggle between civilization and barbarism, corresponding to the struggle undertaken later less thoroughly and with less success by Charlemagne against the Germanic tribes.

As it was, the conquest of Gaul affords such a field for the extension of civilization as has never before or since been afforded to its extension in the history of the Western world. For, first, the «Hinterland» thus acquired was in every way suited to the extension of civilizing power, with a perfect climate, a very fertile soil, a numerous and highly intelligent population; secondly, by an accident without which the Roman Empire could never have come into existence, the Gaul was not only suited to the reception of Roman civilization, but avid of it. Within three generations of Cæsar's great experiment, the whole vast territory was Roman, and more thoroughly penetrated by Roman laws, tongue, feelings and manner than any alien territory has been before or since, with the habits of the conqueror.

Indeed there are but two examples in all history of a success of this kind: that of the Spaniards in the New World, and this of the Romans in Gaul. But the Spanish success, remarkable as it is, does not compare with the Romanization of France. It has achieved a less complete civilization; it was effected at too great a distance from the metropolis.

Other military adventures of the sort have either spread a language or veneered a district with a governing class, without fundamentally changing its daily customs. Such was the Hellenic conquest of the Near East and such was the Roman conquest of Northern Africa, in neither of which were the local dialects extinguished or the local religions uprooted. As for the commercial empires, the Carthaginian, the Venetian or the English, it is not in their genius to impose their will upon subject peoples or to transform these into something after their own image; nor have they commonly made the error of attempting a task so uncongenial to their forces.

This Romanization of Gaul, the most complete, and, in a manner, the most miraculous of historical revolutions, endures in its effect plainly to the present day, and upon it more than upon any other one historical phenomenon the pattern of Western Europe has been based: its bishoprics, its ritual, its law, its philosophy and its social organization. The municipality, with its elected council, European kingship, the legal class, the village with its lord and its prædial serfs—all these proceed from the Romanized town and the Roman agricultural estate, not so much as they appear in their original Italian, but rather as they appear in their later Gallic form.

Some 200 years after the Roman pacification was complete, the preaching of the Christian religion in Gaul began to achieve its remarkable success. Legend, and even to some extent recorded history, shows us the leaven of this new philosophy at work much earlier: thus the famous martyrdom at Lyons took place as early as the middle of the 2d century, and the saints who there suffered were, through Irenæus their priest, in touch with the Apostolic period, for Irenæus was the disciple of Polycarp, and Polycarp of St. John. But it was from the middle of the 3d to the middle of the 4th century that the true revolution in Gallic thought as distinguished from these sporadic origins was effected. And from the middle of the 4th century Gaul becomes, as it has since remained, the chief scene of the struggle between the Faith and its opponents.

The Monastic Institution, Eastern in origin, was then established by the efforts of St. Martin in the West, to produce, after centuries, the university upon one hand and upon the other the representative system. Again, it was then in the middle of the 4th century that the municipalities identical with the sees of Bishops begin to take on a social importance which has made them ever since pivots upon which French development has turned. And it is significant that about the same time the old tribal names of districts reappear, attached to these municipalities. By far the greater part of French towns to-day bear, not their Roman but their second tribal name.

Coincident with the conversion of Gaul and its organization as a complex and highly efficient clerical hierarchy (which, beginning in the 4th century, became within a hundred years the framework of the whole community and the only structure capable of outlasting the dissolution of the Roman world) came the phenomenon loosely and accurately called «the invasion of the Barbarians.»

There was in fact but one true invasion, and that, to the honor of Europe, was utterly defeated. It was the Mongolian invasion under Attila. Even this was provoked by the use of Mongolian soldiers in the Roman armies. He penetrated with his enormous host to within sight of the walls of Orleans, fell back to the great dusty plains north and east of Chalons,—probably much where the camp now stands. He had with him and was joined by every element of disorder and of chaos: German tribes, and, we may presume, the fugitive, the criminal, and the broken men of that declining period. Opposed to them were all the forces of order and they were victorious. But it was the last organized effort of Rome, and within fifty years a local chieftain was to assume power in Northern Gaul without so much as assuming the titles of Roman officialdom.

The wealthier and the more self-conscious the Roman Empire grew, the more defined its social opportunities, the more ancient and fixed its customs and the more beneficent the religion which its civilization had to offer, the more did it attract the perpetual infiltration of Barbarians from beyond the pale. The process may be compared to the increase of potential which is created by the storing up of a head of water, or any other contrast of positive with negative in physical forces. With every succeeding generation there was less and less temptation or need for the Roman to seek adventure outside the Roman pale. The towns were growing in magnitude, the Roman order had existed so long and with such splendid success as to be apparently eternal. Conversely, there was not a Barbarian within a month's march of the border who was not by an irrestible gravitation drawn towards the enjoyment of such privileges. Some small proportion of the more abject savages were attracted by the mere opportunity of loot. These were easily defeated, though the watch against them was a constant care and harassment. They included the few pirates of the North Sea and the cannibal inhabitants of Scotland. The vast majority of the Barbarians were not of this kind. They were men thoroughly acquainted with the advantages of Roman citizenship, men many of whom (in the case of some groups the majority of whom) had served in the Roman armies and who desired the privilege of being Roman rather than the fruits of destroying the only civilization they could conceive. Moreover, the total number was small, and especially small were the numbers of those who achieved political success. First of these in the history of Gaul come the Salian tribe of whose confederation was that limited and fairly definite race which still inhabits the district immediately to the north and west of the Waloon belt of French and Belgian Flanders. The social and even the military organization of Northern Gaul was in dissolution, when, in 1481 a lad whom history calls Clovis and whose actual name may have been spelled in any one of twenty barbaric fashions, inherited the leadership of this little clan. Five years later as a boy of 20 he led them across the border, defeated another body of Barbarians, organized as Roman soldiery, and through the organization of the Church,—notably of the great See of Reims, was permitted to occupy executive rank. It must not be imagined that this, more than any other of the numerous small incursions of the time, violently struck the imagination of contemporaries, still less that it affected the general life of the people. Writs were issued, taxes collected, civil and religious ceremonies performed in the same way, whether the man nominally at the head of the Executive in a province or a district happened to have been born within or without the Roman pale. For quite two centuries this distinction had been of little importance. The new features accompanying the end of the 5th and beginning of the 6th centuries, were merely, first, the advent of a certain though small number of independent warriors who could not be fitted into any known part of the Roman organization (and who were not technically legionaries nor technically Roman officials), and secondly, the break down of the provincial system. City, in the lack of a central power, stood apart from city, each looking to its own affairs. And any petty chieftain, such as Clovis was, would claim to gather taxes, issue writs, enjoy the luxury of the palace, not as the governor of one definite traditional district, but of just so many municipalites as he had troops under him to occupy. It goes without saying that these newcomers at once accepted the religion of the civilization they found, as they did every other of its habits. There was however, one feature, which seems to us of supreme importance, and which the Roman civilization of that date seems to have regarded with indifference: this was the feature of popular language. Semitic dialects lingered unmolested in Northern Africa at this time. And it was a matter of regret to no one or even of curiosity to the learned, whether such a man as Clovis or Theodoric could or could not express himself in Latin. Latin was the only possible tongue for the work of government, for the law courts and for literature. A thousand dialects, Celtic in Britain, Iberian in the Pyrenees, Teutonic in the Rhine Valley, Punic in Africa, which diversified popular speech, played no greater part in the life of the time than private tastes in reading or in cooking do today. Yet the existence of such dialects has warped and distorted the history, especially of Gaul, in that many historians of imperfect information, reading every sentiment of their own time into the past, have seen in language the test of a society, and as we shall discover in a moment, have even made of such a figure as Charlemagne a sort of modern German nobleman.

In this Gaul then, which remained as purely Roman as before, with no perceptible admixture of new blood, and with no change in the methods of government save a gradual weakening and coarsening of them, Clovis established himself in executive power over the municipalities of the North and East; having, that is, the right to issue writs in his name, to gather the dwindling taxes, and to reserve for his part the luxuries and the honors traditionally incident to the position of a great Roman official. For more than a century, till the advent in 628 of Dagobert, the great-great-grandson of Clovis, this local executive power is as vague and changeable as can be. It depends upon personal prowess in battle. Now the petty kinglet in the North stretching his nominal power almost to the Pyrenees; now the whole territority is divided among brothers; now there is an alliance with other Teutonic chieftains of the Burgundian or Visigoths in other parts of the territory; now for a moment the whole is united again in one hand. Save as concerned landmarks, the lives of these Kings are unimportant. The social fact underlying the whole business is the dissolution of one portion of the Roman organization and the survival of another. The portion which dissolved and whose instruments of power became first nominal, then merely legendary, was the central authority and the army upon which it had reposed. The portion which survived and which even increased in strength as the darkness of the time deepened, was the municipality, and above all the clerical organization based upon the municipality.

Meanwhile, like any great body that has gone through a sharp readjustment of conditions, the western districts of the Roman Empire by the 7th century began to organize a new and a debased but yet a stable life. The conditions were these: Britain had been for more than a hundred years quite cut off from the Roman world and the Eastern half of it nearly ruined by pirates. Africa had been overrun by every sort of wastrel, escaped slaves, nomads of the desert, starving peasants, and criminals, gathered round a small nucleus of wandering Teutonic Barbarians called Vandals. It had been temporarily regained by the Imperial power, but was never again the orderly and civilized province which it had been for 700 years, and was destined in the next century to be permanently effaced by the Arab invasion. In Spain and in Gaul the Roman municipality endured, and little bands of Teutonic raiders had established their chieftains as nominal heads of the Executive power. Men had settled down to this conception of the world as to the obliteration of the old central authority; they were long used to seeing upon their parchments the curious names of Germanic origin which had replaced those of the Emperors. Letters and arts had so declined that the past had become a fixed standard of excellence, the attainment of which was despaired, when the ruins of the old Roman order began to group themselves again into something of a stable (though of a coarsened and much lowered) civilization which is generally called that of the Dark Ages. And by an historic accident this civilization was nowhere fully preserved save in Gaul.

This accident was the successful Mohammedan invasion of Spain, a catastrophe which left Gaul the only intact Christian unit, and therefore the only seed plot in which the tradition of civilization could hold its own and be preserved.

Britain was hardly yet re-christianized, and civilization had but just begun to strike its new roots. Theodore had but just organized the Church in that island, and it was still a mass of little warring districts, when Taric landed upon the shore which still retains his name under the Rock of Gibraltar, in 711. In two years the Mohammedans were at the foot of the Pyrenees, and the whole intervening plateau with its Roman municipalities, its organized hierarchy, its European traditions of 900 years, was subject to the Asiatic.

The consequences of this disaster were enormous. The Western Mediterranean, the common highway by which Roman influence has welded all Western Christianity together, was henceforward Mohammedan. Its islands were open to perpetual invasion, many of them to regular occupation (the Balearics were not recovered by Christendom for over 500 years!); every seaport which had escaped actual conquest was open to perpetual insult; Italy, already a mass of independent localities, now lay as to its southern half, open to influences the most antagonistic to those of Rome; Rome itself might henceforward almost be called a frontier town; the balance of the great provincial system was destroyed, and a general observer of history who should not be acquainted with what was to follow might imagine that after this blow Christian civilization and all the traditions of Rome and the West could not but perish. As a fact, by a process with which this paper has not to deal, the indomitable energy of the Spaniard reconquered the Iberian Province and slowly re-established the civilization which we now enjoy. The debt we owe to the crusading spirit of Spain is not calculable; but for it there would not to-day be what we call Europe; its learning and its religion would have perished. As it was, for many hundred years, with Britain hardly civilized, Spain lost and Italy distracted, Gaul remained to the close of the Dark Ages the one intact remnant of Europe.

Meanwhile there had been proceeding in Gaul itself a transformation in the nature of political authority which was destined to have very wide-reaching effects. The spirit of the municipalities, organized and aided by the Bishops, had restored a conception of National unity, and the Frankish Kings were at the head of that unity, the nominal centres from which a political power, debased but still Roman, proceeded. These kings were manifestly unequal even to the moderate task of governing the decline of civilization. The great landowners who formed by this time an intimate mixture of Roman and German families, grew more and more important as communications became more difficult. Chief among these land-owning families was one which had acquired an hereditary position of predominance in the palace. This family had originated in a Roman noble of the territory of Narbonne, nearly 300 years before, but as was the case with nearly every other great Roman territorial family of Gaul, there had been continual intermarriage with families of German-stock, and prior to the Mohammedan invasion of Spain this family is found having its principal seat in that one of its many estates which lay in the eastern part of Gaul in the boundary of German-speaking territory. It was therefore, in the language of the time, an Austrasian family, for the French monarchy was roughly divided into Neustrian or Western, and Austrasian or Eastern, though these divisions did not correspond to anything in race or language, but were convenient categories in which to reckon the topography of the scattered estates. This family was already virtually ruling in the place of the king when the great head of it, Charles, led the combined Gallic forces against the Mohammedan invaders who had passed the Pyrenees in 732. This horde of Asiatics, crossing various parts of the chain of mountains but proceeding mainly by the middle road of the Imus Pyrenæus, sacked the cities of southern Gaul, were turned northward by the resistance of Toulouse, passed through Poitiers and were marching upon Tours and the North when Charles Martel (Charles the Hammer) met them on the plateau of Dissay about half-way between the two towns. Their force was completely destroyed and Europe was saved. The son of Charles, Pepin, was still more patently the head of the State, though for several years he refused to accept the crown; and it is under him that Gaul appears as the protector of the Papacy, an institution which French military power was to support continuously for the next five hundred years. It was not only at the call of the Gallic municipalities and the hierarchy, but also by the direct sanction of the Pope that Pepin in 752 accepted the crown. He died in 768, leaving, as was so constantly the barbaric custom of the time, political authority divided, between his two sons Charles and Carloman: the latter died in 771, and Charles, now 29 years old, became the sole ruler of the great territory which was now the only unbroken piece of the ancient empire, and the only one subject to any sort of central authority; around it upon all sides, in Britain, in the German Marches, in the southern valleys of the Pyrenees and of the Asturias, in Northern and Central Italy, was a confused mass of petty lordships, and beyond that again the external belt of enemies of the Christian faith and Christian civilization, the savages of Scandinavia and of Central Germany, the Mohammedan power of the South. The great Charles, therefore, whose title in history is Charlemagne, stood upon the defensive, as it were, throughout his long and glorious life, holding an island of Christendom against the pressure of these external forces. His defence was successful, and that long respite permitted Christendom to accumulate just so much strength as was sufficient in the next century to repel, though hardly to repel, the final assault of the anti-Christian power.

The reign of Charlemagne extends over 46 years, 43 of which he enjoyed as sole sovereign after the death of his brother, and during the last 14 of which he had mounted to that miraculous position which earned him the title of Emperor of the West and has caused him to fill not only the legends of Europe, but also, as with an original light, all the beginnings of modern European history. His period, therefore, is one of the many of which we can say that the uninterrupted presence of one man at the head of a State for a long period gives that period a peculiar unity and significance. This is often true when the man is merely a symbol; it is particularly true in a semi-barbaric condition of society, when the man happens also to be of military virtue and a successful warrior. That the personal character of Charlemagne determined this wonderful episode in French history, it would be an exaggeration to say, but that personal character made the episode possible; these 40 years and more are full of his individual effort, and they have something personal and epic about them, like the eras which lie behind recorded history at the origin of every civilization.

He was 26 when his father died. Before he was 30 he had determined to extend civilization into the Saxon forests, and he had begun to do so. In his 32d year he crossed the Alps; in his 33d (in 774) he destroyed the power of the Lombards in Italy, and for the second time confirmed, as his father had confirmed, the temporal power of the papacy. The next year he was back again in North Germany, and the next year again in Italy once more; the year after that, for the third time, he was conquering among pagans of Saxony, and this time received at least the oath of their reluctant allegiance. The next year he was off again over the Pyrenees, negotiating with, pressing back, harassed by, but checking, the Mohammedans. The Saxons rose behind him; he hurried North again. In 781 he is yet again in Italy. He was not 40, and these first 14 years of his had been as full of violent and successful war as were the first 14 years of Napoleon. This elegy of rapidity and success, backed by a sort of renaissance of the Gallic spirit, so powerfully struck the imagination of the time as to make him, even in that period of rapid decay or transformation, the necessary leader of a united Christendom. It is from these swarming campaigns that the first new songs, or rather epics, of our modern Christian civilization drew their inspiration, notably from that check or defeat of his rear guard in the pass of the Imus Pyrænæus as he was retreating from Spain, a disaster in which his nephew Roland died, and from whose memory sprang the noblest of Christian poems, the 'Song of Roland.' On Christmas Day of the year 800 the culmination of these campaigns saw him crowned in Rome by the Pope, Emperor of the West. The old title thus revived was but a symbolic name. He himself could exercise central and imperial power in a manner only distantly resembling the old Roman model upon which his title was based; and in the century that succeeded him that title became little more than a name. But it can be said with regard to the title itself and to his individual occupation of it, that it revived just before the memory of such an institution would have decayed, the tradition of an Europe united under a military head. That tradition has never wholly disappeared, and, fantastic as such a prophecy may seem to-day, the future may very possibly see it revived.

The remaining years of his life, though all around the frontiers of his empire the last effort of anti-Christian forces was ready to be made, were full of a sort of tranquillity and splendor which the insufficient knowledge of the time might vaguely compare to the ancient authority of Rome. He died 28 Jan. 814, at the beginning of his 72d year, and was buried exactly upon the confines of the two languages which he spoke, upon the limits of the civilization which he had preserved, in the old Roman watering-place of Aquæ, called since his time Aix-la-Chapelle, his favorite residence. There, in a church long since rebuilt, under the influence of mediæval French architecture, he still lies, surrounded by modern architecture more appalling than most that is to be discovered even in the rapid industrial development of North Germany in our time.

The experiment to which Charlemagne had devoted such energy, and in which he had achieved such success, turned out both at the time and in the judgment of long future generations far more than he or his coadjutors had intended. The vigorous and united symbol of

Christian and civilized Government which his reign had afforded served as a bridge. It prevented Christendom from too much forgetting (though it necessarily largely forgot and blurred) its Roman origins, and it afforded also a halting place to which the Trials and the new youth of Europe could look back in succeeding centuries. The reign of Charlemagne is like a holiday, or like a light in the night. It breaks the continuity of the dark ages, and largely through his intellectual vigor enables us to understand the transformation of Europe from the antique to the modern.

In spite of these qualities in the time, the vital forces of Gallic civilization were still declining. Men built less well and thought less well from year to year, and when the omnipotent Chief of this military episode had died in 814, there broke upon what was left of civilization the heaviest storm it had hitherto endured. In that storm Europe, and therefore its surviving centre in Gaul, was nearly overwhelmed.

The pagan tribes of Scandinavia, a fresh horde of Mongols, a renewed splendor in Islam, all fought together against the Christian name. It was a far stricter ordeal than were the barbarian invasions of the 5th century; indeed, there was but little relation between these infiltrations of that period and the savage attack of this. The numbers were far larger, the opposing forces of civilization were far weaker, knowledge and discipline by which alone civilized men can resist barbarians were at their lowest ebb.

The issue had already been joined in the British Islands by the beginning of what are known as the «Danish Invasions.» Some 30 years after the death of Charlemagne it menaced what was left of the Christian continent, and with the close of the 9th century it came to a climax. In that whirlwind two things of vast importance to the future of Europe occurred. The first was the military success of a Christendom absolutely united in religion; the non-Christian was beaten off by men of one faith and one ritual and of one immutable manner of thinking. The second was that so much was forgotten and so many traditions lost in the struggle as to necessitate the growth of a new society. It is in this close of the 9th century that the old owners of the land, mainly Roman or Gallic in ancestry, become territorial lords. It is in this period of darkness and upheaval that the long process of independence is at last achieved, and that the village communities with their chiefs finally adopt those groupings for self-defense which are later called the Feudal System, and it is in this period that the subconscious national groups of Europe take on conscious form.

Two points of Western Europe determine the struggle in favor of our tradition and of Europe. These are the southwest of England, Somersetshire and Berkshire, in which Alfred outlasted the savage invader and finally defeated him; and Paris, where, just before, the local forces had beaten back the same enemies in a memorable siege in 885.

The second alone concerns these lines.

To understand the city of Paris is essential to anyone who would understand the history of France. The town has played for a thousand years the same part in the Government of that country that the English governing class or plutocracy have played in Britain since the Reformation. Thence have orders proceeded; thither has intelligence flowed, and there has been fixed that specialized organ of administration, round which all national development gathers, and which, though it has many names in many polities, is a necessary nucleus to every great nation.

Paris had risen to its great position through the waterways of northern France. In the breakdown of Roman order the disuse of the roads and the collapse of the posting system had increased the importance of the rivers in a nexus of which the city found itself, and from the last Roman emperors it had maintained a sort of special place, not as a capital (for there was no such thing), but as a chief town—the town of Clovis and of the early kings, the town in which the early Carlovingians came to die and in whose shrine they were buried.

The local chief—who stood the siege of 885—was by name Odo. Of the ancestry of his father Robert we are not over certain, but from that father and his descendants sprang that line of men who symbolized the rejuvenescence of Gaul when the struggle was over, and in whom centered that which was at once the symbol and the organ of the new nation: the Monarchy.

Robert the Second, the brother of Odo, was, like Odo, elected to a rough kingship, in the contempt which all felt for the decaying idea of the Carlovingian Empire, and the grandson of this second Robert, Hugh, was formally crowned at Noyon, and the separation of French Government from the mass of Europe was complete.

From that moment, for exactly 800 years, to the assembly of the nobles under Louis XVI., the monarchy, retained in one house, perpetually increasing its power, is synonymous with and develops the consciousness of the nation. This date, 987, stands as the second landmark in the history of France and our first business before entering the story of that great development is to consider how Gaul looked when the first of its nominal Chiefs was crowned.

Beneath the various episodes which have been described beneath the great names of Clovis, of Dagobert, of Charles Martel, of Pepin, of Charlemagne, of the Robertian House of Paris, whose principal descendant, Hugh, we have just seen crowned, a slow but complete molecular change in society had taken place. The old Roman order had not only decayed, it had also been internally transformed in the 500 years which intervene between the invasion of Clovis and the crowning of the first French King. The slaves of the old Roman landed estates, though still legally slaves, were no longer bought and sold; they had become Christian freemen; the old Roman landed estate had become Christian village and parish; in the breakdown of communications and of learning, agriculture had become, as it were, the sole industry of men. This agriculture had grown to be neither an individual nor a servile, nor what we should call to-day a capitalistic industry, but a co-operative one. The old Roman landlord was now no longer the possessor of the whole territory of a village; only a portion was reserved to himself, and the village population beneath him had grown by centuries of custom and of cohesion to security of tenure and to fixed and customary payments of labor in the place of that surrender of all their energies which their former servile condition had implied. The vast mass of the population, therefore, lived as perpetual holders of land at a fixed and customary due of labor or what-not paid to a local superior; they cultivated the fields together, but apportioned the result in proportion to their respective holdings. The lord with his much larger holding, as he was the richest among them, was also their protector, and, in a modified way, controlled by tradition and by the assessment of his own tenants, their judge. The village so organized was a microcosm of the whole of society. For centuries the noble class, the men descended from the old Gallo-Roman owners of land and of slaves, had tended more and more to regard themselves also as tenants whose absolute ownership, though absolute, was part of a social system involving superiority, social and executive, in some greater man among their number. They had coalesced in groups, usually under the largest landowner of the district, during the pressure of the Barbarian wars; the man owning but one or two villages would «recommend himself» to some local man owning ten or more, and he in turn to some very wealthy personage of the countryside who had accumulated by marriage or inheritance the dues and the lord's portion of, let us say, a hundred villages. And long before the Carlovingian line was extinguished or the new Capetian line was acknowledged, society had become a complicated territorial system with the tenants of the village dependent upon but secure under the village lord, and with the village lords forming indeed one noble class, but arranged in a hierarchy of dependence from the small man, who was but lord of one village, through the big local man of the countryside, up to the overlord of a whole province. What determined the size of these provinces it would be impossible to say; some, like Normandy, were but an old Roman division which had maintained its boundaries; others, like the March, in the centre of France, were vague to a degree, built up of intricate local traditions and customs, and in dispute with their neighbors for all except the very centre of their dominion. Some were quite small, little more or less than a bishopric in extent; others were virtually independent kingdoms, like Brittany; but of all it was true that they formed the true sub-units in the general national unity. The particular house which had been given the symbolical and nominal headship of the nation under the title of King, were the dukes or local overlords of the Isle de France, a territory of which Paris is the centre (they were the lords of Paris, as we have seen), and which extends, roughly speaking, for three days' march round the city. To this house, once the head of it was crowned, the other great houses swore fealty, thus completing the hierarchic system which in its complete later and legal form was called *feudal*. It must not be imagined that the system was as yet symmetrical, even in theory. Not all the efforts of the lawyers during the next three centuries, the 11th, 12th, and 13th, while it was still quite vigorous, could make a thing of such obscure and natural origin symmetrical. But the general arrangement of society, the small farmer secure on his holding under his lord, that lord under a wealthier man of the same countryside, he again under a Duke or Count of the whole province, and he again swearing fealty to the King, who was the symbol of the National unity, is the great social fact we must keep in view if we are to appreciate the development of modern France out of the Dark into the Middle Ages.

This family, the overlords of the Parisian centre who had been crowned King, for a century did nothing but accumulate in their hands more and more manors, and cultivate by an instinct those remaining forces of civilization, the municipalities and the Church, which everywhere unconsciously strove to reproduce the old Roman order which had so nearly disappeared in the Dark Ages. To Hugh, in 996, succeeded his son Robert; to Robert again in 1031, his son Henry; to Henry, in 1060, his son Philip, and to Philip, at the opening of the 12th century, succeeded, first in actual and next in theoretical kingship as well, his son Louis, «the Fighter,» with whom a new expansion of the power of the Crown begins.

Thus four men, each in direct succession, each crowned coadjutor during his father's lifetime, each arriving at the throne in the vigor of his manhood, for well over a hundred years secured the continuity of the new experiment. None save Hugh was remarkable for domination; Robert rather for piety, Henry for a quiet tenacity, Philip for debauch; but all, to some extent in spite of themselves, were accumulators of territorial wealth and influence, and every social influence of the new time worked upon their side. That time, the 11th century, was one in which the energies of Christendom suddenly awoke. No new forms were discovered for it, the old architecture continued, the old customs were observed; but everything from the Rhine to the Atlantic, and from the Tagus to the Channel, was boiling with a vigorous and novel life destined to bring forth the Middle Ages. The advance from the Pyrenees against the Mohammedan begins in the generation just after Hugh Capet's crowning, and the entry of the Christians into Toledo is effected within that hundred years. It is the time when the curious phenomenon of cross-breeding, the vigorous, unique but ephemeral «Norman» race comes into being, spreads civilization through England, conquers, unites, administers, and forever attaches to Europe and separates from Oriental influence the South of Italy and Sicily. It is the time when consonant to the necessities of such new vigors and such new light, the Christian Church redefines its unity, cleanses and organizes all its machinery, and imposes a working discipline under the advice and, at last, the papacy, of Gregory VII.

Many new phenomena advance in parallel, all connected with the general advance of the time, but each following its own path. Architecture does not change, but is everywhere pursued with magnitude and vigor; men are still ignorant of the world outside the Western Christian unity, but although definite learning has not yet been organized, curiosity is wide-awake; and the municipalities which had remained so long anomalies in the agricultural system, osseous relics, as it were, of the old Roman structure, begin again to live everywhere by an independent life. The new roads are not yet built; men still march along the old decayed Roman highways, or make use of the river systems or of the sea; land is not yet bought and sold;

no universities are yet in existence; no Gothic arch has yet been built; vernacular speech is but a tentative beginning, unknown in England, very local and disparate in France, in the Spanish kingdoms and in Northern Italy; no representative system has yet met (save among the clergy), but all these things, the representative system, the Gothic architecture, the universities, vernacular literature, are in seed and are germinating during the 11th century. The outcome of these various energies, their climax, and at the same time the event by which they were to be made fruitful, was the Crusade. The long example of the fighting in Spain, coupled with the unrest of the multitude and with the critical condition of the Eastern pilgrimage, had kindled a flame, and there poured out in successive hordes, mainly from Gallic territory, a host on the march for Jerusalem, the latter and organized portion of which must have been as numerous as that with which Napoleon invaded Russia, the unorganized forerunners of which may have numbered a million souls. Established by the papal sermon of Urban II. in 1095, equipped in the next year in the Summer, they trailed out in a prodigious raid of over 2,000 miles, and three years later, 15 July 1099, the remnant that had survived or persevered stormed Jerusalem and established for close upon a century the curious French experiment of a Christian outpost against Asia, established in French castles, defended (in such a climate!) by French armor mounted upon French horses, in the isolated belt of Palestine and of the Levantine coast.

The effect of that march was overwhelming; the sudden expansion of experience, the awakening of the mind, which accompanied it, produced the Middle Ages. And when from 1100 to 1115 such lords as had not established themselves in the East returned to Gaul, they discovered the monarchy renewed, and the National movement in full strength under the vigorous personality of Louis, who, though the first of that name in the Capetian line, called himself, in memory of the Carlovingians and of the Merovingians, «the Sixth.» The towns, the hierarchy, the populace, everywhere seconded this re-founder of the monarchy, and when he died, in 1137, his son Louis succeeded, heir to an executive power which was no longer founded upon territorial possession nor merely the nominal feudal bond between the great overlords, but possessed a military power of innumerable garrisoned fortresses, of a legal corporation actively allied to the Crown, and of market-towns and great cities which throughout the territory of Gaul were prepared increasingly to insist with every new generation upon the power of the King of Paris in whom they saw the living figure of the nation.

Now, at the end of the first third of the 12th century, France and Europe were fully awake. A whole generation had grown up accustomed to territorial expansion (it was a generation since the Christians had entered Toledo and a generation since the first Christian king of Hungary had died; a generation since civilization had re-entered England and a generation since the first Crusade had brought the West into touch again with the East and had begun again to teach the Christians of the Mediterranean the uses of the sea. It was a generation since the papacy had become a free and self-organized thing, elected from within the hierarchy, and a generation since unity of discipline had been established throughout the West by the powerful will of Gregory VII).

The first effect of the new life was the awakening of intellectual discussion, and of this discussion France, and Paris in particular, were the seat. It turned upon the fundamental problem of all philosophy, the reality of ideas. It had for protagonist Saint Bernard upon the orthodox side, and, in a manner which pretended to compromise but which was really opposing, the brilliant genius of Abelard upon the side that would have led to schisms and perhaps at last to the negation of God. That debate consciously or unconsciously is still in progress; the affections and sympathies of the two parties are to-day much the same. Out of it arose as its first fruit the University. Paris began to found those colleges and to group them into that united organism which soon became the great European model for the collegiate university. Parallel with the growth of a new curiosity came in the same place and from the same people the marvelous symbol of Gothic architecture. Suger, the abbot of St. Denis, the friend and counsellor of King Louis VI., and in a sense the guardian of his son, was the first to light the flame. The south tower of his façade is the first bit of true Gothic in Europe. The same masons who had built it in their youth might have lived in their late manhood to see the beginning of Notre Dame; and with Notre Dame, the first great Gothic building of Northwestern Europe, the style was fixed.

All this movement and advance corresponded to the reign of Louis VII., the son of Louis VI., and to that middle period of the preceding century which is marked by «the Second Crusade,» and in which it was increasingly felt that the French hold on Palestine was doubtful and precarious. This reign was of great length; it stretched from 1137 to 1180; its central episode, the Crusade, was undertaken upon the news of the fall of the frontier fortress of Edessa; it occupied the two years from 1147 to 1149, consisted in a futile attempt to take Damascus, and did little other than weaken the prestige of the Christian name in the East.

As has already been pointed out, not only the Crusades but the new movement and expansion of Europe, the reflowering of civilization had necessarily helped the growth of the power of the Crown; that power, apart from the ceaseless support of the clergy, the lawyers and the towns, reposed upon two territorial bases, the King's political position as superior over the great provincial lords, and the King's economic position as private lord over a number of manors and countrysides. In the first of these he could grow only by the growth of an idea, but in the second he could grow in a material and actual manner. Already the crusading movement had led in Louis VI.'s time to the crown's becoming direct lord of the province of Berri, and thus obtaining direct possession of a district south of the Loire, and in a vast number of minor cases, only a certain proportion of which even are recorded, the commercial and military movement of the time was letting isolated manors and lordships fall by escheat, by confiscation, by disputed possession, and in general by the active presence and effort of the lawyers, into the King's hands; and with every new step in the power of the kingship, the consciousness and unity of the nation increased also.

An accident coming immediately after the second Crusade, an accident which for the moment seemed to check the rise of the Capetian house, proved within half a century the main factor of its definite establishment. The heiress of the crown of England, Matilda, the granddaughter of the Conqueror, and widow of the German Emperor, had married the lord of the great province of Anjou. Her son, Henry, landed as a boy in defense of his mother's rights against Stephen of Boulogne who had contested the English succession and was acknowledged heir. In 1154, therefore, by various relationships Brittany, Anjou, and other lordships, were in the hands of a young and vigorous soldier who also became King of England and Duke of Normandy. Or, to put it as the French lawyers saw it, the Dukes of Brittany and Normandy, the Count of Anjou, etc., were all merged in one person, and that person was the powerful King of England. Nor was this all: The vast territories of Aquitaine, a feudal overlordship which, roughly speaking, comprised all the southwest of France, had ended in the hands of an heiress, Eleanor; the male succession had failed. Eleanor had first been married to Louis VII. of France, and had accompanied him on his crusade; her desperate character had led to a divorce, and immediately upon its pronouncement at Rome, Aquitaine, after its momentary union with the crown of Paris, fell into the hands of this same young claimant to the crown of England, for the divorced woman married him. The position, therefore, on Henry II.'s accession was this: that the feudal lordships of all Gallic territory west of a line drawn roughly from the centre of the Pyrenees to the neighborhood of the mouth of the Somme were in the hands of one man, and that man the King of England. In pure theory the French crown stood as it had stood before: it was still overlord of the whole, and Henry of England had to do homage separately for each province; but in practice three things gravely modified this theory. First, the united control of territories which in the aggregate formed two-thirds of French territory; secondly, the fact that these two-thirds included the maritime and commercial portion of every single great French river (Rouen, Nantes, Bordeaux, were all within Henry's boundaries) and thirdly, the complication by which these maritime provinces were in the hands of an island king. There is little doubt that if the relationship had endured for a couple of generations, its theoretical side would have weakened to such a degree that the Capetian power would have dwindled to a shadow and very soon a Plantagenet would have ruled in Paris. It did not endure. When Louis VII. died in 1180 he was succeeded by his son Philip Augustus, a man in whom the energies and the clear judgment of this new birth of civilization seemed to centre. It is evident that from the beginning of his reign Philip Augustus's great object was to destroy the overwhelming position of the House of Anjou. Fissures were opened in the great fabric by the perpetual revolts of Henry's sons under the impulse of their mother, a curse to her second, as she had been to her first, husband. The fall of Jerusalem in 1187 led to a third crusade. The old king Henry died; his son, Richard I. of England, still nominally the Lord of all these territories, went to the rescue of the Holy Land as did Philip Augustus himself. Richard was imprisoned on his return; the French king intrigued to prolong that imprisonment, and though he failed, fortune was on his side when Richard I. died at the siege of a castle in 1199, leaving England and all the French lordships to his brother John. The opportunity afforded by John's character was exceptional; his premature regency, his license, the envy aroused by his cultivation and his prowess, united against him the feudal aristocracy of England. The claims of Arthur, his nephew, the heir to Brittany, and in strict right his senior in succession to all the territories, coupled with complaints due to his marriage with the betrothed of the Count of la Marche, and the rising of Poitou, gave Philip Augustus a pretext for summoning John as feudal inferior to clear himself before a court of his peers. He failed to do so; his land was declared forfeit; the claims of Arthur were pressed. This was in 1202. In the war that followed young Arthur was captured and shortly afterwards disappeared. John was accused of the murder, and the powerful armies of Philip were supported by the general indignation of Europe. By the end of 1205 only a few towns near the seacoast remained in the hands of the English king. Though the physical conquest of the Angevin territories was thus achieved, the victory was not really ratified till 1214. In that year John, the best diplomatist of his age, rallied against Philip Augustus all the forces which it was possible to bring, moral and material, into the field. The Count of Flanders, against whom Philip Augustus had resolutely set the Roman municipalities of that district, the German Emperor, and the sympathy of the papacy were marshalled in this critical month of July against the French Crown. Philip Augustus won a decisive victory. It was not only a decisive victory for the French Crown at that moment, it was one of the very few battles in which history may be said definitely to have marked the success or failure of a great historical cause, and it affirms for 600 years the power of the French monarchy and for a much longer and indefinite period the unity and existence of the French nation. It had also its reaction upon England, for the aristocratic insurrection against John was emboldened by this defeat of his to press on to the consummation of Magna Charta.

Meanwhile yet another factor had entered into the rapidly growing consolidation of the Capetian hegemony. The Albigensian Crusade had been undertaken and had succeeded.

Contact with the East has invariably produced upon Western Europeans an effect which may be compared with the effect of a spell, and usually of a maleficent spell. Its effects may be clearly observed in those modern nations which have the misfortune to be intimately mixed (especially if their governing class is intimately mixed) with the Asiatic. Oriental customs and vices and Oriental weakening of European health enter in with too much knowledge of the East. The Crusades, now a century old, had cast such a spell over the highly civilized townships of the South of France, and a confused mass of Oriental customs whose origins or nucleus had in the town of Albi overspread the County of Toulouse and its surrounding territory. The danger grew with startling rapidity; the Pope called against it the military power of the overlord, the Northern barons especially answered the call; the fight began in 1208, and the re-establishment of Christian unity and civilization was effected within four years. This campaign, which in the eyes of contemporaries was mainly a campaign for the unity of the health of Christendom, has for these notes the particular importance that it converted what was already a nominal into a real supremacy of the power of Paris over the southern portions of Gaul. The date 1215 may be taken as the term of all this development. England was now pledged to an aristocratic policy which would weaken the growth of a great civilized state. The Lateran Council had affirmed, in its most determined form, the framework of mediæval Catholicism, the Capetian crown had triumphed over all its enemies at Bouvines, the South was definitely in the grip of the monarchy; and on the southern frontiers of Spain the great and successful fight of Navas de Tolosas had extinguished forever the threat of the Mohammedan. Henceforward Islam dwelt only upon sufferance between the extreme boundaries of Andalusia. In Paris, the Louvre, the symbol of the established monarchy was built, and round the city the great new wall, built at civic expense, was the symbol of that new mediæval civilization which was in a way the resurrection of the Roman municipality. The university was chartered and active; the epoch of the 13th century, the climax of the French race and certainly the climax of European development between the Dark Ages and the Renaissance, had come to flower. Philip Augustus died in 1223. The three short years of his son Louis VIII. were mainly distinguished for a triumphant march through the South, and in 1226 the personality who stands most for the 13th century in Europe and in France, that of St. Louis, the grandson of Philip Augustus, was seated upon the throne.

He was but a child, under the tutelage of his mother, Blanche of Castille, but even during the period of her guardianship, which was troubled by civil war, as such minorities invariably were, the power of the Crown was but the more confirmed; and from the time when the King was of age until he undertook in 1248 his first crusade, there was established by example and by vigorous action, so absolute a strength in the monarchy that all the defeats and vicissitudes of the next 200 years were unable to shake it. It had acquired a sanctity that was almost legendary and an actual force which made it coincident with the National life. The crusade of St. Louis was directed against Egypt, for Palestine was now a dependency of Cairo and the recovery of the Holy Land could only be accomplished by the reduction of the Mohammedan power upon the Nile. The five or six years during which the effort lasted were, upon the whole, unsuccessful. St. Louis returned in 1254 with a vastly increased reputation, by far the chief figure in Europe, but there remained of the old French garrisons in the Levant nothing but a few port towns at the mercy of occasional sieges, and doomed to ultimate capture. The 16 years that followed were years of quiet and successful administration, during which the most interesting experiment was that in which St. Louis, after defeating Henry III., the English King in the South, granted him a narrow territory in that region as the price of what was imagined to be a lasting peace. The King, though long past his 50 years, was moved in 1270 to another crusade. The attempt this time was made against Tunis, but at its very inception St. Louis died on the spot that is now marked by his chapel at Carthage. It is possible that the expedition to Tunis was suggested by the position of his brother Charles of Anjou in the south of Italy, for Charles, who 25 years before had married the heiress of Provence (thereby still further increasing the power of the House of Paris) had been called in by the Pope to combat the last efforts of the German Empire in Italy, and held for the moment, but only for the moment, the sovereignty of Sicily and of the Kingdom of Naples. The massacre of the French in Sicily in 1282 put an end to his power, but it did not afford any opportunity for the interference of the Empire with the papacy or with the affairs of the Italian peninsula. With the fall of the last Hohenstauffen, the mixture of the Germans in Italian affairs comes to an end forever and the anarchic welter and ill-organized conception, which had called itself for the last 300 years the Empire, meant nothing more in future but a loose confederation of shifting Teutonic lordships. The Valley of the Rhone, over which a German executive power had nominally existed for so long, though not yet technically subject to the French king, was now virtually within the orbit of which Paris was the centre. The reign of Philip III., son of St. Louis, from 1270 to 1285, contains little of moment. His son Philip the Fair, who came to the throne in this latter year, marks, despite evident signs of internal decay, the summit of the material power of this first unbroken Capetian line. His mother, the heiress of Navarre, brought to the Crown that kingdom or province. His long struggle with the papacy ended in the capture of that institution, the election at Lyons in 1305 of Clement V., and the presence at Avignon of French popes for 70 years. He had the strength to destroy the gross and highly dangerous power of the Templars, a military order which had grown to be an immensely wealthy secret society upon which the just execration of the European populace fell from every side. When he died in 1314 it seemed as though no further advance could be made in the strength of the French sovereigns. Yet it is from that date, or shortly after, that the chief peril of the Nation and of the House itself must be counted. For Philip the Fair left three sons; and, by a catastrophe hitherto unknown in all the three centuries which had seen the rise of this great family, a direct male heir to the succession failed. These three sons, Louis X., Philip V., and Charles IV., each enjoyed a brief reign, and each failed to leave a son who should succeed him. The whole course of the three reigns covers no more than 12 years, and the only chance of a direct succession lay in a man-child, John, who died within a week of his birth. Charles IV. did indeed leave a daughter, but the tradition which had strengthened for so long and whose example had been so glorious, by which a male heir alone could succeed, led through a curious legendary fiction or memory, embodied at last in definite constitutional terms and called by the name of «the Salic Law,» to the rule that only a man should succeed to the throne. The nearest male heir, therefore, if this baby daughter of Charles IV. were to be set aside, was the first cousin of Charles IV., Philip of Valois. Philip the Fair's brother Charles had been granted the title and position of Valois. It was his son who now laid claim to and immediately mounted the throne in the year 1328, 14 years after the death of his uncle. The Capetian House had proceeded without check from father to son in the virtual control of the town of Paris and the Duchy of France for more than 400 years. For 340 it had held that position with increasing magnificence, the son regularly succeeding the father, and crowned in the father's lifetime. It had at last come to be the strong ruler of a great and united nation, a nation which was the centre and core of mediæval civilization. It was impossible that so great a change, though it were but the accession of a near collateral, should pass unchallenged, and the challenge came from Edward III. of England. There was no claim worth calling a claim upon his part to the French throne, nor is it absolutely certain that at first he put forward the plea of blood. To inherit at all he would have to inherit through women, and even so he did not stand first in the succession. The policy of the French King in Flanders, his harassing of the great English trade with the ports of the Low Countries, afforded a pretext in 1336. In 1337 hostilities broke out; in 1339 the English King, Edward III., quartered upon his shield the lilies of France, which were not finally abandoned until the middle of the 18th century. And from that year may be said to date, in legal and heraldic theory at least, the struggle of the Hundred Years' War.

The epoch or trial upon which the French next entered, that of the Hundred Years' War, falls into two very distinct parts: In the first part, which corresponds roughly to the second half of Edward III.'s reign in England, successful and brilliant raids terminate in startling victories, and the French crown consents to abdicate a portion of its territory. During this first part of the wars, the armies proceeding from Britain were commanded by French-speaking nobles and a French-speaking King, and though the English language was in process of formation, and an English national spirit was already apparent, the whole thing was a chivalric adventure based upon the Gallic model. Then there was a lull, corresponding roughly to the reign of Richard II. in England, during which again the English lose ground.

At the end of Richard II.'s reign in England the Cadets of the Royal line, the House of Lancaster, usurped the throne. The usurpation was downright and even cynical—it was, of course, hateful to the morals of that time, nor could the Lancastrians maintain themselves in power save by a sort of reign of terror, coupled with a strict alliance with the wealthy and official class. Of all the elements which had gone to build up the English oligarchy, with the exception of the Reformation, none has been so powerful as this Lancastrian usurpation. The experiment rapidly led, as all such experiments have in all countries, to a foreign diversion. The war with France was renewed, but in a very different manner. The English king now claimed a real power. He was an English-speaking king, a soldier of extraordinary capacity, and very soon became, especially after his first great victory, Agincourt, a national hero. The old mad king of France in Paris was compelled to marry his daughter to Edward V. of England, and the rightful heir of France, the Dauphin, was thrust out, to the advantage of the issue of that marriage, who became the English king, Henry VI. What followed is common knowledge. Henry V. of England died; a vague national sentiment rose throughout French territory, and was embodied in the person of Joan of Arc. After one of those desperate and foot to foot struggles which are characteristic of French military history, the Capetian House gradually recovered all the territory which had been lost. The final expulsion of the last English garrison coincides, roughly speaking, with the close of the Middle Ages. This great struggle was accomplished within a few years of the development of printing and within a generation of the discovery of America.

A recapitulation of the main dates of the Hundred Years' War will not be without value to the reader.

Philip of Valois had his first engagement with Edward III. upon the fall of Cressy in 1346. The English, though a far smaller force, gained a complete victory. Immediately afterwards the town of Calais fell to Edward III. This did not lead to any immediate disintegration of the power of the French crown, though that power was gravely shaken. The next years were occupied with the great plague, the Black Death, which, though its effects have been so greatly exaggerated, especially by English historians, does form so deep a division across the history of Europe. These years indeed, though suffering from the English attack, saw an extension of the power of the King of Paris, for Philip bought the town of Montpellier in the South and acquired in full right a province which had now for 100 years been within the French orbit, the Dauphine.

Philip died in 1350. His son, John, was 30 years old on ascending the throne. The truce which had been established between the two countries had come to an end. The King of England again took advantage of the disturbed state of France (characterised by the convocation of the Northern States General in 1355) to push the attack. In 1356 the Prince of Wales, now a young man and an excellent cavalry leader (Edward the Black Prince), was advancing from the South while his father had sent a powerful army into Normandy. It was again a small cavalry raid supported by bow men that decided the issue. The terms offered to the French king by the Black Prince were refused, a battle was engaged near Poitiers, and not only resulted in an overwhelming victory of the small English forces, but in the capture of the French king. The result of this dramatic victory was the temporary dismemberment of the kingdom. The wealthy merchants and some part of the commonalty attempted a government under Etienne Marcel at Paris in the absence of the king, and convoked the National Parliament.

In 1360 John in his captivity consented to cede the Southwest in absolute sovereignty to England, and for the first time in its history a portion of the territory of Gaul was separated, though temporarily, from the National sovereignty. John returned and died in 1364. In the same year his son, Charles V., not quite thirty, that is, much of the same age as his father on ascending the throne, took over the government. He had already been the virtual head of the government for several years. Under him du Guesclin, against the spirit of the treaty signed with England, but with great courage and capacity, attempted the reconquest of French territory. A long Fabian series of skirmishes followed. The Spaniards defeated the English fleet at La Rochelle and permitted du Guesclin to recover Poitou from the English. Brittany, after the long doubt of the whole generation, began to support the French cause; Edward of England in his old age landed again, but his army was exhausted by perpetual dilatory tactics on the part of the enemy, it was virtually destroyed as a fighting force by disease and fatigue and ill-organization, and the old king of England died, after signing a disgraceful truce, in 1370. Charles V. of France held the throne till 1380. The country was impoverished, although the ancient power of the Crown had revived, and the new king, Charles VI., suffered on his accession from double disability. He came to the throne as a minor and he had madness in his blood. His very long reign (he was upon the throne for 42 years) led to nothing but disaster. The weakness of his character led to a struggle between two rival factions, known by the names of their leaders as the Armagnacs and the Burgundians. The Duke of Burgundy died in 1404, but his successor, John the Fearless, continued the struggle, seized the heirs to the throne and virtually governed Paris

The Armagnac faction, now deriving its name from a marriage of the heir of the Duke of Orleans with the heiress of that family, began to press upon the Burgundian power and was undoubtedly favoured by the people in general, and secretly by the poor king. The Gascons, the chief military element on the Armagnac side, were marching on Paris, a civil war of the most desolating kind broke out; when the moment appeared propitious for a new descent on the part of the English king.

In 1415 he landed in Normandy. It was originally, like the earlier wars, a mere raid, but it was far more successful than former raids had been. Normandy was completely conquered, after the utter breakdown of the French army at Agincourt, and finally on 21 May, 1420, the Treaty of Troyes was signed, whereby Henry V. married Catherine, the daughter of Charles V., and was declared heir in remainder to the Crown, with his descendants. The Dauphin was legally outlawed, and the position seemed secure for Henry, when in 1422 he died, succeeded immediately afterwards by Charles VI. after a reign of 42 years. There immediately began the struggle for the recapture of the territory, and that struggle was successful. Although a son had been born to Henry V. before his death, and had been solemnly crowned on his father's death, as Henry VI. of France and England, at the age of barely 12 months, the armies of the Dauphin began the reconquest. The chief elements in this were the defection of Burgundy, and the appearance of Joan of Arc. When the struggle had continued with doubtful success for seven years, this child of nineteen, confident of a supernatural mission, approached the court of the exiled Dauphin—Chinon, recognized there by some supernatural power both the King and various historic relics presented to her, relieved Orleans, had the Dauphin crowned in Rheims after a successful march across country, and in general roused in the army and the populace a confidence of success. She was taken prisoner in the second year of this marvellous career, outside Compiègne, after being wounded in her failure to capture Paris. She was sold to the English and burnt alive at Rouen. Nevertheless the English garrisons perpetually retreated or surrendered, and in 1435 the Duke of Burgundy himself abandoned the English Alliance, and with that act, of course, after the defection of so many of his supporters, all further English successes became hopeless. A few garrisons still held out, notably the St. Michael in Normandy, but Paris was taken the next year, and Rouen in 1453; and when Charles VII. died, in 1461, the French territory was clear. He was succeeded by a son who had rebelled against him, a man approaching 40 years of age, of a character dark, intelligent, very powerful and tenacious, deeply religious, and a little mad, known to history as Louis XI.

Louis XI., who next succeeded to the throne, had to meet a combination common enough at the close of any great epoch, coming as he did at the close of the Middle Ages; that is, a combination of forces which depended upon the ritual service still paid to old names and old ideas, but which only survived as clumsy anachronisms. In this case the forces with which he had to contend were the last forces of feudalism. Feudalism had long lost its vitality, and instead of having to meet a rebellion of local lords numerous and well-founded in their localities, he had to meet a combination of very great men most of them of blood royal but depending upon feudal theories and technicalities for their rebellion against him. His own brother, Charles of France, the Duke of Brittany, the heir to the Duchy of Burgundy, banded themselves under the name of «The League of the Public Good,» won the battle of Mont l'héry and proceeded as they thought to a complete success. It was here that for the first time Louis XI's powerful if not quite sane character appeared. He immediately gave way, where a weaker man would vainly have resisted, granted Normandy to his brother, made Saint Pol a Constable, and in general did all that could be done with the mouth and the pen. But it is a rule throughout French history that periods in which the French executive acts in this fashion, are those which accompany an increase of force for such an executive, and for the nation. Within three years of the defeat he summoned his Parliament at Tours. The nation as a whole was now, as always, in support of the Crown against the wealthier merchants and the aristocracy. Louis received the strongest popular support, he incited the commercial towns of the Lowlands to rise against his enemy of Burgundy, he organized the military force of Paris, and though Charles of Burgundy, who had now succeeded to that throne and who is known to history as Charles the Bold, was still far stronger than the French king, compelled him to attend the sack of Liege and even to sign the Treaty of Perronne in which Louis granted Burgundy complete independence, the Capetian could not but win. On his return to France he summoned an assembly of the notables, they denounced the Treaty of Perronne, and Charles of Burgundy's invasion of France which immediately followed was checked by the resistance of Beauvais. Everywhere in the Lowlands, in the heart of France, in his parliament and in the small provincial towns, it was the Commons who sustained Louis XI. And the Commons in France were beginning to be that which they had long ceased to be in England, peasants and small tradespeople. For in France the end of the Middle Ages tended to be democratic: in England aristocratic.

The end of Louis XI's reign emphasized at once his curious character and his successful policy. The extravagance of his religion, and the cruelty of his revenge were never more apparent than in the last years of his seclusion; and yet it was during these last years that the death of Charles of Burgundy in battle against the Swiss, gave him that province. When he died on 30 Aug. 1483, with all the provinces he had reunited to the Crown he governed almost automatically by far the greater part of the territory of modern France. Brittany alone was quasi-independent.

His son Charles was only 13 at his father's death, and the kingdom was under the guardianship of his elder sister Anne. She was well served. A second revolt of the great men in the kingdom was crushed at the battle of Saint Aubin du Cormier, and five years later Charles VIII. having now freed himself from his sister's power, married the heiress of Brittany and united that province to the Crown. He next invaded Italy in pursuance to a claim to the throne of Naples. The military result was small, but the moral results large. First, and by far the most important, the military temper of the nation was given an opportunity to exercise after the long and successful diplomacy of his father. Such foreign wars have always been of the utmost stimulant effect upon Gaul. And the second result was the introduction into France of the Italian Renaissance. When Charles VIII. died, still quite a young man, in 1498, he was succeeded by the Duke of Orleans, a distant cousin of his, the great grand-son of Charles V., who was the nearest male heir, and who had led the great insurrection of 12 years before. This prince, among the most sagacious and temperate of all European kings, insisted as a matter of policy upon renewing the Breton marriage, though the experiment was perilously near incest, continued the Italian invasions, effected an alliance with Henri VIII., marrying Mary, a sister of that king, and died on the first day of 1515 with power more complete, a territory more united, and the military organization of the kingdom more thorough, than any of these factors in French history had hitherto been.

This date, the opening of the year 1515, is of such moment for France and for all European civilization, that a short digression is necessary in order to appreciate the change we are about to witness.

The change which fell upon Europe in these first years of the 16th century is not one to which precise causes can be ascribed: it was rather one of those whirlwinds which appear to blow from without the field of material observation and of material causation, though it is indeed true that the mind of Europe had been stirring uneasily and with increasing force for three generations past. The movement which was to be of such prodigious consequence, and to which we owe the modern world, took two forms; the first of which was evidently of vast moment, the second of which at first appeared to be a particular and local phenomenon. The first was an extension of human knowledge and a rediscovery of the past. The second was the revival of those interminable theological discussions which had been wearily familiar in Europe for more than a century past. The revival of learning, the discovery of antiquity, the expansion of the known world and so forth, for a hundred years occupied the chief energies of men, but side by side with that great wave of change, went with expanding force the theological discussions of the time, until their united effect was such as to split asunder the unity of Europe; that unity has not yet been regained, though it very nearly was under Napoleon, and though the trend of things to-day is to achieve it at the expense of bitter conflicts. When this enormous result of pettifogging theological discussions was apparent, even educated men woke up to the importance of what had hitherto been a by-product in the general intellectual movement of the time.

This waking up, so to speak, to the importance of the religious quarrel, took place in the middle and towards the end of the 16th century, but it was not until the 17th century had opened that the schism was irredeemably fixed or that the division of Europe into two camps of opposed thought and morals was reluctantly accepted. This period of ferment is covered in French history by six reigns. That of Francis I., from 1515 to 1547, very nearly contemporary with the reign of Henry VIII. in England, was occupied with the glories of the Renaissance. It also corresponds to the reign of the great Emperor Charles V., and covers the first stage of the theological discussions already alluded to.

The first ten years of Francis I.'s reign were occupied with foreign ambitions, and were closed by his defeat at the Battle of Pavia in 1525. He was defeated, and only obtained his liberty with difficulty. The remainder of the reign is concerned with the transformation of architectural and every form of plastic art under the inspiration of his court, and quite late—in 1535—it was occupied with the beginning of the persecutions, an attitude which is retained during the remaining twelve years of the reign. Meanwhile, however, as the middle of the century approached, and as the principles of the Reformation obtained hold in Germany, the French kings saw the opportunity for maintaining the independence and increasing the greatness of France, against the overwhelming power of the Hapsburg House which surrounded them on every side, in Spain as upon the Rhine, and in the Low Countries. This opportunity was afforded by the Reformation which was supported in Germany as everywhere, by the squires and the great merchants, and all those who desired to break from the central authority of the Crown. From this period, for full 200 years, it was the constant policy, now more, now less active, of the French monarchs, to support the petty Protestant communities against the general authority of the Empire.

The next reign, that of Henry II., was imbued with this idea, although the repression of the Protestant movement at home was continued.

Charles V., who had survived Francis, engaged in war against that policy, but was checked by the defence of Metz. At the end of the reign, in 1559, Henry II. had done little to check the growth of Protestant feeling in France itself, had powerfully aided it in Germany and had secured for the French Monarchy the district of the three bishoprics. The wife of Henry and the mother of the next three kings was a Medici—Catherine, a woman of singular courage, probably corrupt in temper, and certainly in physique. The first two of her sons to succeed, Francis II. and Charles IX., were not quite sane, and were even more uncertain in bodily health than in mental. The theory of monarchical government which was increasing in power daily in the French mind, was weakened in practice by the spectacle of these two debilitated men. The country was in active quarrel between those great families who sided with the Reformers and those who maintained the defence of Catholicism, while the Crown was at times nothing but a pawn in the hands of either. It must not be supposed that the division really lay along philosophical lines. Nothing was commoner than for a man to appear first upon one side and then upon the other; but the progress of the Reformation was producing such an effect throughout Europe that its principles made a convenient line of division for warring factions. Meanwhile the populace, whom these factions of the upper class confused, were very strongly in favor of the national tradition, and consequently increasingly hostile to the Reformers. The feeling became acute in the town of Paris, where the adherents of the Reformation were very wealthy and powerful, and into which were already beginning to crowd those who expected a political or a diplomatic career. The natural jealousy of wealth, coupled with the indignation against the new theories (which were openly placarded in the street, often in the form of violent insults to the popular religion) led to the explosion known to history as the Massacre of Saint Bartholomew, a piece of bloodshed which, though it was less in extent than many, must rank in history as one of the great Parisian days of violence, and takes its place beside the attack upon the Commune and the Massacres of September. (See Bartholomew, Massacre of). How far the Queen Mother took advantage of the popular exasperation against the Huguenots, it is quite impossible to say. The legend that the King fired a shot by way of signal has been exploded, but it is probable that the sympathies of the Court in favor of suppressing one or other of the factions were sufficiently strong to have led to active intrigue, and it is equally probable that the popular feeling was let loose by the Crown.

Whatever the causes—and they will never be fully determined—the effect of the Massacre of Saint Bartholomew was to make Protestantism impossible as the national religion of the French.

But some years later the death of the remaining son of Catherine de Medici, brother and heir to Henry III., who since 1574 had been on the throne, left no male descendant of the Capetian House save Henry of Bourbon, the son of the King of Navarre, to whom he immediately succeeded. Now the House of Navarre had, through the influence of Henry of Bourbon's mother, supported the Reformation: not in its moral aspect but as a piece of protest against the central authorities of Europe. Henry of Navarre had no great attachment to the system on its political side, none on its theological, and an active dislike of it in its moral aspect. He was for his friends a hearty liver, for his enemies a libertine, and above all a highly successful soldier. The town of Paris under the influence of the family of Guise, went so far in its hatred of the Reformation as to refuse the quite unchallengeable claim of Henry to the throne, because his name was connected with the Protestant side, and because in the recent civil wars those who were now the members of his army, had in the main been fighting for the Reformation. Under the authority of what was called "the League," Paris refused to accept Henry of Navarre's heirship to the throne, and when in 1588 Henry III., the reigning king, had procured the death of the Cardinal Guise, and, being excommunicated for that act, joined Henry of Navarre and took refuge in his camp, Paris declared not only against the succession of Henry of Navarre, but also against the reigning and legitimate king.

In August 1589, that king was stabbed and killed by Jacques Clement. Henry IV., as Henry of Navarre must henceforward be called, was successful in the field, but was unable to take the capital; and his final admission within its walls must not be ascribed to purely military success. It was rather his personal character which gave him popularity in every circle that he led, whether military or civil, his tenacity and the growing absurdity of the attempt to put a subject upon the throne, as well as the adhesion of the remainder of the country, that slowly converted Parisian opinion. Henry IV. was ready to meet this process of conversion halfway. Within four years of Henry III.'s death (in July 1593), he abjured heresy at St. Denis just outside the walls of the capital, and next year was secretly admitted by night. The Pope accepted his reconciliation with the Church; he became immediately popular with the town of Paris, and from this date begins his true reign over the French people.

The first and most turbulent period of the religious quarrel in France ends with the Edict of Nantes, signed by this monarch in 1598. It is a document of capital importance, the first of the three great steps by which modern religion has been affected in France; the fourth of which, though already imminent in France, has not yet been taken. These three steps are: The Edict of Nantes, its revocation less than a century after it was promulgated; and the virtual secularization of the State by the French Revolution. This last or the third step, in its turn has been followed by a reaction towards Catholicism which may at any moment produce, as I have just said, a fourth landmark in the history of the French religion; but this modern process does not concern these pages.

The Edict of Nantes was remarkable in several ways: It was the first and almost the only document to grant religious toleration in its time. For three generations during which it was death to say mass in Protestant England, a Protestant in Catholic France enjoyed all the facilities of a citizen and many special privileges as well. The principle was recognized that if a religion alien to the body of citizens was tolerated at all, it must be tolerated as a privileged and exceptional thing. The Huguenot body which was then somewhat more numerous than it is to-day, and may have amounted to 5 per cent. of the population, was not only permitted to hold any office but was allowed to organize its interior life, to hold gatherings at regular intervals; to decide upon the attitude which it should maintain towards the rest of the State; and even to possess special towns as its places of refuge. The settlement was not wholly successful, as will be seen by what follows; but though it worked under an increasing strain, it was not definitely put aside until the reign of Louis XIV. and the two other generations during which it was in vigor, nourished the small but wealthy Huguenot body, permitted it to strike deep roots, and to become what it still is, though it has dwindled in numbers—a powerful alien element in the midst of the French State.

With this date, 1598, and with the signing of the Edict of Nantes, much more than with the end of the reign, the next period of French history may be said to begin.

After the settlement effected by the Edict of Nantes the energies of Henry IV. were given up as his temperament demanded, to aggrandizement, for it is remarkable that all those who acquire power over the French are tempted in a short time after that acquisition to theories of military expansion, finding in their hands the best material in Europe for such a purpose. The plan of Henry IV. was clear enough, and though it has been termed immoral was none the less patriotic. He proposed a destruction of the only strong and centralized power opposed to his own, that of the House of Rothschild, and he would have accomplished this at one stroke by the use of a powerful army, after which it is just possible that he intended to assume the headship of Europe and to impose peace. In this task or ambition he was aided by the great Sully, a man avaricious in temperament, orderly, careless of divine things, but undoubtedly courageous. The plan of the war was to help the petty German principalities in their attack upon the central power of the Emperor. The greater part of these petty principalities were naturally protestant, for protestantism had been for them the religious aspect of their political claim. Germany was therefore supporting them against their traditional authority, whether civil or religious. All was ready for the expedition, when on 14 March 1610 Henry was stabbed by Ravaillac on his way to visit Sully at the Arsenal. Many prognostications and omens had foretold this murder, the motive of which was the popular exaggeration that Henry's plot involved a war against the Pope himself and the Catholic Church. Henry was succeeded by his son Louis, the 13th of that name, then in his minority. The Queen Mother, Marie of Medicis, was Regent. She ruled with great individual power and singular energy, but perhaps with insufficient judgment. And the point was of importance because all Europe was then in the great settlement of the quarrel which the Renaissance and the Reformation had aroused.

Roughly speaking, from this moment the Protestant nations tend (a) to become oligarchic, that is to be governed by a clique of wealthy men; (b) to develop an intense local life; and (c) to deny in practice and in theory the unity of European civilization; for instance, it is amongst them that the Jews began to be treated as citizens not distinguishable from the Europeans round them. Such communities as had preserved the older philosophy tend, on the contrary, to egalitarianism: first, under the form of despotic central powers, later under the form of democratic experience. England, Holland, the Protestant Swiss cantons and the Protestant principalities of Germany and Scandinavia, tend to oligarchy and all its consequences. In England itself a great civil war was about to break out, primarily oligarchic in its origin, that is, having for its motive the determination of the squires and the big shop-keepers and merchants to govern the common people and to oust the King. But France remained the arena. The Protestants were immensely powerful; they had cities of their own, forming as it were a state within a state; they were still very numerous (forming perhaps a quarter, perhaps a third of the well-to-do classes), and the generation which could remember, whether in France or elsewhere, the old unity of Europe in philosophy and government was dead. The force of Protestantism in France lay of course upon the side that Protestantism took all over Europe, against central monarchy, in favor of oligarchic theories, and of the independence of the great landowners and of the great merchants. Had the first years of Louis XIII.'s minority been under the hands of some one strong man, France might at once have become the one thing or the other. As it was, sufficient interval was allowed for the Huguenot theories of independence to take root. It was not until 1617 that Louis XIII., now in his 17th year, began to act upon his own initiative. Much at the same moment there appears in French politics the great personality of Richelieu (q. v.). He was of the squires family, by name du Plessis. He had been trained to the Church, was poor, but had sufficient influence to be made Bishop at the age of 22. The meeting of the French Parliament or States General in 1614 (when he was not yet 30) had brought him into some prominence, for he was a member of the House of the Clergy. Two years later, in 1616, the Queen Mother with her keen Italian eye, picked him out for the ministry. From that moment he is the principal figure in France. A quarrel which Louis XIII. engaged in against his mother eclipsed Richelieu for a moment, but when that quarrel was appeased she used her influence to have him made Cardinal (in 1622), and in 1624 he entered the Council of the King, never to leave it, and to direct it during the remaining 16 years of his life with despotic power.

Richelieu, like all men who count in history, had a very simple plan, if it may be called a plan at all. He was determined to aggrandize the material power of the nation. He had, as have also all great men in history, not a simple but a highly complex and subtle appreciation of the medium in which he lived. To him is due that «rediscovery of the national soul,» which in France is only satisfied by unity and rapid centralized measures. He made short work of the Huguenot pretension to maintain within the State a body of rich men defying the authority of the State. He took, after a most gallant and savage defence, the protestant stronghold of La Rochelle, in spite of the active aid of foreign enemies, whom the Huguenots had at once summoned to their aid, and by the Peace of Alais in 1629 he destroyed their conspiracy. He left them, however, complete liberty of conscience, a stroke of statesmanship as wise as it seemed (at that moment) enormous and paradoxical. At that moment and for long years afterwards it was death to say mass in England and no Englishman could have understood the ideas of toleration at all. Neither did any Frenchman understand it as an idea, and Richelieu probably thought it illogical himself, but he forced it on the French in spite of civil war, as a measure of statesmanship.

He was not content to destroy the root of rebellion; he was also determined to destroy what was left of the ambition of the squires, apart from any religious or philosophical attitude their class might have adopted. He took the occasion of an excess in the practice of duelling to execute more than one great Catholic noble who persisted in flouting his decree against that habit; in a word, before the outbreak of the Civil War in England, he had made of France one united country in which the power of government was observed by all, and in which all tendencies to oligarchy had been utterly destroyed.

Abroad his policy was naturally the very opposite. As he had desired to strengthen France, so he desired to weaken her rivals. With this object he ardently supported all tendencies to division beyond her frontiers, and notably the claim of the German Protestants against what had a hundred years ago been the common civilization of Europe. There had broken out in Germany in 1618 the war known as the Thirty Years' War (q. v.) in which the small Protestant parcels, notably those whose conversion to Christianity was recent and whose foothold in European civilization was still insecure, had determined to break off from that tradition by the sword. Their cause was hopeless in Germany itself, but Richelieu threw the whole weight of French influence upon their side. In about 1635 the Empire and the old traditions of unity were completely successful, and in the same year France declared war against the Empire. The Spaniards invaded and were with difficulty repelled, but in the next few years the French armies occupied the Roussillon (which is now the Department of the Pyrenees Orientales), and when Richelieu died in 1642 and, some months after him, the King, Louis XIII., a definite French success was approaching. The young, brave, eccentric and somewhat taciturn prince of the blood, Condé, then Duke of Enghien, delivered the fortress of Rocroy on 19 May 1643, and five years later in company with the great Turenne, he accomplished for his country after the most striking military successes, the Peace of Westphalia, by which, in 1648, the Protestant principalities,—and notably, the sandy wastes whence has sprung the kingdom of Prussia,—were created independent units, and the power of the Austrian Empire and of the old traditional central authority in Germany, finally wiped out.

The centre of the 17th century, like the close of the 16th, and like the year 1515, is a date upon which all historical students should repose. Another stage in the great quarrel was accomplished, and the schism of Western Christendom was signed and sealed. Within a few months Charles I. was to lose his head and the English were to lose forever the conception of monarchy and perhaps forever, the sentiment of civic equality. Germany, though destined perhaps ultimately to be reunited, was for 300 years left torn between the old Roman civilization and the barbarism of the North. France, the agent of this vast Protestant establishment, had, so far as domestic politics were concerned, welded her unity, re-established her own traditions, and crystallized into the highly definite modern form, which she not only preserves to this day, but seems destined to preserve indefinitely. There was not yet a code of laws, the old gimcrack pretensions of the nobility were still strong, but the whole spirit of the people and of their literature, had become again egalitarian and Roman, and the destiny of the next century and a half might be predicted from the Peace of Westphalia.

Meanwhile Louis XIII. was dead, a little child six years old, another Louis, his son, was upon the throne. The regency was again in the hands of a woman, and when this great development before mentioned was in process, the government was in the hands of Anne of Austria, the Queen, and of her favorite, an Italian of great subtlety and low birth, known to the French as Mazarin (q. v.).

Mazarin was not only lowly born and subtle; he was also extremely fond of money. But he had all the Italian conception of what is august; he had inherited the tradition of Richelieu; he maintained it, not nobly but by successful intrigue. He managed to wear down the tendencies of revolt on the part of the nobles which still remained (the greatest French generals, Condé and Turenne himself mixed in that revolt) and when he came to die he left to the boy, Louis XIV., then but 23 years of age, a complete inheritance of a thoroughly successful foreign policy (the Peace of Westphalia was 13 years old); an altogether independent personal despotism in the hands of the King, and a nation so organized in literature, in self-appreciation and in common morals as to form a completely homogeneous body in the Europe of its time. With that year (1661) in which Mazarin died, corresponding within a few months to the restoration of the impoverished, undignified and salaried monarchy made in England, begins in actuality the peculiar and (in the eyes of contemporaries) the glorious reign of Louis XIV. A boy of 23, as has been said, on his virtual accession, he reigned until 1715, a period of 54 years, and from the habits of the generation formed in that space of time, descend the 18th century and the Revolution in France, and, in a sense, modern Europe.

The reign may be conveniently regarded in three periods. The first, of 17 years, covering Louis' active manhood and taking one to his 40th year, was principally composed of successful warfare. And the Peace of Nimeguen in 1678 terminated a successful and advancing struggle against what had become a coalition of the smaller powers against his throne. From that period till close upon the end of the century, the very rapid perfecting of French life which was setting, as it were, into a clear classical form, tempted him to that great sin of every French leader, which is ambition. With such armies and with such an intelligence as his allies, he began to dream. There was even for a moment a danger of the French Church becoming national and losing the spirit of Catholicism. The combination against him continued to exist, and in the midst of this period the final victory of the English aristocracy over the Stuarts threw a heavy weight into the scale against Louis XIV. He was a man of strict honor, and his policy as well bade him support the claim of James II. and of James II.'s son. He had against him, therefore, from 1688 onward, the whole force of the governing power in England as he had already had against him for 20 years the whole force of the governing power of Holland. To this period also belongs (in 1685) the most disputed act of the whole reign because it was the one which most nearly touched the interests of those opposed to the French people, the interests of their philosophy that is, and by philosophy alone do communities live. This act was the revocation of the Edict of Nantes. From that date it has been a fixed article of French policy that the State shall be one, and that no power within the State shall be permitted to exist. There was a vast outcry against the victims of this determination for unity; logic demands that a similar outcry should be raised against the persecution of the priests under the Revolution, of royalists under Napoleon, of the religious orders in modern France, and of countless other instances of minorities which this cardinal principle has caused to suffer. It was not of course a personal act of Louis XIV., it was but one further stage in the maturing of that principle of absolute unity, which had been growing in the French mind since the opening of the Middle Ages, and which had acquired such open symbols upon the accession of Henry IV.

In the third period of his reign, as an old man, Louis XIV. engaged upon the last great struggle of his life. The King of Spain, Charles II., had left the crown of that country by will to the young grandson of Louis, Philip, Duke of Anjou. This was in 1700. It was debatable whether Louis XIV. should accept this onerous honor or not; he determined to accept it.

It must be remembered that until within living memory, monarchy was a real political principle. Those who now exercise the function, make us forget what a very real thing a reigning family was up to the moment when the French Revolution had worked out its full effect. For members of one family to rule over France and Spain at the same time had something of the same effect on contemporary imagination as would have today the declaration by one great power that it was determined to annex the territory of another. War flamed at once throughout Europe. It was one of those contests in which the French nature was in real peril and in which defeat seemed certain; one of those contests of which the two other historic examples are the invasion of Henry V. and the German war of 1870-71. Upon this occasion, however, there was toward the end of the struggle a rally which prevented the consequences that followed upon the earlier and upon the later occasion, and when the Treaty of Utrecht was signed (as well as those of Restadt and Baden) in 1714, the honor of the country and of the monarchy was saved. All that was lost by France was colonial territory to which at that time no more importance was attached than is attached by us today to the impoverishment of the laboring classes of a nation, or to the loss of its religion, for no generation is capable of foreseeing the future.

The next year the old King died, leaving for successor a little child, his great grandson, who is known to history as Louis XV.

During the minority of this child France was in the hands of the Duke of Orleans, acting as Regent. The Regent had all the qualities that we admire in man, especially that of courage. He was a gentleman, and thoroughly generous; but he was a libertine, and this weakness of sensuality marred both the dignity of his position and the efficacy of his government. His counsel, the Cardinal Dubois, was probably most unworthy, but one must be careful not to exaggerate one's impression of him, for the attack upon authority was already beginning, and the fact that Dubois was in orders was quite enough to make the intellect of his time emphasize his vices. After a period of violent speculation and of great though perhaps exaggerated public distress, the Regent died, having held his authority for eight years. From that moment (1723) Louis XV. began to reign.

Nothing is more difficult than to estimate the character of this man. It cannot be denied that upon this character the history of France during the next 70 years largely depended. For the monarchy was still real and absolute and the method in which it was conducted was the chief factor of the national destiny.

The writer of these lines has minutely examined the acts, the portraits and the handwriting of Louis XV., and in relation to a monograph concerned with that period, has made himself thoroughly acquainted with the personality of the man; and yet he finds it very difficult to give a true judgment. He was profoundly Christian, with a fervor of religion that verged upon superstition; he was undoubtedly courageous, somewhat sensual, in old age excessively so. On the other hand he suffered from an impediment of the will. To say that his will was weak would be to convey a very erroneous impression. But there were a certain number of things he could not bring himself to do, and chief of these was the exercise of authority face to face. He hated and avoided all interviews and all scenes. In his character of gentleman this was well enough, but in his character of King it was fatal. The first war of his reign was upon the whole glorious. And the Treaty of Vienna, signed in 1738, gave France the reversion of Lorraine. But two years later the principal quarrel of the century and the most important event, in its effects between the English Revolution and the French, took place. This was the death of Charles VI., the Emperor of Germany, who left as heir his daughter Maria Theresa. The German anarchy was at once aroused. The attempt to destroy the empire virtually was begun by the Protestant princes, and notably by the rising power of Prussia. At this moment a clear error, one of the very few with which French diplomacy can be reproached, was committed. Two centuries of tradition proved too strong for the French intellect, and the French armies were allied with those of the petty princes and of Prussia against Austria. The origin of the war was marked by the first of those scandalous acts which have brought European civilization into such peril during our own time. Frederick II. of Prussia, a man subject to every vice, with the exception of cowardice, seized Austrian territory without title and without any declaration of hostilities. It was the act rather of an Asiatic than of an European. But the French monarchy, whose whole history had been a protest against such a perversion of public morals, found itself in alliance with this detestable soldier. The alliance was not unsuccessful, and the war which followed will be forever famous in French annals from the great victory of Fontenoy on 11 May 1745, a victory largely due to the Irish exiles who fought under the French flag. The Peace of Aix la Chapelle signed in 1748 did not show the fruit of so much military valor and success; it left France very much as it found her. But the struggle with its false issues and its vanity had luckily converted the French diplomats, and henceforward France wisely associated herself with Austria, with the especial purpose of meeting the rising power of England. Had the French forces been confined to the struggle with England, their success, which was already great at sea, would probably have been final, and the strange spectacle would have been presented in our own time of a France weighted with eccentric, un-European colonies, and probably deprived of its whole national spirit and tradition. The reason that we have no such spectacle to enjoy or deplore is that the government of Louis XV., not content with fighting England abroad and at sea, undertook a continental campaign, and fought side by side with Austria in what is known as the Seven Years' War (q. v.). At the very beginning, in 1757, Frederick of Prussia inflicted a crushing defeat upon the French at Rosbach, a defeat entirely due to the ineptitude of the French command. Meanwhile in the colonies the French lost and the English won. And in 1763 the Treaty of Paris was signed, which for a century destroyed all French effort oversea, left Canada to the English, abandoned India, and, what was graver in the history of European morals, permitted Frederick of Prussia to retain Silesia, thereby acknowledging in a public instrument for the first time since the foundation of Christendom, that lawful succession and inheritance might be waived in presence of force. From this grave crime Europe still suffers. It was the precedent of all the international anarchy which our generation has almost become accustomed to.

The remaining 11 years of the reign were passed in peace, but in dishonor. The nation was profoundly troubled in its pride as in its economic circumstances. The heir to the throne was a lanky, very stupid boy, the grandson of the old king, and men saw nothing in the immediate future for their relief, though the death of Louis was looked forward to as to an event for public rejoicing. He passed, after a few senile years of debauchery, in 1774, and his grandson, Louis XVI., who had been married as a boy (four years before) to the youngest daughter of Maria Theresa, Marie Antoinette, ascended the throne. On the same day the Boston Harbor Act was proclaimed in the American colonies. It is quite impossible in a few short notes such as these to prepare the reader for the enormous convulsion through which France and all civilization was now about to pass. It is enough to say that the mind of that generation was by this time securely fixed in a clear and intense conviction: that lucid, mechanical and direct methods capable of reasonable analysis were in all departments of human energy the only ones which man as a moral being could entertain. It followed that all merely organic things were in peril, the old and merely traditional constitutions of the country, and of course religion. The Catholic faith had never been at so low an ebb since Constantine; its power has been returning for a century, and it is difficult for our generation to understand how completely the faith had disappeared just before the French Revolution broke out. The first years of Louis XVI. were occupied with a renewed struggle against England, which struggle was successful beyond the dreams even of those who most ardently supported the policy of attack. French guns had been supplied to the army which conquered at Saratoga shortly after a French fleet rendered possible the surrender of Yorktown; and it was imagined both in England and upon the continent (such is the impossibility of foreseeing the future) that the power of Great Britain was finally extinguished. Meanwhile, the American colonies and their ideal republic furnished an object lesson, as it were, to the rationalism of the time. And the public mind was moving very rapidly indeed towards a reconstruction of society. The moral equilibrium was utterly unstable. It needed but some material cause for that equilibrium to be upset, and for a new society to arise. This cause was presented by the condition of national finance. France was a very wealthy country and like all the rest of society at that moment, was rapidly increasing in wealth. But the methods of taxation were grossly imperfect, the burden fell upon the wrong people, and was imposed in the wrong way. So that France could with difficulty furnish a sum equivalent to no more than five dollars per head of its population, where today it furnishes with the utmost ease close upon and often exceeding, 20 dollars a head. An assembly of the notables of the kingdom was summoned in 1787 and did nothing. And finally in 1789 was convoked the first great democratic parliament ever seen in Europe since the Middle Ages had declined. The experiment was watched with alarm, especially in England, where the conception of popular government was mistrusted and disliked, not only by the ruling oligarchy but by the people themselves. When the assembly had met, which was in the May of that year, the commons proceeded to claim in practice complete power in the State. They had for their ally the city of Paris, without whose energy and courage their rhetoric would indeed have been vain. The mobs of the capital proved incapable of withstanding regular troops. That was the chief and least understood aspect of the Revolution. Nor can any unacquainted with the military temper of the French people comprehend the movement. It was, for instance, Carlyle's principal error that he imagined a display of public force sufficient to check the Revolution. Public force was used to the utmost, and failed because the people were in a mood of indifference to suffering and to death, a phenomenon so rare that, save in Ireland, the modern world has seen no example of it. It is possible that a democracy would have been established and that the names at least of certain great traditional functions in the State would have been preserved, and that the Revolution would have ended in a compromise, had there been no foreign war. As it was, the attack made upon the organization of religion, and the attempt to withdraw the Catholic priesthood from their normal organization and to make of them a civil service, coupled with the perpetual indignities offered to the King and Queen, and added to the ceaseless effects of violence, moved Europe to interfere. The method of this interference was cautious and long debated, but the threat of it was enough to goad the French people. In June 1791 Louis XVI. and his wife and children fled to the frontier and were recaptured. Two months later Austria and Prussia publicly agreed upon a policy of intervention, though even at this late stage the agreement was conditional, and so far as we can judge by the private letters exchanged in that autumn, the idea was rather to overawe the French democracy by a display of invincible force, than to proceed to actual invasion. In the winter, largely through the action of Marie Antoinette, Austria, ruled by her brother, proceeded to impose minor but direct commands upon the French policy. In the spring war was declared. The allied armies did not cross the frontier until the height of summer, but it appeared certain that they would be in Paris by the end of August, for the disorganization of the French army was complete and it was quite incapable of making a stand. The invasion was accompanied by a manifesto drawn up by advice of Marie Antoinette (who was probably the author of its principal threat) and this manifesto devoted the town of Paris to military execution, if the persons of the royal family were not left inviolate. The answer of Paris to this document was to storm the palace on 10 August. The building was well defended by a powerful force of 6,000 men, and it was the opinion of Napoleon Bonaparte, who seems to have been an eye witness, and who was certainly an excellent judge of military affairs, that the military chances were in favor of the crown. The mob fought with the utmost courage, losing men in numbers variously estimated at 150 and 3,000,—the latter is the nearer computation, for though the losses were heavier of course upon the defeated side, the services of numerous carts and carriers were required for the whole day and the succeeding night in removing the dead. At any rate the populace were completely successful. The royal family was imprisoned and a committee of extreme democracy, the chief of whom was the learned but impetuous Danton, took over the management of the country in the face of the enemy. That enemy proceeded without obstacle, forced the three passes of the Argonne, and met such forces as the French had scraped together on much the same ground as had seen the struggle against Attila, the great plain now occupied by what is called «the Camp of Châlons.» The center of the French position was the windmill of Valmy. What followed is a singular lesson in strategics. There was, properly speaking, no battle. A distant cannonade and an abortive charge made up the whole action. But precisely because the Duke of Brunswick did not press his power home Valmy had all the effect of a thorough defeat. A retreat was negotiated, and from that day, the equinox of '92, the Revolution took on its final phase. The republic was declared, the trial of the King was prepared, the army though still undisciplined and unmilitary gained the haphazard victory at Jemappes, and poured over the frontier into Belgium. On 21 Jan. 1793 the King was executed; within a fortnight Holland, England and Spain, one may say the whole of Europe, was at war with France. The volunteers and other hotch-potch under Dumouriez in Belgium were defeated; at Neerwinden, Dumouriez betrayed the country and ultimately accepted a large salary from England, whose strategy he advised and overlooked, and the French Revolution, for the second time in peril, established martial law. A strict military despotism in the hands of a small committee, known as «The Committee of Public Safety,» governed France with ruthless severity for 16 months, defeated the enemies of the country and began that marvelous series of victories which within a generation transformed the world. During those 16 months the committee was changed; but its principal names give it unity from first to last, and in its latter stages the name most upon public lips was that of Robespierre (q.v.). Robespierre did not command the committee. They were at first jealous of him and toward the end of the period he hardly attended their meetings. He was a man of many virtues, of a high political idealism, and of conspicuous sincerity and candor, but he suffered from the vice of ambition. He loved the popular idolatry that surrounded him, and used it as a lever against the committee. This committee, therefore (in which he had but two friends), being essentially military in its nature, and occupied principally in the military problem of repelling the foreigner, determined to be rid of him. They planned his destruction, and Robespierre was outlawed and guillotined on 28 July 1794.

It so happened that the period of his great popularity had coincided with the height of the revolutionary delirium. Three-fourths of the country was in revolt. Savage acts of repression had followed the crushing of the rebellions and «the Terror,» as it was called, had come, very falsely, to be associated with Robespierre's name. When he fell, therefore, the committee found to their astonishment, that his fall was taken as a signal for the relaxation of their military power. From that date (called in the new revolutionary calendar «the Tenth Thermidor») the active portion of the Revolution ends. It had succeeded in finally establishing the theory of democracy.

In the next year it achieved its most diplomatic success, and imposed peace upon its enemies at Basel in a treaty which considerably enlarged French territory, and shortly afterwards the public assembly which had accomplished this great result was dissolved. England

and Austria alone remained at war. Against the second was despatched into the Plains of Lombardy a young Corsican who had but lately been given his brigade, and who was but 27 years of age. This man was Napoleon (q.v.) and from that date, 1796, the history of France begins to be a record of his exploits.

See CLOVIS; CHARLEMAGNE; CHARLES MARTEL; PEPIN; PARIS; CRUSADES; HUNDRED YEARS' WAR; JOAN OF ARC; HENRY OF NAVARRE; GUISE; EDICT OF NANTES; HENRY IV.; SULLY; LOUIS XIII., XIV., XV., XVI.; RICHELIEU; THIRTY YEARS' WAR; CONDÉ; TURENNE; MAZARIN; MARIA THERESA; SEVEN YEARS' WAR; FREDERICK II. OF PRUSSIA; MARIE ANTOINETTE; MIRABEAU; DANTON; ROBESPIERRE; MARAT; GIRONDIST; REIGN OF TERROR; NAPOLEON; FRANCE—CHURCH AND STATE; GREAT BRITAIN—FRENCH WARS OF THE 18TH CENTURY; UNITED STATES—THE REVOLUTION; ITALY—MODERN HISTORY; GERMANY—POLITICAL HISTORY; AUSTRIA, and the various personages and events mentioned in this article.

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3. **France—History 1796-1804.** See FRANCE HISTORY FROM THE REVOLUTION TO THE ESTABLISHMENT OF THE EMPIRE.

4. **France — The Empire.** As the fear of socialism helped to found the consulate in 1799, so the royalist plot of 1804 precipitated the foundation of the Empire. Much as France abhorred the execution of the Duc d'Enghein, she was still more aghast at the prospect of the turmoils which would ensue, should Napoleon be suddenly removed from the head of affairs. "The need of repose and stability," says Miot de Melito, "was so pressing, the future so disquieting, the fear of terrorism so great, the return of the Bourbons so formidable that people quickly grabbed at any expedient which might save them from those dangers." Seven days after the Duke's murder, Fouché appealed to the Senate to establish hereditary government. The idea was taken up on every side. Carnot alone opposed it in the Tribunate; the Senate, the Council of state, reported in its favor and after a brief period of affected hesitation Napoleon complied with the general desire. On 18 May 1804, a constitution which had been elaborated by Fouché and Talleyrand was adopted in the Senate with three dissentent voices. It decreed to Napoleon the title of Emperor of the French and settled the succession to the throne on his direct male issue, natural and legitimate. It enabled a childless emperor to adopt the children or grandchildren of his brothers, and designated Joseph and Louis Bonaparte (Napoleon's brothers) to the succession, in case the Emperor should die without natural or adopted children. The civil list was fixed at 25,000,000 francs, a sum established in the constitution of 1791; and other provisions were added with the design of adding brilliance and authority to the throne. Six grand dignitaries of the Empire, irresponsible, irremovable, enjoying the status and prerogatives of princes, were to support the new Emperor. Cambacérès was made Archchancellor, Lebrun, Archtreasurer. The office of Grand-Elector — a title borrowed from the nomenclature of the Holy Roman Empire — was conferred on Napoleon's elder brother Joseph; the office of Constable was given to the younger brother Louis. The remaining two dignities were ultimately conferred upon connections by marriage, and while Napoleon's stepson, Eugène Beauharnais, became Archchancellor of State, his brother-in-law, Murat, was given the rank of High Admiral. Another provision in the Senate's constitution of 18 May 1804, was designed to conciliate the army. There were to be 16 marshals of the Empire, and the marshal's bâton henceforward became the chief prize of military ambition. At the same time the court was furnished with decorative officials, with a grand almoner (Cardinal Fesch), a grand marshal of the palace (Duroc), a grand chamberlain (Talleyrand), a grand equerry (Caulaincourt), a grand master of ceremonies (De Ségur), and with numerous prefects and ladies of the palace. The changes made in the mechanism of the government were even more significant of absolutist tendencies. The restriction placed upon the numbers of Senators was removed and their nomination conferred upon the Emperor. The Tribunate was divided into three sections, dealing respectively with legislation, home affairs, and finance, a measure which effectually destroyed its potency as an organ of protest; and though the legislative body was given the power of discussing measures in a general committee, the discussions, unless invited by the Council, were neither to be published nor printed. As a matter of fact both Tribunate and Legislative ceased to be working parts of the machinery. As the powers of the Tribunes expired, no fresh nominations were made, and so the body vanished from the constitution. A more expeditious method of legislation was discovered. The Emperor governed by means of *Senatus Consulta* or decrees of the Council of State.

The French people acclaimed the constitutional revolution by more than three and a half million votes; that is to say, by a larger majority than was given for the Consulate or the Consulate for Life. Of the opponents, Carnot was the most conspicuous; and it is noticeable that almost all the barristers of Paris were against the establishment of monarchy; but the army was flattered by the elevation of its leader, and the peasantry saw in the change a fresh guarantee for the stability of the revolutionary land settlement. That he might reassure the Catholics, and win the royalists, Napoleon summoned the Pope to preside over the coronation. Pius VII. undertook the journey, but was destined to receive a lesson upon the relations of the spiritual to the temporal power. After he had anointed the Emperor and Empress with the holy oil and as he was proceeding to perform the act of coronation, Napoleon seized the crown and placed it on his head with his own hands. The sword and insignia of Charlemagne were brought from Aix to give significance to the occasion, as if the ceremony of Notre Dame betokened nothing less than a revival of the great Frankish empire.

Meanwhile war had broken out with England. The vigilance of the English fleet prevented that concentration of the French navy in the channel which was essential to the escort of the Boulogne flotilla, but Napoleon had paved the way for a war with Austria, in case it should prove impossible to strike at London. On the pretext that an emperor could not also be president of a republic, it was determined to convert the Italian republic into a monarchy. The Italian crown was offered first to Joseph, then to Louis, but the brothers were too ambitious to renounce their claims on the imperial succession, and Napoleon finally decided to assume the crown himself and to appoint Eugène Beauharnais his viceroy. Italian deputies were summoned to Paris to vote the crown and in May 1805 Napoleon went to Italy to receive it. In the cathedral of Milan on 26 May he placed the old iron circle of the Lombard Kings upon his brow, and though the French Senate and the rulers of Europe were assured that the Italian Kingdom and the French Empire would be kept strictly separate, no one was deceived. The annexation of Genoa to France was a proof that Napoleon's ambition was insatiable, and advertised to the powers that war was the only remedy. By July 1805 Russia had determined to break off relations with Napoleon; on 9 Aug. Austria gave her secret adhesion to the Russo-British alliance, by the middle of September an Austrian army under General Mack was at Ulm. The speed and genius of Napoleon disconcerted all the calculations of his enemies. The army of England (rechristened 29 Aug. the grand army) was swung round, and rapidly pushed through Germany into the valley of the Danube. On 20 Oct. Mack, surprised, surrounded, and overwhelmed, capitulated at Ulm; and on 2 Dec. (the anniversary of the coronation) the Austrians and Russians were defeated with huge loss at Austerlitz. Francis withdrew from the war and on 20 Dec. 1805, signed the treaty of Pressburg with France.

The most obvious political result of the campaign was that the influence of the French Empire was substituted for that of Austria in Italy and Germany. The Hapsburgs were compelled to recognize the Italian Kingdom and the annexation of Genoa, and to cede Venetia, Istria, and Dalmatia to the victor. The Neapolitan Bourbons had received an Anglo-Russian force into their capital, and for this violation of neutrality they were condemned to expulsion. Accordingly no sooner had peace been struck at Pressburg than Napoleon sent St. Cyr (q.v.) and Massena (q.v.) to expel "the guilty woman" who had so flagrantly "violated all that is sacred among men." In this mission they were successful. On 13 Jan. 1806, Ferdinand and Caroline fled to Sicily, where they were secured by the protection of the English fleet. The Kingdom of the two Sicilies was given to Joseph. Elise Bacciocchi, a sister of Napoleon, became Princess of Lucca and Piombino, while another sister, the beautiful Pauline Borghese, received the principality of Guastalla. Thus the whole of the Italian peninsula, save the Papal States, came under French control.

The results of Austerlitz were no less impressive in Germany. Before the war Napoleon had solicited and obtained the alliance of the South German dynasties and after the victory he proceeded to reward his allies. Bavaria and Wurtemburg were raised to the dignity of kingdoms; Baden became a grand duchy, while marriages were arranged between Eugène and Princess Augusta of Bavaria, Jerome and Princess Caroline of Wurtemburg and Stephanie de Beauharnais and the Crown Prince of Baden. By recognizing the independent authority of the three South German Princes Napoleon had practically eliminated Austrian influence from South Germany, but so long as the shadow of the Holy Roman Empire remained, the Hapsburgs still retained a right of intervention in German affairs. This right Napoleon determined to abolish. On 1 Aug. 1806, the Diet of Ratisbon was informed that the Holy Roman Empire was at an end. In place of this ancient and picturesque institution a confederation of the Rhine was formed under the protectorate of Napoleon, a "new Carolingian code" as it was called in Paris, where it was drafted under the direction of Talleyrand. The 16 princes who joined the confederation were bound by a close offensive and defensive alliance to France and compelled to furnish contingents to the grand army. As the price of their subservience to the Protector of the League, they were encouraged to be autocratic in their own dominions.

As Austerlitz gave Napoleon control of Southern Germany, so Jena and Friedland made him master of the north. The Prussian Court, roused by the occupation of Hanover in 1803, the murder of the Duc d'Enghein in 1804, and the violation of Prussian neutrality by Bernadotte's corps in 1805, determined (October 1805) to present an ultimatum to Napoleon and in the event of his refusal to cast in her lot with the allies. But the battle of Austerlitz intervened, and Haugwitz, the bearer of the Prussian ultimatum, was compelled to sign the humiliating treaty of Schönbrunn (15 Dec. 1805), the main object of which was to involve Prussia in war with England by forcing her to accept Hanover. But the war spirit was now high in Berlin, and everything in Napoleon's conduct during the ensuing months — the formation of the Confederation of the Rhine, the obstacles placed in the way of a counterbalancing confederation of the North — was calculated to raise it. Finally Prussia learned that Napoleon was offering Hanover to England, and rushed into war. Napoleon, swiftly marching through the depths of Thuringia, beat the Prussians at Jena and Auerstadt, 14 Oct. 1806, occupied Berlin, compelled the Saxons to enter the confederation of the Rhine, and finally, after the bloody and indecisive battle of Eylau, 6 Feb. 1807, won a crowning victory at Friedland, 14 June, which led Alexander of Russia to decide for peace. The three sovereigns met at Tilsit, and then a peace was signed 7 July 1807. Prussia was not only compelled to pay a heavy war indemnity, and to support a French army of occupation, but was stripped both of her eastern and western provinces. The provinces (save the circle of Bialystock) acquired by the second and third partition of Poland, were formed into a grand duchy of Warsaw, which was attached to the Saxon kingdom, and consequently included in the Rhenish confederation. On the western frontier, the Westphalian province, including the important fortress of Magdeburg were, together with the Duchy of Brunswick, parts of Hanover and the electorate of Hesse-Cassel, formed into a kingdom of Westphalia for Prince Jerome, the youngest brother of the Emperor, likewise included in the Rhenish confederation. The Baltic littoral passed under French control, for, though Danzig was proclaimed a free city, it was to be governed by a French force, and though the Duchies of Oldenburg and Mecklenburg-Schwerin were restored to their respective dukes, they were to sustain a French army of occupation until the general peace. Meanwhile, on 21 Nov. 1806, Napoleon had issued the famous Berlin decrees (q.v.), the object of which was to ruin England by excluding her goods from the continent, and by declaring the British isles to be in a state of blockade. But to make the continental blockade completely effective it was necessary to control all the littoral of continental Europe; and this, accordingly, became the primary aim of imperial policy. The Batavian Republic was converted into a kingdom of Holland, and placed under the control of Louis in 1806, while the refusal of the Pope to accede to the blockade led to the gradual absorption of the Papal States, and to their final incorporation in the French Empire in 1809. This, too, was the primary motive for Napoleon's intervention in the affairs of the Iberian peninsula. While returning from Tilsit, Napoleon commanded Talleyrand to inform the Portuguese that unless they closed their ports to the British by 1 Sept. 1807, he would declare war upon the Prince Regent. As Portugal did not acquiesce, a secret convention was signed at Fontainebleau, 27 Oct. 1807, between France and Spain, providing for the joint conquest and partition of the Portuguese kingdom. The conquest was rapidly effected, and as Junot (q. v.) with 1,500 famished grenadiers struggled into Lisbon, 30 Nov. 1807, the Prince Regent and the royal family fled to South America. But meanwhile Napoleon was preparing to overthrow the Bourbon house in Spain. The court of Madrid had secret grudges against the French Empire, and in a moment of infatuation during the summer of 1806, the Spanish army had been mobilized, with a view of rejecting the treaty of Ildefonzo, which had been the source of the destruction of the Spanish navy. But Jena upset the calculation of Godoy, the miserable favorite, who held the reins of Spanish policy. He explained away his action, protested friendship, showed himself in the treaty of Fontainebleau, prepared to connive at the destruction of the house of Braganza, and did not for a moment deceive Napoleon. The Portuguese campaign, and the dissensions between Charles IV. and his son Ferdinand, gave to Napoleon the pretext for interference. French troops were sent across the Pyrennees, nominally for the purpose of supporting the army of Portugal, really in order to effect the subjugation of the country. Finally the royal family was enticed to Bayonne, and father and son compelled, 5 May 1808, to renounce their claims to the throne. Joseph was sent to govern in Madrid, while Murat, the grand duke of Berg, took his place in Naples. By the middle of May the whole Iberian peninsula had nominally become an annex of the French Empire. In reality the gravest mistake had been committed. An English army under Sir Arthur Wellesley (q. v.) defeated Junot at Vimievo 21 Aug. 1805, and forced the French to evacuate Portugal, while the Spanish people, passionately loyal to the fallen dynasty, hating the French revolution, and impervious to the charms of a scientific administration, everywhere rose in revolt. On 22 July 1808, a large French force under Dupont (q.v.) capitulated at Baylen. It was the first serious military reverse which the French Empire had sustained.

The Austrian war of 1809 was the natural sequel to the insurrection of the Spanish people. Germany was smarting under the hardships involved by the French military occupation and the continental blockade; and the deepest resentment was caused by a decree issued by Napoleon, commanding the banishment of Stein (q. v.), the great reform minister from Prussia. Every German who hoped for better things, looked to Austria as the destined liberator; but again the genius of Napoleon overcame all obstacles. Five brilliant battles (19–23 April) drove the Archduke Charles out of Bavaria. On 13 May, Vienna surrendered to Napoleon. On 6 July he won the hard fought field of Wagram. The English diversion at Walcheren was as ineffective as the gallant raid of Colonel Schill or the march of the Duke of Brunswick's black legion through northern Germany. On 14 Oct. 1809, Francis of Austria accepted the treaty of Schönbrunn, and abandoned the Tyrol, Trieste and the Illyrian littoral to the conqueror. The Tyrolese, who, under the leadership of Andreas Hofer (q.v.), an innkeeper, had made a gallant resistance to the French, were now easily overcome, and while their leader was shot, to the eternal disgrace of Napoleon, their territory was divided between the kingdoms of Italy, Bavaria, and the Illyrian provinces of the French Empire. Nor was this the last affront to Austrian pride. Divorcing Josephine, Napoleon demanded and obtained the hand of Marie Louise, the daughter of Francis. The French Empire had now reached its zenith, though some further rearrangements of territory were effected, mainly for the purpose of improving the mechanism of the blockade. Thus Louis, who was considered to be too lenient to the Dutch, was compelled to abdicate, and the kingdom of Holland was annexed to the Empire on 9 July 1810; while at the end of the year (Dec. 1810) the northwestern portion of the Westphalian kingdom, and all the northwest littoral of Germany, including Bremen, Hamburg, Lübeck were similarly incorporated and organized as French departments. The rigor of the blockade now reached its height. Heavy duties were placed upon all colonial imports by the Trianon tariff, 5 Aug. 1810. The Fontainebleau decrees (18 and 25 Oct.) ordered that all British manufactured goods found in the Napoleonic states should be seized and publicly burnt, while 51 tribunals were established for the purpose of trying persons accused of contraband. So eager was Napoleon to complete the system that in Jan. 1811, he dethroned the Duke of Oldenburg, the uncle of the Czar.

The French Empire by this time consisted of 130 departments, stretching from the Ebro to the Trave, and from the Tiber to the Channel, and girt with a circle of vassal kingdoms and principalities. Throughout this vast area the valuable principles of social equality, religious toleration, and promotion by merit were enforced. Though the codes of the Empire were more perfunctory, more observant of older legal traditions and less liberal than the civil code, which was the work of the consulate, yet they preserved two valuable conquests of the Revolution, the petty jury and public trial. If the essence of democracy was, as Napoleon contended, "a career open to talent," than the French Empire was democratic; but in every other respect it violated the principles of liberty. Special courts were created with summary jurisdiction in the disturbed districts. The censorship of the press (aggravated by the decree of 5 Feb. 1810) annihilated political criticism. Holding that there could be no political stability without "a teaching body actuated by fixed principles," Napoleon created 17 March 1808, a University of France, which was intended to include all the educational agencies in the Empire, and to form citizens "attached to their religion, their prince, their country, and their family." No one could open a school or teach in public without being a graduate of the university, which was to create and administer the public and to authorize and supervise the private schools. The university was divided into 17 academies, one in Paris and 11 in the provinces, and governed by a grand-master, whose appointment and dismissal lay in the hands of the Emperor. The aim of the whole institution was to inculcate habits of military discipline and blind subservience, and to secure complete educational uniformity throughout his Empire. An Imperial catechism, drawn up by Napoleon himself and inculcating obedience to his person, was intended to give a similar direction to the public mind. To fortify the dynasty, Napoleon saw that it was necessary to create an hereditary nobility, but the opposition which had been made to the Legion of Honor in the name of equality warned him to proceed with caution. In the first instance he began by distributing foreign fiefs and titles, carving no less than 17 duchies out of the Venetian states; then (Aug. 1806) license was given to exchange grand ducal fiefs for estates within the territory of the Empire, and to transfer to estates so acquired the privilege attaching to noble tenure. Finally, on 1 March 1809, a new nobility was created, the titles to be hereditary and the noble lands to be entailed. In all, 31 dukes, 388 counts, 1,090 barons, and about 1,500 knights were created under the first Empire; but Napoleon was uneasily conscious that aristocracies were the product of time, and that the nobility of the Ancient Régime despised the upstart dignitaries of the Empire. "I have made princes and dukes," he said at Saint Helena, "but I could not make real nobles."

In France the burden of the Empire was great; but it was still more crushing in the dependencies. It was part of Napoleon's system to reserve half the domains in every vassal state to serve as endowments to generals or favorites, or to help to replenish his imperial treasury. In addition to this, the dependencies were subjected to the conscription and the blockade, compelled to support the French troops who might, from time to time, be quartered on them, and to maintain war establishments quite out of proportion to their financial resources. Thus the benefits secured by the introduction of the French legal codes were largely neutralized; and the French rule became detested all over Germany and Italy. The conscription was everywhere abhorred, while the blockade inflicted great injury wherever, as in Holland or the Grand Duchy of Berg, commerce or industry had been active. If the Italian, Dutch and German merchandise had been permitted a free entry into the French markets the lot of the mercantile and industrial community might have been alleviated; but in this, as in other respects, Napoleon sacrificed the interests of the French dependencies to those of France herself.

The reconciliation with the Papacy, which had been one of the principal achievements of the consulate, was broken under the Empire. The Papal States were annexed to France, 17 May 1809, by a decree recalling the donation of Constantine, and Rome was declared to be a free imperial town. Pius VII. retaliated by excommunicating the despoilers of the Church, and the bull was secretly circulated through the Empire. For this act of temerity he was seized 5–6 July 1809, and carried off to Savona, where he was kept a prisoner. Difficulties, however, soon arose. The Pope refused to institute the bishops named by Napoleon; and Napoleon failed to coerce him. The cardinals and generals of the Orders were convoked to Paris, and the archives of the Roman administration were similarly transferred to the capital of the Empire. By a decree of 17 Feb. 1810, the Pope was guaranteed a salary of 2,500,000 francs, given a palace in Paris, while at the same time it was ordained that all future Popes should at their enthronement swear to observe the Gallican articles of 1682, which were declared common to all the churches of the Empire. This bold and revolutionary measure aroused great protests. Thirteen cardinals refused to attend the Emperor's marriage with Marie Louise, and were in consequence banished to provincial towns and prohibited from wearing the purple. A national council (17 June to 5 July 1810) gave Napoleon no satisfaction, but at last a mutilated remnant of the assembly was induced to declare that the right of institution to vacant sees lapsed to the metropolitan in case the Pope failed to grant institution within six months after the see fell vacant. The Pope signed a brief accepting this conclusion, but in a form which was distasteful to Napoleon, and the sore remained open. At last, after the Russian disaster, Napoleon was induced (concordat of Fontainebleau 25 Jan. 1813) to renounce his claim to the Catholicity of the Gallican articles, while the Pope on his side confirmed the conciliar decree on the institution of bishoprics. But good feeling was never restored, and the alienation of the Catholic Church was one of the greatest errors of the Napoleonic Empire.

The downfall of the Empire was the natural result of Napoleon's ambition. The Peninsula war drained France of her finest troops, relieved the pressure on Prussia, and prevented Napoleon from carrying out the designs on the Balkan peninsula, which had been part of the secret arrangement at Tilsit. Other causes contributed to weaken the Franco-Russian alliance, —Napoleon's encouragement of the Poles, the continental blockade, the Austrian marriage, the annexation of Oldenburg. War broke out in 1812, and Napoleon led a huge army to Moscow. He retreated among the rigors of a Russian autumn (Oct.–Dec.), lost a quarter of a million men, and shattered his prestige. First Russia, then Austria, ranged themselves on the side of the allies. A crushing defeat at Leipzig (16–19 Oct. 1813) compelled the evacuation of Germany, and brought about an invasion of France. Though Napoleon fought a brilliant campaign in the valleys of the Marne and the Seine against the Prussian and Austrian armies, the allies eventually pressed on to Paris. On 30 March 1814, the defence of the capital was surrendered by Marmont, and on 6 April, Napoleon signed an act of abdication at Fontainebleau, and was allowed to retire to Elba. His dynasty was proscribed. On the advice of Talleyrand, Alexander of Russia, who had entered Paris at the head of the allied armies resolved to recall the Bourbons. So perished the Empire in a blaze of military glory, which France will never forget.

On his return from Elba in 1815, Napoleon, realizing the growth of liberalism, made a pretense of liberalizing the imperial institutions, and Benjamin Constant, who had led the opposition to Louis XVIII. was summoned to draw up a constitution. The defeat of Waterloo supervened before any serious trial had been made of the Additional Act, which established an hereditary Chamber of Peers, an elected chamber of representatives, and at the same time guaranteed the freedom of the press; but it cannot be doubted that had Napoleon succeeded in reestablishing his powers, he would have made short work of liberals and of liberalism. At Saint Helena, however, he professed that the despotism of the Empire had been a transitional expedient, and that the future of liberalism and nationality in Europe were bound up with the fortunes of his house; and this was the creed of the Bonapartist party, and the pretext and apology for the second Empire.

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5. France—History Since 1815. The history of France since 1815 is the history of the events that led up to the establishment of the Republic and of democracy. This establishment was not the result of a continuous development but of a series of crises followed by periods of reaction, each crisis making a progress, or as Mr. Seignobos says, «carrying off from the old monarchy a fragment that could not be restored.»

The first crisis is the Revolution of 1830 which put an end to the government of the Restoration. When the allies in 1814, at the fall of Napoleon, reinstated the old dynasty, what the people demanded was peace and also the preservation of the chief reforms got from the Revolution, viz., equality of rights, the selling of the *biens nationaux*, the essentials of political liberties and a chamber of representatives elected by the Nation. To these demands the charter of 1814 gave almost entire ratification; besides, the personal temperament of King Louis XVIII. (1815-1824) was of a conciliatory turn. But he had to strive against the «Ultras» who were uncompromising royalists, and whose chief was the King's own brother, the Count of Artois. This party wanted to restore the former régime of absolute monarchy, in its aristocratic and intolerant form. It was the Ultras who led the movement of violent reaction known as the «White Terror,» and who, being the majority in the chamber of 1816 (called Chambre Introuvable), placed the monarchy in such an awkward position that the King had to get rid of them by a *coup d'état*.

For three years, from 1817 to 1820, Louis XVIII. governed with moderate and liberal-minded ministers. This short period is of great importance; then for the first time were adopted in France those customs that are the necessary adjuncts of a constitutional and representative government, periodical election, annual vote of the budget, the liberty of discussion in the Chamber and, within certain limits, the liberty of the press. It was the régime of the *Monarchie Censitaire*, so-called because the political power belonged to the moneyed classes, only those who paid taxes (or *cens*) to the amount of 500 francs being voters, and those who paid 1,000 francs having a right to be elected.

It is easy to conceive that this policy of Louis XVIII. encouraged the liberal aspirations of the Nation; it vexed the Ultras who succeeded in putting a stop to it, thanks to two favorable circumstances. First they obtained the support of the aristocratic governments of Europe (Prussia, Austria, Russia) that had pledged themselves at the Treaty of Vienna to oppose revolution in any country, and that were already growing anxious at the manifestations of liberalism not only in France, but in Germany, Italy, Spain and the Spanish colonies of America. At the Congress of 1819 at Aachen, remonstrances were made to the French embassador. The second circumstance was the murder of the Duke of Berry (1820) by a lunatic called Louvel. The liberal party was held responsible for it, and the Ultras again seized the power, which they retained till the Revolution of 1830 (except for the short interval of the Martignac Ministry, 1828-1829), under the direction of the Count of Villèle (1820-1827) and afterward of the Prince of Colignac (1829-1830). The reaction of the Ultras was both aristocratic and catholic in character: they endeavored to establish the preponderance of the class of the great landlords, and the authority of the Catholic Church. This reaction reached its climax in the reign of Charles X. (1824-1830), the Count of Artois, who succeeded Louis XVIII. Abroad the Ultra government supported the reactionary policy of Metternich; it was a French army, under the command of the Duke of Angoulème that overcame the Spanish Revolution (1823). Afterward they joined with the English and the Russians in the intervention in favor of the Greeks (1826-1829), and began the conquest of Algeria (1830), but without regaining their lost popularity.

Against the Ultras a coalition was formed that included the modern royalists, the Gallicans, the manufacturers and tradesmen, and the whole of the working classes; as a consequence a majority hostile to the Ultras was sent to the Chamber. In the hope that this majority would not again be returned, Charles X. had twice recourse to a dissolution; but this proving of no avail, he resolved to transgress the charter by a *coup d'état*. The elections were annulled, the electoral laws altered and the liberty of the press momentarily suppressed. These were the famous «July Ordinances.» This *coup d'état* was immediately answered by the Revolution of 1830, originated by a small group of republicans that belonged to secret societies and were chiefly recruited among the undergraduates, the workmen, and people of the middle-classes. After three days' fighting Charles X. was dethroned. But a reaction began at once. In the first place the republicans, few as they were, could not prevent the monarchy from being maintained as the form of government; only another dynasty was called to the throne, that of the d'Orléans who were cousins of the former king, and a pledge was exacted from the new sovereign to adhere to the charter. In the second place, on account of the riots that had broken out in Paris and Lyons, and the manifest signs of a new revolution approaching, the republicans were prosecuted and dispersed by the government. So the crisis of 1830 did not end in the establishment of the Republic, but it founded forever the sovereignty of the Nation with a constitutional government.

The second crisis is the Revolution of 1848, which brought to a close the reign of Louis-Philippe (or July Monarchy, so-called from the Revolution of July 1830). The most characteristic features of this reign are with regard to foreign policy the alliance made with England to ensure peace on a durable basis, and at home the ascendency of the well-to-do classes. The electoral *cens* was indeed lowered, but only to 300 francs for the voters, and 500 francs for the candidates, which still excluded from public affairs both workers and people of small income alike. Now the epoch of Louis-Philippe was marked by an unprecedented development of all manufacturing industries, which created in France as everywhere in Europe a vast proletariate. This proletariate began to ask loudly for laws that should protect them against their employers and even alter the conditions of individual property. The socialistic theories were growing more definite, and the socialists as a party were slowly emerging. Of course the Chambers, elected as they were by the capitalists, could not reject these demands that were aimed against them. The natural consequence of their attitude was a campaign of the socialists and republicans, supported by a large majority of the people, in favor of universal suffrage, or at least of an extension of the right of voting. The resistance opposed by the Guizot Cabinet to this movement caused its fall, and at the same time the fall of the reigning dynasty. Once more the republicans allied to the socialists, provoked a revolution in Paris (February 1848), dethroned Louis-Philippe and established a republican government.

This time the reaction did not take place immediately, and had two distinct stages from 1848 to 1851. There was first a reaction of the republicans against the socialists: the two parties, after uniting to found the Republic and institute universal suffrage, disagreed on the subject of social questions. In June 1848, the republicans shut up the «National Workshops» lately opened by the socialists and ordered a ruthless repression of the riot that ensued. Then there was the reaction of the monarchists and of a newly revived party of Bonapartists against the republicans themselves. The fear of a revolution was cleverly directed against the republican government and speculated upon to bring to the presidency of the republic a nephew of Napoleon I., the prince Louis-Napoleon. The monarchists hoped that he would serve their plans, but he only served his own interests: at the head of the different ministries and public services he appointed men on whom he could entirely rely; and with their co-operation and with the help of the clergy he effected the *coup d'état* of 2 Dec. 1851. The Assembly was dissolved, about 100 deputies were exiled and several insurrections that broke out in Paris and the provinces were sternly put down. A new Constitution was then drawn up that was almost a copy of the Constitution of the year VIII. with the addition of universal suffrage; and the following year Louis-Napoleon had himself proclaimed Emperor of the French, under the name of Napoleon III. Thus the crisis of 1848, in spite of momentary success, cannot be said to have established the Republic; but at all events it strengthened the former acquisition of the people, viz., the sovereignty of the Nation, and maintained their more recent conquest, universal suffrage.

The third crisis is that of 1870. The Second Empire was at first a highly despotic government: every newspaper had to be authorized and was under a censorship, the elections were controlled by the government that required from all candidates alike an oath of allegiance and supported openly its own candidates, the Chambers were deprived of the fundamental rights of deliberating assemblies, the rights of initiative, of amendment and of interpellation; their sittings were not public and reports of their proceedings could not be published; lastly a regular system of political inquisition was established. These were, until 1860, the characteristics of the Imperial government which depended upon the same coalition of conservative interests that had brought it to power and chiefly upon the Church, that was rewarded with the liberty of teaching and a kind of control over the university.

The events abroad obliged the Emperor to modify his policy at home. «The Empire is peace,» were the proper words he had used in 1853 to remove the fears of the French as well as of the foreign powers; yet France under Napoleon III. was engaged in several wars. The first was the Crimean War (1855), which served at the same time the interests of the English and the traditional spite of the French against the Russians. Then there was in 1859 the Italian War into which he was led, perhaps in spite of himself, by a pledge he had formerly taken as a *carbonaro* and by Orsini's outrage, and from which France gained the Savoy and the county of Nice that have been French territory ever since. This war was the most important event in Napoleon's reign, for it opened the «Roman

Question» and dissatisfied the French Catholics who never forgave Napoleon III. his allowing Vittorio Emmanuele to seize the Pontifical States. From that time the Emperor was obliged to form a new majority from the ranks of the liberals and to alter his policy. From 1860 to 1870, and chiefly after 1868, the Empire was liberal: the government became truly representative, the elections were no longer controlled, the press was freed from former restraints and meetings were allowed unconditionally. Napoleon trusted this change of tactics would disarm the opposition of the liberals and the republicans; in fact it furnished them with arms against him. Liberals, republicans, monarchists and Catholics, all joined in an attack against the Empire and were decidedly successful at the elections of 1863 and 1869. The failure of the Emperor's foreign policy brought them further assistance: the «Roman Question» grew so entangled that French troops had to be kept in Rome after the battle of Montana; the Mexican War that partook as much of the crusade as of the financial venture, and that was brought to an end by the intervention of the United States, had a lamentable conclusion; lastly serious differences were growing between France and Prussia whose designs in Germany Napoleon III. neither encouraged nor opposed frankly and toward which he carried on, without the least success, a policy which Bismarck graphically described as «a policy of tips.» The Imperial government thought that a war with Germany would be a convenient way out of all these difficulties: a victory would have consolidated the tottering dynasty. The defeats of Frœshwiller and Sedan completed its ruin. As in 1830 and 1848 it was an insurrection of the republicans in Paris, immediately followed in most of the provincial towns, that upset the second Empire and proclaimed the Republic (4 Sept. 1870).

This time there was, properly speaking, no reaction, but only an attempt at a reaction, and this failed. So long as the war lasted, the republicans retained the power with the *Gouvernement Provisoire*, the most famous member of which was Gambetta. But in order to ratify the preliminaries of the peace, they had to summon an assembly: this was the *National Assembly* that sat first at Bordeaux and afterwards at Versailles. The election took place in most exceptional circumstances: the large majority of the Nation was strongly in favor of peace; on the contrary the republican candidates, like Gambetta, were for carrying on the war to the last, so that the electors, chiefly the peasants, voted for royalist candidates, and the majority in the assembly (some 375 out of 700) was composed of monarchists. But a reaction was not so easy then as in 1830 or 1848; the republican idea had gained ground in the departments of the East, of the South and of the Centre; the party of the Bonapartists had been swept away by the disastrous war, and above all the monarchists themselves were divided in two parties, the *legitimists* who supported the Count of Chambord, a descendent of Charles X., and the *Orleanists*, the Count of Paris, a descendant of Louis-Philippe. These two parties at first silenced their personal ambitions to sign the Treaty of Frankfort and to strive against the insurrection known as the *Commune de Paris;* they further agreed to intrust provisionally the executive power to M. Thiers on whom they officially conferred the title of President of the Republic for this was the only name then available but without feeling bound thereby to accept the Republic as the definite form of government. Both parties hoped they would come to an understanding and ultimately unite, but this hope was frustrated, first by M. Thiers himself who refused to be a party to any restoration and resigned his office 24 May 1873; secondly by the Count of Chambord who persisted in claiming as the National emblem the white flag that was the symbol of absolute monarchy and therefore was as much detested by the Orleanists as by the republicans and Bonapartists. On the other hand, by elections and in every other manifestation of public opinion, it was clearly visible that the republican party was everywhere gaining favor; so that the majority in spite of their monarchic tendencies were at last reduced to vote a republican Constitution which began to work in October 1875, when the *National Assembly* broke up and was replaced by two Constitutional Chambers: the Chamber of Deputies and the Senate.

Then the victory of the republicans could be deemed complete: the government of the country was officially a parliamentary republic with universal suffrage, and the majority in the Chamber of Deputies was republican. Yet both MacMahon (who had succeeded Thiers as President), and the Senate still belonged to the conservative party. The latter resolved once more to try their fortune: on 16 May 1876, the republican minority was dismissed and the Chamber dissolved. But MacMahon shrank from the responsibilities of a *coup d'état,* the elections again sent to the Chamber a republican majority, later on the senatorial elections also placed a republican majority in the Senate; MacMahon had to give up the Presidency and the republicans appointed in his place one of their own men, J. Grévy. Since that date the internal history of France has only to deal with the normal development of her democratic institutions. This development has operated in three principal directions: (1) In the confirmation of political liberties (press, meetings, associations); (2) In the complete secularization of all public services (primary education laicized and made compulsory and gratuitous, divorce, suppression of the religious orders, disestablishment of the Church); (3) In social laws that authorize strikes and trades-unions, enforce certain sanitary regulations in workshops and factories, determine the employer's liability, regulate the work of women and children, limit the working-hours and secure a weekly day's rest to all employees. In spite of the eagerness of the conflict between the different political parties (the moderate or *opportunists,* the radicals and the socialists), the internal peace of the country was not once seriously disturbed. There were, however, two junctures when circumstances assumed a character of particular consequence. The first was what has been called *The Boulangisme* (1887-1889). A coalition was then formed under General Boulanger between the monarchists, the Bonapartists and a fraction of the republican party, dissatisfied at the policy of the *opportunists,* with a view to overthrow the Republic and restore the Monarchy or the Empire under the name of «Plebiscitary Republic.» Boulanger and his supporters took advantage of the *plurinominal* ballot (*i. e.* balloting for a list of persons), to stand candidates in all the departments at once, which amounted to trying a plebiscite. The government checked the movement by restoring the *uninominal* ballot and depriving candidates of the right to stand for more than one constituency at a time; besides it dispersed the leaders of the movement by having them tried for high-treason before the Senate. The second of these junctures was the Dreyfus case, which, owing to its political consequences, had all the importance and significance of a real revolution. First of all it determined a new grouping of the parties: on one side the *Nationalists* recruited from among the monarchists, the anti-semites and a fraction of the progressists, relying for support on the conservative forces (army, religion, capital); on the other side the republicans, radicals, socialists and the remainder of the progressists united into the so-called *bloc* to fight against the same conservative forces in the name of individual right and of justice. The greater cohesion of the parties gave renewed vigor to the political life of the country: from that period date the creation of political leagues as *Les Droits de l'Homme* and *La Patrie Française,* the foundation of the popular universities and of several new journals, and also the interference of the trades-unions in politics. All these influences combined to bring to power such governments as those of Waldeck-Rousseau, Combes, Rouviers, Sarrien, Clemenceau, under which (from 1898 to 1906) the social reforms enumerated above have been accomplished. Since the Dreyfus case two principal tendencies are discernible in the general trend of French politics: one, which brought about the ruin of the denominational schools and the disestablishment of the Church, is irreligious; the other is socialistic: though the party in power still vindicates individual property as the actual basis of society, the nationalizations that are part of its programme are essentially socialistic and at all events can only be worked out with the help of the socialists.

If the progress of democracy has been the characteristic feature of the internal policy of the French since 1870, the maintenance of peace has been the constant object of their external policy. To this peaceful disposition must be ascribed the Franco-Russian alliance and the many treaties signed of late with England, Italy, and even with Japan. May be that to a few individuals these alliances have seemed to offer an opportunity for some underhand action against Germany, but the recent Morocco incident has shown how sincerely the people at large are determined to reprove all manner of aggressive policy.

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6. France—The Government. I. *Constitutional Laws.*—Strictly speaking, the political régime of France cannot be defined as a Constitution but as three separate laws, called constitutional or organic, voted in 1875 and amended by two other laws, one in 1879 and the other in 1884. Strange as it may seem, these laws which make up the political mechanism of the Third Republic were prepared and accepted by an assembly in which monarchists constituted the majority. In fact, of the 750 members composing the National Assembly elected by universal suffrage in February 1871, about 420 were monarchists, the peasantry having voted for the monarchists who favored peace rather than for the republicans who wanted war. However, in spite of their majority, the monarchists were powerless to restore royalty in France, and that for two reasons: (1) the views held by French citizens were so manifestly hostile that M. Thiers, minister to King Louis-Philippe and a strong Orleanist, chosen as «chief of the executive power» and provisional president of the new government by the monarchists, who counted on using him to bring about a restoration, openly declared himself for the Republic, thereby causing his downfall in 1875, when he was replaced by Marshal MacMahon; (2) the monarchists were divided into two rival factions, each of which supported a different candidate for the throne, the *Legitimists* being the partisans of the Count of Chambord, a descendant of King Charles X., dethroned in 1830, and the *Orleanists,* adherents of the Count of Paris, a descendant of King Louis-Philippe, dethroned in 1848. At one time harmony or fusion, as it was then called, seemed about to be realized between the two parties, as the Count of Paris had acknowledged the anterior and superior claims of the Count of Chambord, who, on his side, had legitimatized the dynasty of Orleans by accepting as successor the Count of Paris. But the Count of Chambord forfeited everything by obstinately rejecting the tricolored flag, symbol of the new revolutionary France, and favoring the white flag, symbol of the France of the old régime and of the divinely authorized monarchy. Therefore, Orleanists and Legitimatists resumed their former positions and resigned themselves to a parliamentary republic which put them temporarily on terms of agreement by eliminating the two rival claimants. According to an amendment to the law on the organization of executive power, known as the Wallon amendment, it was decided in the name of the new government, to confer upon the chief of the executive power the title of President of the Republic, and in memory of this amendment M. Wallon was jocosely called «Father of the Constitution.»

These circumstances explain the absence of a Declaration of rights and a co-ordinated

Constitution, such as exists in the United States of America and existed in France from the Constitution of '91 to that of 1848.

The following are the three constitutional laws:

1. *The Law of 24 Feb. 1875,* relating to the organization of the Senate. It regulates the number of senators, the conditions of eligibility, the mode of election and renewal and the power of the assembly.

2. *The Law of 25 Feb. 1875,* concerning the *organization of public power.* It defines the exercise of legislative power, the mode of dissolving the Chamber, the ministerial responsibility, the method of amendment, and fixes the seat of government and of the Chamber of Versailles.

3. *The Law of 16 July 1875,* treating of the *relations of public power.* It deals with the meetings of the Chambers, their prerogatives and the connection of the executive power with the Chambers.

The laws of amendment are as follows:

1. *The Law of June 1879,* suppressing the constitutional residence at Versailles and transferring it to Paris.

2. *The Law of 14 Aug. 1884,* excluding from the presidency members of ancient dynasties and forbidding the republican form of government to be called into question and suppressing irremovable senators and public prayers.

Of these five constitutional laws one has now almost completely disappeared, that is the law concerning the Senate. Of the four others, exclusively relative to political organization, only the following facts are constitutionally established:

1. The existence of a *legislative power* divided into two assemblies, the Senate and the Chamber of Deputies, concerning the organization of which the Constitution mentions only the functions, the interior organization, the privileges of members and the election of deputies by universal suffrage.

2. The existence of a *President of the Republic,* the complete enumeration of his functions and prerogatives and directions in regard to the mode of election and the duration of power.

3. The *reciprocal powers* of the President and the Chambers either in regard to each other or to common questions, such as the convocation of the Chambers, length of sessions, form of dissolution, general procedure of amendment, forms of presidential and ministerial responsibility, method of promulgating laws and concluding international conventions.

Everything outside of these matters depends upon legislative action; the electoral system, ministerial organization, communal, departmental, judiciary, military and financial administration, etc. However, one question remaining outside of both constitution and legislation is the form of government. Contrary to preceding constitutions, these constitutional laws give the greatest scope to legislative action and tend to confound the legislative and constitutional authority.

II. *The Principle of the Separation of Powers.*—It is the opinion of the authors of the constitution of 1875 and of those who interpreted and applied it, that its fundamental and, in a way, its vital principle is that formulated according to Montesquieu under the title of separation of powers. «All would be lost,» says Montesquieu ('Esprit des Lois XI,' 6), «if the same man or the same body of leaders or of nobles or of people, were to exercise these three powers, that of making laws, of executing public resolutions and of judging crimes or individual disputes.» It is important briefly to examine this opinion. Montesquieu's idea may be taken in two different senses. It may signify that the same individual or the same body cannot be simultaneously and successively a legislator, an executing agent and a judge; if so, it is a critical reflection upon the absolute monarchy wherein the king claims the right to make, execute and apply the law himself, or to act in like manner through his agents; every superintendent having a jurisdiction and every minister a *lettre de cachet.* Such a system begets not alone tyranny but, above all, confusion and anarchy. Therefore, if, by separation of powers, Montesquieu meant a division of functions, the assignment of a definite function to each, or, better still, the dedication of each function to a special staff, his idea was simple, elementary and just. But it is not more characteristic of the constitution of 1875 than of any other; it is characteristic rather of modern governments nationally organized. However, if Montesquieu's idea is—and it has been thus interpreted, the interpretation seeming a true one—that in every society there exist three self-governing powers whose parallel action must be separately exercised, independent in their origin and in their course and concurring only in their results; and that a constitution is the affirmation and solid organization of these three powers, on the one hand, the principle does not seem to be admitted by the constitution of '75, while on the other it does not appear admissible. The principle of the separation of powers is not admitted in the constitution of '75, (1) because this constitution does not organize an independent judicial power; (2) because, in this constitution, the legislative power chooses and superintends the executive power; (3) because, in this constitution, the legislative holds the judicial functions; (4) because the executive convokes, prorogues and dissolves the legislative. On the other hand, this principle is not in itself admissible because it is antinomical. A first reason for this is that social life is the result of a collaboration, of a reciprocal penetration of the various forms of activity and not of their parallel isolation. A second reason is that all powers, in no matter what government, emanate from a common source, *i. e.* monarchical or national sovereignty, and that, as representative of that sovereignty, the legislator is the common master of him who executes and of him who judges. Hence in the principle of the separation of powers we can admit only the practical distinction between executive and legislative that serves as a basis of the constitution of 1875, and according to which we shall analyze it.

III. *The Legislative Power.*—The two powers established by the constitutional laws have been accurately stated and defined by a combination of laws forming the real constitution.

1. *The Election of Representatives.*—(*A*) *The Chamber of Deputies.*—The application of

universal suffrage was regulated by the laws of 20 Nov. 1875, and of 13 Feb. 1889, both of which bear upon a great many points in the laws of 31 May 1850, and of 2 Feb. 1852. *Electors.*—Any citizen over 21 years of age enjoying civil and political rights, domiciled for six months in a district and enrolled on the electoral lists, is entitled to vote, which right is, however, withheld from all military men actively engaged either on land or sea. *Eligibility.*—Any citizen fulfilling the aforesaid conditions is eligible except in the cases prohibited by law, *i. e.* where one is a member of an old dynasty or holds a government office within his own province. Moreover, numerous *incompatibilities* prevent the cumulation of a public office and a legislative mandate. Exceptions are made in favor of ministers, prefects of the Seine and of police, chief magistrates of the high courts of Paris and professors of the University. All candidates must declare their candidacy at least five days before the voting so as to prevent one individual presenting himself as a candidate in more than one constituency, such plural candidatures being forbidden by the law of 1889. The voting is by ballot, one deputy being named for each arrondissement; however, when an arrondissement has more than 100,000 inhabitants, it is divided into electoral districts, thus bringing the present number of Deputies up to 583. (The vote is by secret ballot on a white paper—«bulletin»—folded and deposited in the ballot-box by the chairman of the voting-bureau, who is always a municipal magistrate, assisted by four assessors appointed by the electors at the opening of the poll; the hours of voting are from 8 o'clock in the morning to 6 in the evening. A rough count by a committee of the electors themselves follows immediately on the close of the poll, before the official recount. This rough count consists in the exercise of the right of such a committee to open all the voting papers.) The law prescribes two ballots at an interval of 15 days; to be elected on the first ballot, a candidate must have an *absolute majority* (half the votes plus one); on the second ballot, called *ballotage,* and brought into play only if the first ballot is inconclusive, a majority of votes cast suffices. Deputies are elected for four years, the full number of the chambers being elected on one and the same day.

(*B.*) *The Senate* is composed of 300 members, the number determined by the constitution. Since the amendment of 1884 all senators are elected to office, the 75 life-senators appointed by the Senate and created by the constitution, having been then suppressed. Senators are elected from each department, their number varying from 2 to 10, according to the population. The suffrage is called *limited;* the electoral body is formed of it: (1) the *departmental representatives* (senators, deputies, general councillors); (2) *senatorial delegates* elected from among the voting citizens of each township by the municipal council and varying from 1 to 24 according to the population. These senatorial electors constitute a college that meets at departmental headquarters under the presidency of a civil magistrate. The election must end on the day of the third ballot, the first two being cast to find, if possible, an absolute and the third failing an absolute majority for a majority of votes cast. Senators are elected for nine years, some of their number being renewed every three years. Hence, the Chamber of Deputies represents the people as a whole and the Senate *local* bodies. Gambetta called the Senate the Great Council of the Communes of France.

2. *Prerogatives.*—(*A.*) The members of both Chambers enjoy the same personal prerogatives, inviolability from arrest and a fixed salary (15,000 francs to Deputies—9,000 to Senators). (*B.*) They exercise the same *legislative* privileges; adopt their own rules and elect their own committees. Their essential privilege consists, as in all other parliaments, in *introducing* and *voting* laws. In this regard the only difference between the Senate and the Chamber of Deputies is that all finance laws must first be voted by the Deputies. All laws must be voted by each Chamber separately. Only the laws of amendment to the constitution are voted on in another fashion; for these both Chambers combine and form a congress held at Versailles. (*C.*) Both Chambers assembled in congress at Versailles exercise an electoral privilege also, that of electing the President of the Republic. (*D.*) The Senate alone enjoys the judiciary privilege and constitutes itself a High Court to judge the President of the Republic and ministers arraigned by the Chamber of Deputies, as also individuals accused of conspiring against the security of the state (the Boulanger affair in 1889 and the Deroulede in 1899). (*E.*) Finally, each Chamber exercises a similar power over the ministry through the right of *question* and *interpellation.* The latter is especially important inasmuch as the minister summoned is obliged to respond and the interpellation is followed by a vote, after which, unless he receive a majority, he must retire. Interpellation is the practical mechanism through which the ministerial responsibility is exercised. Either Chamber may further control the Government by naming a commission of parliamentary inquiry (the Panama and Boulanger affairs, the condition of the Navy, etc.). The Chambers, especially that of Deputies, exert a really dominant influence over the French Government.

IV. *The Executive Power* is exercised by the President and his ministers. (1) *The President* is elected by Congress (Deputies and Senate combined) for seven years, being chosen from among its own members. His power is very extensive, as he can introduce, promulgate and execute laws, make appointments to all civil and military offices, dispose of the armed forces and negotiate and sign treaties. But, since he can exercise it only through the medium of his ministers, this extensive power is practically reduced to that of appointing his ministers. Being politically irresponsible, he can only be summoned before the High Court for felony. He resides in the Palais de l'Elysée in Paris, and receives a regular salary of 600,000 francs, with as much more for expenses incidental to official entertaining. List of Presidents of the Republic: Thiers, 1871-1873; MacMahon, 1873-1879; J. Grévy, 1879-1888 (the only one reelected); Carnot, 1888-1894; Casimir Périer, 1894-1895; F. Faure, 1895-1899; E. Loubet, 1899-1906; Faillières, 1906—. (2) *The Ministers* form a jointly responsible Cabinet under the direction of the President of the Council.

The latter is appointed by the President of the Republic and is free to choose his colleagues: (11 ministers, those of Justice, the Interior, Foreign Affairs, War, Navy, Colonies, Public Instruction, Commerce, Public Works, Finance, and of Labor, the last created in 1907). They are the President's deputies, who, in his stead, sign or veto all executive documents. Their essential character is their *political responsibility*. They are responsible for their acts to both Chambers, whose members, thanks to the right of interpellation, already defined, can put their actions to a vote which, if it place one or more in a majority, will entail his or their resignation. Such a consequence is not explicitly declared in the constitution, but it follows in the logical order and from the practice of the Government. In fact, in case of conflict between a minister and the majority, two solutions may be resorted to: either the minister's resignation or the dissolution of the Chamber, which must be voted by the Senate. Throughout the history of the Third Republic there is but one record of a like dissolution, which was that of 16 May 1876. President MacMahon had formed the conservative ministry of the Duc de Broglie in opposition to the liberal Chamber, which, by a majority of 363, refused to enter into relations with him. The Chamber was dissolved, the elections resulted in a majority of liberal votes, in face of which the conservative ministry had to submit and resign. Since then, all ministers in the minority on a *matter of confidence* have tendered their resignations. During the first 20 years of the Republic ministerial instability was a veritable governmental defect, being due to the disintegration of parties and the impossibility of constituting lasting majorities. There were, however, ministries that last two and even three years as, for instance, the second Ferry ministry and the Méline ministry. But within the last 10 years this instability has disappeared in consequence of the Dreyfus affair and of the new division of the parties into two *blocs*, the radical-socialist and the conservative. The Waldeck-Rousseau and Combes ministries each lasted three years, the incumbents retiring voluntarily, the Rouvier two years, and the Sarrien is being continued with the same party under the Clémenceau ministry.

National sovereignty, acquired through universal suffrage and political liberties — such as those of the press, of meeting and of association — and a parliamentary régime, that is to say, the supremacy of parliament over the ministry, have become the groundwork of the constitution and of the political government of France.

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7. France — French Socialism. Socialism is an international theory. The same doctrine, the same conception of property, that is, is laid down by socialists in all countries. But every nation has produced its own form in the development of this doctrine, and these forms have been determined both by historical traditions and by the economic medium in which they have appeared.

Two traits have distinguished French Socialism from the rest. The first is that its character is strongly political, by which is meant that it is perpetually attempting to arrive at the government of the state, the second that it is continually animated by an active hope of immediate success in that effort. The French proletariat has (since the French Revolution) been mixed up with most of the decisive political struggles. It was the proletariat which dominated the Commune of Paris in 1793, and thus indirectly dominated the Convention. The French proletariat had, therefore, at the beginning of the modern period, already put its hand upon the central lever of the Revolutionary power. Somewhat later when the energies of the Revolution began to sink, it was among the populace, among the working people (who were already filled with the communistic spirit) that the vital forces of the Revolution were maintained; and the hopes which the proletariat entertained at that moment were of the most vigorous sort. Their programme at the close of the 18th century is summed up in the name of Babeuf. Babeuf did not look upon himself as the head of a mere party — it was in his character rather to despise party, because party always looks for its success to some chance hazard on the political field: it was rather his object to take up again the whole effort of democracy at the point where Robespierre (*q.v.*) had left it, and to widen it beyond the limits which Robespierre had assigned to it. It was his object to free those energies of the Revolution which had been captive since Thermidor. Babeuf believed the proletariat ready to assume and capable of assuming the responsibility of governing France, and had his conspiracy succeeded he would have changed the destiny of the country. The present writer has been told by a friend of Gambetta's that in his youth, when that leader had just come to Paris, he said freely «If Babeuf had won, the world would have been saved.» It would indeed have been saved from the counter revolution, from militarism and from the Napoleonic dictatorship, and a democracy which should have been based upon egalitarianism and alive with enthusiasm would have proceeded in peace to the organization of labour.

The note of all this is that at the very beginning of modern history the French proletariat had ceased to be «underground» as it were in the state. It thought itself strong enough for the highest tasks and it is this hope and this power of action which are continued obscurely or brilliantly in France throughout the whole of the 19th century. The proletariat recovered these hopes of theirs and put them forward again in a lively manner during the «Days of February» in 1848, on which occasion it was a socialistic inspiration which, for a moment at least, was the driving force of the second revolution. Even the terrible reprisals of June did not destroy the historical pride of the French proletariat. The day after the disaster it restated its leading idea and regathered its strength. Proudhom, in the book which he dated from the Prison of the Conciergerie in July 1851, defied the reaction to proceed to its logical end. "*The Revolution,*" he says, "*is at the present moment so thoroughly consummated in the national thought that to pass from thought to action is but a matter for executive energy. It is too late to avoid its power. The Revolution wills to be, and for her to will to be is to will to reign.*" The Bonapartist coup d'état was the object of this peculiarly audacious expression, and it had the effect of raising the proletariat once more to a conquering height in politics. The same hope, the same ambition permeated the days which elapsed just before the fall of the second Empire. Throughout 1868 and 1869 public meetings were the medium where the communist or the mutualist put forward the socialist doctrine with the utmost strength. The middle classes, especially the middle classes of the republican stamp, held aloof and affected to despise such programmes as "utopias," but in the midst of their disdain the revolutionary working men were planning to lay a hand upon the new régime which was so soon to appear. Among Blanqui's papers, notes have been found upon the rôle which the proletariat would presumably play in the Revolution which he saw to be imminent. Had not the war of 1870 cut into these plans and had not the Empire fallen under that particular blow it would, without the slightest doubt, have fallen a few years later under the blows of a Revolution in which Socialism would have had a very large part. The attempts which were made during the siege of Paris by the Blanquistes on the 31 October, and which later developed into the Commune, would have dominated the new government or at least would have been very largely represented in it. There was even a moment when the republican part of France hesitated between the Commune and Versailles, and once again at that moment the French proletariat might have thought itself upon the eve of obtaining power.

It is evident that a working class with traditions of this sort and with an education of this sort is essentially political. It is evident that such a class will be acutely sensitive to political events, will be ready to watch them upon all occasions, and to seize every chance of penetrating into the very heart of the state and of there establishing its sovereignty.

Nevertheless a man might have asked himself after the Commune whether the socialist idea had not been buried. Superficial observers believed it to be dead, or at least laid for a long time. M. Taine expressed that thought clearly, standing with some friends before the wall where the prisoners had been shot in Père la Chaise: he said, "We are rid of Socialism for half a century," and M. Thiers in his electoral manifesto of 1877, during the great struggle of the Republic against reaction which is known as the "Seise Mai," boasted that he had finally crushed "the insane doctrines." It is true to say, moreover, that Socialism then seemed doomed. The foremost of its fighters had been thrown down by the reactionary government of Versailles, they were transported or they were weary of the fight, or they were forced to fly the country. The people no longer so much as heard the distant voices of the exiles.

It must not be imagined on this account that the French proletariat, which had refused to give up hope or to cease a moment from its effort after the days of June 1848, had lost its ideal after 1871.

What had happened was that the working people of the country were now absorbed by another battle which though it was not fought in the streets was not less tragic than a civil war. This battle was the struggle between monarchy and republicanism. The French proletariat at this moment had the foresight to perceive that before it could raise the socialistic flag again, the republican battle must be won, and therefore, under the appearance of a mere constitutional struggle, a class war arose which lasted until 1877. The point of the struggle was to determine whether France should be governed by an oligarchy drawn from the remains of the old régime, an oligarchy of which the Orleanist and clericalized middle class were the nucleus, or on the contrary by an artisan democracy. But this class war, embroiled and intricate as it was, did not suffice for the socialistic idea once it was thoroughly awake, and the proletariat was but waiting for the defeat of the counter revolution to bring forward the social question and to force it upon the victorious republican party. Just after the Republican elections in which the country replied in October 1877 to the challenge of the reactionaries, Guesde and his friends began their revolutionary and collectivist campaign in their newspaper L'Egalité. The moment marks a decisive date in French socialism.

The first number of this journal appeared on 1 Nov. 1877. The very greatest difficulty confronted the leaders of the movement. In the first place the resistance of Marshal MacMahon and of the survivors of the coup d'état had not yet ceased and the socialist party had to defend itself against the accusation which the Republicans brought against it of creating a diversion in the midst of the struggle. "L'Egalité replied to these calumnies and to the treacherous insinuations which accompanied them by exactly defining its republicanism. It used the following words:

"The appearance of this journal in the midst of a political crisis does not arise from the fact that its founders are under any illusion as to the objections which would be made to them by the Republican party, objections of which the last speech of M. Jules Ferry has given us a foretaste. The moment in which we appear has been said by those who are too honest to calumniate us to be ill chosen. To this we reply that we have not chosen the moment. Week after week our first number has been put back in the hope that the will of the country as it was expressed on the 13 October would have been put into full execution. It is not our fault if the delay in radical reform has been caused by the struggle between a small clique against the whole nation.

"We might further ask whether in the opinion of Republicans who blame us any moment whatever seemed well-chosen for attacking the economic privileges of their class, and we defy them, if they are indeed sincere, to reply in any affirmative manner.

"The only men who have the right to attack us in the matter of our publication are the working men, whose organ we desire to be, and upon that side we are quite at our ease. The working class have too clear a conception of their interest not to understand that the moment just before a battle is the very moment when it is the most essential not to leave the liberal middle classes in any doubt as to the nature of the help which we are willing to give them against a common enemy. The moment before the battle is also the moment for proclaiming in the strongest manner that it is not the business of the working classes to be perpetually pulling the chestnuts out of the fire for professional politicians, but rather to clear the only ground upon which their claims can be successfully established. And that ground, of course, can only be a republican republic."

Another formidable problem arose before the organizers of socialism at this time — that is 1877. What should be their attitude toward universal suffrage? Should they despise it or should they use it? Up to that date universal suffrage in France had always appeared as an instrument of reaction. It was under the heavy weight of the peasantry that the Empire had crushed the republican and socialist thought of the towns. Hardly had that thought been relieved somewhat by the revolutionary forces of September and the fall of the Empire than France was again given up by universal suffrage to the reaction, to the country squires and to the fanatical clericals of the assembly at Versailles. But universal suffrage was destined bit by bit to be enlightened and to emancipate itself. The republican idea alone had had the strength to liberate the country from the assembly at Versailles. Universal suffrage had (again through the republican idea) found the strength to break the counter revolutionary attempt on the 16 May 1877. To despise universal suffrage and not to take advantage of it would be to remain outside the national life. To have done so would have been to reduce the socialist to an anarchic and powerless sect. Guesde and his friends accomplished a decisive act and rendered the French proletariat a vast service when they decided to rely upon universal suffrage, for by this decision the proletariat entered into the main current of the national life. They did not expect democracy would of itself achieve the socialization of property. They believed that only revolutionary violence would succeed and that the proletarian revolution would have to be accomplished by force, as every other revolution had been accomplished, and as more recently in the United States had been accomplished the abolition of slavery. But by relying upon universal suffrage they changed the nature of the class struggle, they took it out of the workshop and brought it into the large world of politics. It was decided that the proletariat should choose men who would represent their class when they should send into parliament men who had no idea of needing a majority there, but who could without ceasing act upon and render anxious the capitalist régime.

The plan was to cast upon that régime so implacable a light that in its exasperation and bewilderment a social revolution far more systematic and far more thought-out than the Commune should at last push capitalism to its last entrenchments and make it deliver a decisive battle. The resources of universal suffrage were for Guesde and his friends only the prelude to an active revolution. What might be called the historical ambition and the historical habit of mind of the French proletariat was awake. It thought itself now as ever on the eve of a final assault and believed that it might enter into the government of the state by some unguarded door, and in its turn become master where the other classes had reigned. From 1877 to 1893 this was the attitude of mind of the French socialists whether they were the friends of Guesde or Blanquists, whose leader Vaillant had been brought back from exile by the recent amnesty. In the same tone of thought were journalists who, like Allemane, represented the Parisian proletariat. The great electoral successes of 1893 which suddenly introduced into the Parliament a body of 40 socialists brought this excitement to a head, and the more enthusiastic of the party were justified in believing that the proletariat had at last reached the goal of their effort. The Republican and the middle class parties, worn out by the long and continual struggles between the opportunists and the radicals and broken by the Panama scandals, seemed condemned to impotence. Guesde believed their régime to be in its death throes, and he thought that the moment had come to turn democracy away from what was now no more a corpse. The socialistic minority needed nothing more than ability and courage in his opinion to become the leading majority, and universal suffrage would vote socialist if only an active and wide propaganda could be inaugurated among the peasantry and the smaller tradesmen, to prove to them that their personal interests lay in an alliance with the industrial proletariat.

It was at this moment that Guesde addressed to the bourgeois parties in the Chamber, the phrase: "We need use no weapon against you but those which you have provided for us in your own legal forms."

It will be seen that by this time the tactics founded in 1877 had changed. But the same hopes and the same courageous spirit of action permeated the socialist proletariat. These hopes undoubtedly contained an element of illusion, but they were not all illusion. The political efficacity of socialism was rapidly growing and although the results had not given the socialist proletariat the full victory for which it had hoped, it nevertheless kept the activity of the party and its general spirit alive. Even when, after 1898, the socialist party had to give up the hope of an immediate and final success, it none the less retained the knowledge that it had become an historical force of the first order and one capable of playing a decisive part in the national life. It is this result which, when one eliminates the details of the struggle, remains the chief fact in the participation of socialists in the defence of the Republic under the Waldeck-Rousseau ministry, and the participation which the party also took in the work of laical emancipation under the Combes ministry. The traditional thread which unites the action of the French proletariat is perpetually showing itself in new forms which arise for the momentary necessities of the Republican democracy and the Parliamentary régime. At the present moment the "parti socialiste uni" is withdrawing itself from the parliamentary system of groups and especially from those which aim at the forming of a ministry, but it is not so withdrawing itself in a sort of contemplative solitude, neither is it so withdrawing itself because it has given up hope of some ultimate decisive action. It is withdrawing itself because its leaders have discovered that the moment had come to rally to itself the general conscience of the whole working class and it could not do so without further propaganda. When that propaganda shall be completed, it will be able to throw all its forces into the general movement of politics without in the least abandoning its ideal. In the first great crisis whether interior or exterior that may shake the troubled modern life of France the Socialist party will throw itself into the centre of the struggle and it will be driven forward by the indomitable and compelling hope which its history has taught it.

So true is this that even those of the French proletariat who imagine themselves to be divorced from political action, are, if their methods be closely watched, only seeking some new form of action which shall be more political. What is known in France as "La Syndacalisme," that is the Trade Union movement which pretends to stand aside and to be able to despise electoral and parliamentary action, is at bottom an essentially political thing. When the leaders of this movement put it forward that a general revolutionary strike may compel the world to a communistic form of production — to put forward such a theory is to inaugurate an action that is, at bottom, definitely political. It would be an error therefore to think that the newer movements in French socialism are an abandonment of the chief political method or a delaying of it. They are rather an emphatic assertion of it, an exaltation of that certitude in the political future which we have called the defining character of Socialism in France.

This note of hope, however, which has been so frequently mentioned in this article would be but a sort of madness if French socialism were to count upon the industrial worker alone. For the industrial development of France, though in the last 50 years it has been accelerated, is relatively far less than that of England, Germany or the United States. France is still largely an agricultural country, and if Socialism were to retain as enemies against itself the 19,000,000 of peasants, nay more, if it did not draw them in the wake of its ideas, it would break itself against an insurmountable obstacle. It is on this account that the party has attacked the problem of converting the peasant. The French Socialists know very well that the millions of peasant proprietors will never allow themselves to be expropriated by law. The party has put forth all its efforts to persuade the small proprietors that no such agrarian communism is in view. The theoretical formulæ which have here arrested the development of German socialism have not weighed upon the French party. It is the opinion of the leaders of that party that the peasant proprietors will bit by bit enter voluntarily into a state organized upon the socialistic basis and this is the future that far-seeing men like Blanqui believed to be nearer than in the event actually proved to be. It is this process of gradual and voluntary acceptation of the collectivist state by the peasant proprietors which Guesde foresaw in 1877 and put forward in his newspaper. "The French peasantry" he wrote "may rest assured that expropriation of their land would remain necessarily outside any programme for a collectivist organization of the great industries or of large landed property." Blanqui also had laid it down as a doctrine of tactics in the admirable notes which he drew up at the end of the Empire. He pointed out that the peasants of the country were permeated by revolutionary memories, that the peasants like the rest of the country had a tradition of hearty political initiative, that the peasants had given battle to the nobles and to the priests, and that the peasant had no love for the "fat bourgeois" who had taken the best of the lands. And Socialism he thought based upon these traditions and these memories would end by attaching the peasant to its movement.

In a word, one does not find in France any ineradicable conservative force nor any permanent trend of affairs which can oppose itself to the action of socialism. The Socialist party has such certitude of this that the future seems assured to it.

It remains to add that French socialism, though perpetually attaching itself to party forms, can never permanently attach itself to such forms. It looks to a revolutionary and decisive achievement and bases itself upon a sort of national habit of revolutionary action. It is not to be imagined that this formula, however true, means that French socialism can in the future detach itself from the universal suffrage which governs the country, nor must it be imagined that it can develop its nature apart from the creed of democracy, which is part and parcel of the French people. But when one says that its character will remain essentially revolutionary and attached to the traditions of rapid political action one means that the French Socialist party will, like its predecessors, be perpetually and rapidly choosing from the mass of political events such a congeries as may be used for producing the maximum effect at the critical moment of a struggle, and that, like every other French party of the past, it will continue to reject compromise and to attempt nothing less than the full success of its clear and definite enterprise.

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8. **France—Church and State.*** *Under the Ancient Régime.*—As early as the 6th century when the bishops became influential persons, the Frankish kings began to intervene in the episcopal elections and the two powers—civic and religious—were interdependent. No vital point in the doctrine being ever interfered with by the monarch, the bishops and clergy never found themselves in the necessity of withstanding him, and the Church remained for many centuries the councillor and auxiliary of the king. Throughout the Middle Ages the bishops and richer abbots were great «ecclesiastical lords,» and when the feudal system had made room for the royal supremacy, their order remained on the same level as the nobility and high above the Third Order. The kings of France, Saint Louis as well as Louis XIV. were jealous of the Papal power and carefully fostered in the clergy the national spirit known as «gallicanism» (q. v.).

But although the power of the clergy was so great, one ought not to imagine that their spiritual influence suffered no weakening in the course of ages. The literature of the Middle Ages is full of taunts against the Church, and the Protestant revolt of the 16th century was followed in the 17th by the sceptic spirit of the Libertins, and in the 18th by that of Voltaire and the Encyclopedists. The higher clergy were still a powerful aristocracy when, on the eve of the Revolution, the number of the faithful had dwindled ominously (15 millions out of 27 being only nominal Catholics), and the country clergy had imbibed the spirit of reform which was so soon to cause the great disruption.

The Concordat.—The schism brought about by the *constitution civile,* the banishments and executions made by the Terrorists, the latent persecutions carried on until 1798 and the lack of organization which prevailed during the next three years had left the Church of France in a sorry state, when Bonaparte, then First-Consul, felt in 1801 the necessity of making use of the religious element for his work of restoration. There were very few priests left, numberless churches had been pulled down, or neglected and out of repair, and nine-tenths of the ecclesiastical property had been confiscated by the government or sold and could not be reclaimed without difficulties of all kinds.

It was then that Bonaparte after several months' negotiations with Cardinal Consalvi signed the famous Concordat with Pope Pius VI. The main points of this agreement were the following: The Catholic religion and worship were to be protected by the State, and the clergy to be maintained by the Treasury (the bishops receiving 10,000 francs, and the parish priests 900 francs); in exchange for these advantages the Pope was to nominate no bishop without the consent of the government, and the property lost by the Church during the period of disturbances was to be given up forever. Later on some additional clauses of an aggravating character, known as *Articles Organiques,* were surreptitiously appended to the Concordat; all Papal documents ought to be submitted to the *Visa* of government; the bishops were forbidden to travel out of their dioceses without permission; they might be tried and reprimanded or punished by the State Council; they had no right to hold assemblies between themselves, etc. This arrangement worked for a whole century without any serious hitch, but there were between the Church and the age deep differences which were inevitably to bring on a crisis. There was little real life in the Church. The clergy had been taught to stay at home and dread the worldly visit and they were carefully kept in ignorance of nearly all the scientific movements going on around them.

The only exception was the liberal group formed by Lamennais, Montalembert and Lacordaire, who advocated more freedom for the Church, even at the cost of disestablishment, and pointed out the resemblance between several principles of the Revolution and those of Christianity. But these forerunners of the Catholic democrats of to-day were not heard and the Church was content with the drowsy comfort of her situation. The governments of the Restoration, Louis Philippe, and Napoleon III. looked upon the clergy as a valuable assistant, and while keeping it under control allowed no attack against it. The power of the bishops had never been so great as in the first 10 years of the reign of Napoleon III. (1852-1862).

Meanwhile, an aggressive spirit of unbelief was rapidly developing, thanks to the stagnation of theology, and the success of Renan's works was not long in giving its measure. The politicians who favored the Church were not believers in Christianity. Republican proselytizing was active, too, when the greatest part of the clergy would still support the doctrine of divine right and prayed for a Bourbon restoration. The war of 1870 gave the Republicans their opportunity; the Republic was established, and an overwhelming majority of the clergy found themselves in opposition.

The Disestablishment.—The Concordat was not to be cancelled yet for more than 30 years, but its disappearance was spoken of as possible and easy, and M. Clemenceau never let a year pass without delivering some strong speech against it. He gradually spread a conviction that it was absurd for a democratic and anti-clerical government to maintain a clergy opposed to them and held in subjection by the Pope, *i. e.* a foreign ruler; that the tax corresponding to clerical salaries ought to be levied exclusively on practicing Catholics; and at last that the Catholics themselves would be freer when untrammeled from the state control. For nearly 30 years prime ministers in succession replied that the Concordat was a treaty and could not be cancelled without the Pope's consent; that clerical salaries were part of the public debt, and last, that it was not advisable to give complete liberty to the Church.

In the year 1890 Pope Leo XIII. wrote to the Catholics of France the famous encyclical advising total and sincere loyalty to the Republican government and discouraging the monarchic hopes of the old parties. The younger clergy, who for some years had been republicans at heart, welcomed the Papal letter as a chart of enfranchisement and for a few years the situation seemed altered. The spirit of loyalty gained ground every day among the Catholics, and anti-clericalism was decreasing; for a few years the «new spirit» which M. Spuller had

* Clerical view.

proclaimed in a famous speech really prevailed.

The Jesuits whom Jules Ferry had expelled in 1880 had nearly all come back and filled their old colleges. Most of them were royalists. On the other hand the Freemasons had resumed their anti-clerical campaign, and their influence in Parliament being very considerable, they succeeded in passing several Acts (loi militaire, loi d'abonnement, laicisation des écoles, loi surla comptabilité, des fabriques, etc.) which the Catholics could but look upon as molestations.

The French Free-Masons (Grand Orient of France) differ widely from their Anglo-Saxon brethren. They are above all a political body, strongly tinged with Socialism and so averse to spiritualism and theism that the name of God has been struck from their rituals. They are purely materialistic and aim at nothing short of the total elimination of religion from the body politic.

The last two years of the 19th century were almost entirely occupied by the Dreyfus affair (q. v.). The Catholic papers, especially the *Croix*, showed their anti-semitism in a stupid and shocking manner, and it can hardly be doubted that the increase of anti-clericalism in the following years was mostly a reaction against it. The government of M. Combes was only a long persecution with a dangerous forgetfulness of many vital interests at home and abroad. Its chief act was the expulsion of the religious orders and the confiscation of their property in disregard of the law passed by M. Waldeck-Rousseau. In 1903 President Loubet went to Rome on a visit to the King of Italy and ignored the Pope. Such conduct was considered by the Church hardly reconcilable with the presence of an ambassador to the Vatican. The Pope complained in a circular sent to every Catholic government, whereupon the French ambassador was recalled and all intercourse with the Nuncio suspended, and disestablishment became a certainty in the near future. In fact, the Separation Law was passed by the Chamber in June 1905 and by the Senate in December of the same year.

The main lines of the Act were as follows: The French government ignored the Church as a religious body, and only recognized associations formed according to the law of 1901. These associations were to consist of seven to 25 members who would represent the parish. To these associations the places of worship should be left free, but with the heavy burden of keeping them in repair. The rectories, bishops' palaces, and seminaries should be regarded as state property and taken back from their present owners within five years. The Public Worship Budget was suppressed and the priests were to depend for their maintenance on the associations. The latter were entitled to civic rights, but their property was not to exceed the limits of their needs and their accounts were to be yearly looked into.

The majority of the French Bishops were for submitting to the law, but the Pope, considerably influenced — as was demonstrated through the Montagnini papers—by a few laymen of monarchist and conservative tendencies, vetoed the formation of associations and rejected each successive *modus vivendi* proposed by the French government, so that there is neither a legal status for the Church nor complete separation. The possession and use of the places of worship constitute the last bond. All churches are legally municipal property, but ought neither to be denied to the Catholics nor used for other than religious purposes. On the whole, the Church of France never enjoyed as much freedom as at present, but she never was so utterly destitute. See CHURCH AND STATE. ABBE ERNEST DIMNET.

9. France—Church and State.* At the outbreak of the Revolution of 1789, the Apostolic and Roman Catholic religion was the religion of the State, and, since the Revocation of the Edict of Nantes, no other religious sect, Christian or non-Christan, had had any legal existence in France. Nevertheless, a royal decree two years before had granted a sort of tolerance and legal status to the Protestants. The king had likewise allowed the Jews to live in certain cities in the kingdom, and there to carry on their worship in private: a régime of tolerance, not of freedom of conscience. The relations between the king and the Pope were determined by the concordat concluded in 1516 between Francis I. and Leo X.

The men of the Revolution had no intention at first of secularizing the State or of separating it from the Church, nor even of establishing any real liberty of conscience. The Declaration of Rights of 1789, granted, in fact, only tolerance, and it was not until the 27 Sept. 1791 that the Constituent Assembly placed the Jews on a similar footing with other citizens. While it confiscated the possessions of the Church, it nevertheless tightened the bonds of Church and State by means of the law entitled the «Civil Constitution of the Clergy» (12 July 1790). This gave to the clergy a salary from the State, by which the parish priests especially profited, and this first budget of the Religions rose to about one hundred million francs. As a consequence and climax of the Gallican policy of the kings, the Civil Constitution of the clergy tended to make the Catholic religion national. Thenceforth the bishops and the priests were elected by the people; the bishops no longer received from the Pope their canonical institution; it was given them by another bishop. The newly elected clergyman could not address to the Pope any request for confirmation; he had to confine himself to writing to him, as visible head of the universal Church, in testimony of unity of faith and communion. Thus without any diplomatic notification, the concordat of 1516 came to an end.

But the Catholic religion continued to be the religion of the State, and no salary was allotted to the ministers of other creeds; it was thought that enough was done for them in leaving them undisturbed. Such were the events which, little by little, led the Revolutionaries to loosen the bonds which united Church and State. The Pope, after much hesitation, condemned the Civil Constitution, and the clergy divided into two factions whose numerical proportions are not well known. Those who accepted the Civil Constitution and

*Anti-clerical view.

took the oath it demanded were called *Constitutionals,* or *Assermentés;* those who in obedience to the Pope refused the oath, were called *Refractories.*

There were thus a Papal Catholic clergy and a non-Papal Catholic clergy whose partisans quarrelled for the possession of the churches almost to the point of civil war. The inclinations of both parties alike were adverse to the liberty of sects; but most violent objection to such liberty was made by the papal clergy, who had become an opposing minority. The Constituent Assembly with very ill grace finished by granting the principle of it by the law of 7th of May, 1791, which authorized the Papal party to carry on their worship in the churches in concurrence with the non-Papal party with reservations and irksome restrictions. This was to some extent a recognition and consecration of the existence of the schism, but the people, attached to the idea of religious unity, had no wish for any schism. Consequently, in one part of the country the Papal clergy, in another the non-Papals were harassed; and continual religious disturbances took place during the years 1791-2. It was the recognition of this situation which inclined many enlightened Frenchmen to the then very unpopular idea of the separation of Church and State and the secularization of the State.

Even the National Convention, which passes in history as an assembly of atheists, put aside at first, in Nov. 1792, a project of separation, and formally maintained the Civil Constitution, limiting itself to making laws against refractory priests. But soon, when the Republic had replaced the monarchy, all the Catholic clergy became unpopular. The patriots accused the Papal clergy of conspiring with outside enemies and with the *émigrés,* and also of fomenting the Civil War in the province of la Vendée. They accused the non-Papal clergy of having taken part in the Civil War of the Republic with the Girondins against the party of the Mountain. It seemed to the people that all the priests, Constitutionals or Refractories, were conspiring against the Revolution, and that they were a permanent danger to the Republic. Although the people had not become philosophers, they had the feeling that to put it out of the power of the priests to harm the country, they would have to tear down their altars; and it was thus, much less by philosophy than by patriotism, much less by anti-religious fanaticism than as an expedient of national defense; it was thus, I say, that there arose these popular disturbances which finished by taking the form of an attempt at the dechristianization of France. There was first the cult of Reason, with which the Convention was associated only to a limited extent, principally in permitting the communes to renounce their worship. Through its Committee of Public Safety it strove to prevent violence against persons; it proclaimed the principle of liberty of conscience. But passions were stronger than the laws or the Government. One after another most of the churches were closed and the observance of religious worship was pretty generally suspended in 1794.

A new attempt at a State religion was made the same year by the efforts of Robespierre, who was then the true head of the French government; this was the worship of the Supreme Being, a sort of philosophical religion or purified Christianity, which disappeared entirely, or almost so, when Robespierre died.

Then, when the victories of the French had put an end to the terror which the coalition of priests and foreigners had inspired, the Catholic religion spontaneously reappeared. Then at last, enlightened by experience, waiving all idea of a State religion, the National Convention established the secular régime of separation, which lasted from the end of 1794 to the spring of 1803. Under this régime the State paid no further salaries to any sect, and all the sects, equal before the law, worshipped freely, with the provisional restrictions and the police precautions rendered necessary by the state of foreign and even civil war in which France still labored. A number of the churches were restored to purposes of worship, on condition that the priests who should enjoy the privilege should submit to the laws. Nevertheless, there remained a shadow, a trace, of a State religion; this was the «*culte Decadaire*» or «Ten-Days» religion, a sort of official religion of patriotism, which disappeared little by little under public indifference, when the country was no longer in danger. On the other hand a new religion arose, a kind of unofficial continuation of the cult of the Supreme Being; this was Theophilanthropism.

Papal Catholics, non-Papal Catholics, Jews, Protestants, Theophilanthropists, adepts of the ten-day cult; all these sects acted as counterpoise to each other in a state of liberty, and although the vicissitudes of foreign and civil war brought on acts of intolerance, it may be said that the régime of separation of Church and State became a part of the life of France at the time of Consulate, that it was at least endurable for all sects, and that there was a rich development of religious life.

If Napoleon Bonaparte suppressed this régime of liberty, at which he had himself presided with as much success as talent; if he came at last to desire and to effect the reunion with Rome, to conclude a new concordat, it was not at all from piety but from personal ambition, his purpose being to command, through the Pope, the consciences of men, to realize through the Pope his dreams of power and of universal empire.

When the victory of Marengo had made him sufficiently popular to believe that all things were permitted to him, in the enforced silence of public opinion and the press, he entered upon negotiations with the Pope, and on 15 July 1801, at Paris, an act was signed which, since none dare call it a concordat, was called a Conversion, but which was really an agreement analogous to that which Francis I. had concluded with Leo X. In it Catholicism was not declared the religion of the State, but the fact was recognized that it was the faith of the great majority of the French people. The Pope was to demand or force the resignation of all the bishops then acting, and after a new circumscription of dioceses had been determined on, the First Consul was to make nominations to these bishoprics or archbishoprics, and the Pope was to confer on the persons thus nominated, canonical ordination according to the forms of the earlier concordat. The bishops should nominate the priests, but subject to the approval of the government. The Pope promised that the purchasers of property formerly belonging to the clergy should not be disturbed; and a suitable salary was to be given the bishops and priests by the Government. On the other hand, the First Consul instituted some regulations of policy, called the Organic Articles, by which he received security from the churches, in conformity with the ancient Gallican policy. The Conversion and the Organic Articles became law on the 18 Germinal, year 10 of the Republic (March 1802) and the new concordat was in force from the end of the following April.

The greatest advantage that accrued to the Pope from this document did not appear in writing: this was the suppression of schism. Bonaparte abolished the heretofore constitutional church. He abolished also Theophilanthropy and whatever remained of the «Ten-days» worship. Protestants and Jews were recognized and protected by the State, but not with the same degree of honor and influence. The Concordat promised salaries only to the district priests. When Bonaparte became emperor, he allowed a salary to other priests or curates to the number of more than thirty thousand. The budget of Religions swelled little by little. At the time of the rupture of the Concordat, in 1905, it was about fifty millions of francs.

Pope Pius VI., who had signed the Concordat, came to Paris in person to consecrate the new Emperor, but Napoleon did not find in him the docile tool he was counting upon. Not being able to bend him to every whim of his despotic will, he used force, had him carried off from Rome and kept him a prisoner at Fontainebleau, thus provoking the wrath of the Catholics and bringing upon himself the hatred of all religious persons.

It was in hatred of Napoleon, likewise, that Louis XVIII. planned to make a new concordat more favorable to the Church. This concordat was, indeed, drawn up in 1817, but it was not carried out, and it was the concordat of 1801 which governed the relations of the Catholic church and the State up to the beginning of the 20th century. The charter of 1814, while guaranteeing the freedom of conscience, declared Catholicism as the State religion. This declaration was from the charter in 1830, and the government acted from 1815 to 1905 in the direction of a real liberty of the sects, at least of those recognized by the State: for no legal guarantee was granted to the founding of new sects. On the whole, although some of the liberal party, from the time of Louis Philippe demanded a return to the régime of the separation, the regulations of the Concordat acted without encumbrance and seemed to suit the state of public opinion in France up to the end of the 19th century.

After the promulgation of the dogma of Infallibility, the Catholic Church, now an entirely absolute monarchy, appeared a menace to civil society; especially when the suppression of his temporal power had made the Pope invulnerable. On the other hand, since the loss of Alsace-Lorraine separated from France a large number of Lutherans, Catholicism had no longer any rivals but the Jews, who do no proselytizing, and the Calvinists, who do very little. In the years which followed the Franco-Prussian war, the Catholic clergy showed a desire to govern France and even to plunge her, all shattered as she was, into the perils of a war for the restoration of the Pope's temporal power. The same clergy favored the two attempts at political reaction by Marshal MacMahon. Thus the priesthood lost its popularity. Soon the primary schools, now a lay institution, enfeebled religious faith in France, and free-thought made great strides. Every year in the Chamber of Deputies, lively opposition was made on the vote on the budget of Religions, and the separation of Church and State was demanded in a considerable number of Electoral programs; but there was, nevertheless, no strong popular movement in this direction. Even the Chamber elected in 1902 seemed determined to maintain the Concordat.

An unlooked-for incident changed the situation. In the spring of the year 1904 the president of the French republic returned the visit which he had received from the King of Italy, and moreover returned it at Rome. The Pope, who still claims the sovereignty of his ancient States, declared himself insulted by this proceeding, and addressed to all the Catholic Powers a document in which he complained of the offence committed by the French against his rights and his dignity. This memorandum, when made known, deeply wounded the national sentiment of the French. The government of the Republic recalled its ambassador from Rome and returned to the Papal nuncio his passports. There was a complete rupture of diplomatic relations between France and the Pope, and on 10 Feb. 1905, the Chamber of Deputies, by a majority of 386 votes against 111, declared «that the attitude of the Vatican rendered necessary the separation of Church and State.»

The writer of the project of a law of separation was M. Aristide Briand, Socialist Collectivist, a man of character more moderate than his opinions. He strove, by skillful combinations, to prepare a régime that would be acceptable to the Church, but there were no negotiations, official or direct, with the Pope himself. The Briand plan received, in the course of debate, but few amendments.

The whole bill was passed in the Chamber of Deputies on 3 July 1905, by 341 votes against 233, and in the Senate, on 6 Dec. 1905, by 179 votes against 103. The law was declared 9 Dec. 1905. It forms to-day (1907) the politico-religious system of France.

The particulars of the law are these: the Republic assures liberty of conscience, and guarantees the free observance of religious worship; it does not recognize nor pay nor subsidize any sect. All public religious establishments are suppressed, revenues, factories, councils of elders, consistories and the like. The property of these establishments will be transferred to associations called «cultuelles» to provide for the expenses, the maintenance and the public observance of a sect, and composed of a minimum of 7, 15, or 25 persons, according to the population of the community. The church buildings which belong to the nation (and this means the greater number) will be left free of charge at the disposition of the religious societies, who will be held responsible for repairs of all sorts. Life pensions are granted to ministers of religion of more than 60 years of age and actually in service; those less than 60 years old will receive an allowance for four years. As to the police regulations of the sects, the meetings are public, but take place under the surveillance of the authorities in the interest of public order. Penalties are enacted against such ministers of religion as shall make in the churches any extreme political opposition to the Republic.

The Protestant and Jewish congregations submitted without difficulty to this law, but such was not the case with the Catholic Church, or rather with the head of this Church. The majority of French bishops, in assembly at Paris, agreed to accept the law, after a formal protest, and to organize under the name of Canonical Associations, societies analogous to those the law recommended. There even seemed to be a sort of agreement established between the clergy and M. Briand, who had become Minister of Public Instruction and Religion, and who had charge in this capacity of the administration of the Law of Separation. Moreover, the most eminent of the Catholic laity, the Catholic «Intellectuals,» had publicly advised the Pope to accept the law. The Pope preferred to follow the advice of the Jesuits, who urged him to an uncompromising resistance. He believed that the formation of religious societies would bring democracy into the Catholic Church in France, and from that the destruction of the monarchical hierarchy of the Church would some day result. Not only did he condemn the law but he forbade the formation of the religious societies or anything that resembled them. The French bishops were dismayed, but they obeyed the Pope.

There seemed reason to fear a religious civil war. Already at the beginning of the administration of the law, when the government wished to make an inventory of articles of furniture kept in the churches, the Catholics had forcibly opposed the officials in more than one place, and in some conflicts blood was shed.

This time the government pushed prudence to the point of negative passiveness. It allowed the Catholic priests to continue their services in the churches of which they already had possession, and to this day they keep this possession under provisional title with no legal right nor guarantee. There has not been any religious disturbance in any part of France since the Pope rejected the law. Some of the Catholic laity tried by a sort of schism to form religious associations in defiance of the Pope's orders; their attempt fell flat, in the face of public indifference.

But the decision of Pius X. deprived the Catholics of property whose transmission to the religious societies was assured by law, that is to say, the property of the former establishments of the sect, whose sum total is reckoned at about three hundred million francs. The Catholics thus see themselves defrauded of the resources they would have found in the assessments, collections, and contributions of the religious associations. It will be difficult for them to pay their clergy, it will be difficult to recruit them. Furthermore, the Pope has the advantage of being able to name the bishops without the permission of the French government, and he makes use of this privilege in such a way as to strengthen his absolute power by the choice of bishops of the most tractable nature, and oftener Romans than Frenchmen.

At present the politico-religious question in France seems dormant. The progress of philosophical thought and especially of democratic ideas has turned the attention of the French away from theological discussion, and almost all their intellectual activity seems to be occupied with social questions. The Catholics appear to be resigned to the situation, so troublesome from a material point of view, which the uncompromising attitude of the Pope has forced upon them; the free-thinkers and the anticlericals do not seem to think of contesting with the Catholic clergy the provisional possession, however illegal, of the churches which the tolerance of the government actually leaves to them. There will be, however, one difficulty, namely the very expensive repairs of these buildings. On whom will this expenditure devolve? But it does not appear from the present state of public feeling, that this difficulty will lead to disturbances. At this time the régime of separation of Church and State is acting in conditions of peace which indicate not so much a state of provident wisdom as the weakening, each day more marked, of religious faith in France. See CHURCH AND STATE.

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10. **France—Education and the Educational System.** I. *The Development of Education.*—The organization of education in France as a public service is of comparatively recent date. Before the Revolution of 1789, teaching was considered as essentially a matter of private enterprise, and little, if anything, had been done to regulate and control it. Naturally enough it was the Church that first understood the importance of instruction and the first masters were members of the clergy. As far back as the 10th century there were monastic and cathedral schools scattered all over the kingdom, which possessed a large population of scholars and attracted students from the most remote parts of Europe. At the end of the 12th century some of these schools had already developed into universities. The University of Montpellier, the most ancient of all, was established about 1125; that of Paris about 1150, and others followed rapidly: Orleans 1200, Angers 1220, Toulouse 1230, Grenoble 1339, etc. In their turn the universities gave birth to a num-

ber of colleges, and after the great revival of learning at the Renaissance, the latter multiplied so, that in Paris alone, there were more than 50 of them. As to the universities, they, too, steadily increased, and when the Revolution broke out in 1789, there were no fewer than 25 in France, Paris being the most important with 6,000 undergraduates. But so far, little had been done for the education of the people at large, and learning had remained the portion of an «élite.» Primary instruction was given in small uncomfortable schools by masters not often qualified for their task: teaching the rudiments was looked upon as a trade, and the customers were few, because few were able or willing to pay. Yet a universal feeling prevailed throughout the kingdom that this state of things was to be remedied, and when the «Etats généraux» summoned by Louis XVI. assembled in Paris, there was a loud cry from the third estate and the clery for better schools and a wider diffusion of instruction among the people. They distinctly asked for a national education of all classes, by means of national schools. But the expense entailed in the execution of such a vast scheme was obviously too much for the public treasury, exhausted as it was by continuous war. «The Constituante» adopted the principle, but two years later when the members of the «Legislative» were asked by Condorcet for 24,000,000 francs as a first outlay, they were obliged to reduce the estimate to a paltry 200,000 (29 May 1792). In spite of repeated discussions in the assembly concerning the opportunity of making education compulsory, and of several decrees trying to enforce its decisions, nothing really effective could be done for the time being. The first practical measure was taken by Lakanal and the «Convention» (27th Brumaire year three) when they granted a subsidy to the primary schools then extant, and created training schools to recruit masters. This was but a very imperfect solution, and one that only partially met the wishes of the people, but it was the greatest effort made by the Revolution to solve the problem of a national primary education. More was attempted in favor of secondary education, which received a common programme of studies combining scientific with classical training, and for which the act of the 7th Ventose year three established the so-called «central schools.» A new plan of secondary education, drawn up by Napoleon, then first consul, with the help of Fourcroy and adopted by Parliament (1 May 1802) brought up to 36 the number of the central schools, which took the name of «lycées» and which were provided with the necessary staff of masters and an effectual budget. And it was only the beginning of a vaster scheme, for in 1808, when he had become emperor, Napoleon with a view to forming a young generation devoted to the Imperial régime, founded the Imperial University, «exclusively entrusted with the mission of teaching and giving education in the whole Empire.» It was a complete organization of education in three degrees, elementary, secondary and superior, placed in the hands of a privileged corporation, which, in the intention, at least of its founder, was destined to abolish private education everywhere and in all its forms. This total abolition, of course, was as yet impossible; so private colleges were tolerated, but only under the control of the omnipotent University and with the main object of recruiting pupils for it afterwards. Moreover, of the national primary schools that were so badly wanted, few, if any, were created; Napoleon's University merely adopted and, so to speak, legitimated those which existed already. Guizot in 1833 for the first time seriously took in hand the interests of popular education; under his influence the primary schools increased in the proportion of nearly 900 a year (24,000 in 1847, against 9,000 in 1830).

However, it belonged to the Third Republic to achieve the task conceived by the Revolutionaries of 1789, unsuccessfully attempted by their successors and only begun by Guizot himself. In 1882 Parliament adopted Jules Ferry's famous education bill that rendered primary instruction compulsory and gratuitous. Nor was its interest limited to the more elementary and democratic form of knowledge, all the departments of education were infused with a new life: 800,000,000 francs (£32,000,000 sterling) were spent on new buildings including Faculties and Lycées as well as schools, and the annual educational budget was raised within 30 years from 44,000,000 francs to 210,000,0000 francs.

These figures, of course, must be understood to represent the share of the State only, not the total of the expenses connected with education; besides the national schools and faculties, there exist a very large number of private institutions, of which further mention will be made.

II. *Organization of National Education.*— The modern «University of France» is still to some extent organized as was Napoleon's «Imperial University»; only it is no longer, as it was then, an independent corporation. Since the creation of the Ministry of Public Instruction by Charles X. (26 Aug. 1824), it has been administered directly by the State, as the other great public services. The supreme authority is officially in the hands of the Minister of Public Instruction, who, however, is helped in his decisions by the directors of the three departments of superior, secondary and primary education, and more effectually still by several deliberating assemblies of professors and officials, the most important of which are the University Council and the Committee of Public Instruction. As direct representatives of the central power, 15 *rectors* residing in the 15 university towns have the supervision and management of all educational matters in their academy (or academic province). Each academy possesses also an assembly of professors elected by their colleagues, the Academic Council, in which are treated pedagogical and administrative questions interesting the academy. Under the rector are placed *Academy Inspectors*, who have the care of secondary and primary instruction, and under them again *Primary Inspectors* who superintend the primary schools.

Thus the three different branches of education are grouped into one vast administrative organism, insuring their homogeneity and the necessary unity of direction. Each of them, however, being destined to meet distinct and separate wants and consequently being managed on a distinct and separate plan, it is necessary to view them each by itself.

Primary Education is compulsory for all children from 6 to 13: those who do not attend the government schools (where it is gratuitous), are obliged to prove that they receive proper tuition either in a private school or at home. The matters taught are reading and writing, orthography, composition, arithmetic, the elements of natural history and natural philosophy, history, geography, drawing and singing and also gymnastics for boys and needlework for girls. At the end of their regular course of studies, those of the pupils who want a more substantial and wider instruction, and yet do not choose to go to a lycée or a college, may get it in one of the 350 «superior primary schools» created within the last 25 years, or attend the so-called «complementary lectures» where superior schools have not yet been established. This «superior primary education,» which in some points is like a sort of cheap secondary education, has, however, a more practical and positive object than the latter and is better suited to the wants of the working and commercial classes. For such of the young men or girls who cannot spare the time to complete their studies in superior primary schools, there exist in all towns and in most villages, evening classes, which, it is true, are due to the masters' own initiative, but which at the same time are officially recognized and encouraged by the academic authorities.

Everyone possessing the necessary diplomas may apply for a post of master or mistress in a primary school; but the government, understanding that good teaching can only be given by well trained teachers, has provided in each department two training schools, one for girls and one for young men, in which the future masters and mistresses are kept and educated for three years at the expense of the State. School-masters and mistresses are appointed and promoted, not by the minister, as is the case for the professors of the other two degrees of education, but by the prefect in each department, with approbation of the Academy Inspector.

Secondary Education is given to the boys in 106 lycées and 246 colleges. A lycée is properly a public school, being the property of the State, kept and administered by the State; whereas a college is a municipal institution. In both the professors are appointed by, and placed under the authority of, the Minister of Public Instruction; in both also the matters taught are the same; yet there is a difference between them as regards their respective importance, the average number of boys in a lycée being 500 to some 200 in a college; and instruction in the former being generally recognized as of a higher standard. In a lycée the masters are divided into two classes: the «agrégés de l'Université» (*i. e.* fellows) who hold a regular professorship, and the licenciés (M.A.) who are simply «chargés de cours» or lecturers. In a college the professors are only licenciés.

Within the last 15 years the secondary curriculum has been repeatedly modified: originally it comprised only two parallel courses of study, of which one was chiefly classical and the other chiefly scientific. It has now become more complex: the division in two sections is kept through the lower forms up to the third, after which the boys have to choose between four sections according to the «specialties» they think will be most useful to them in after life. These specialties, which are part of the staple of secondary education, are coupled into four groups: (1) Latin and Greek; (2) Latin and Modern Languages; (3) Latin and Sciences; (4) Sciences and Modern Languages. At the end of the first form, generally at the age of 17, the boys undergo one of the four examinations corresponding to the section to which they belong, and then spend one year more in the study of philosophy or of the more advanced mathematics, after which another examination (the second of the «baccalauréat») successfully passed gives them the title of «bachelier,» the official conclusion and stamping of secondary education, the possession of which is necessary for most liberal professions, and absolutely requisite for admission in the Faculties.

Up to 1881 the State had provided no regular system of education for girls. In spite of a not very successful attempt of Duruy in 1867 to organize lectures for them with the help of professors from the boys' lycées and colleges, it may be said that the girls had really no choice but between education at home or in private schools, chiefly in convents. Within six years (1881-1887) 35 lycées and colleges for girls were founded in as many towns, and the number has since rapidly increased. In these the lessons are now given everywhere by lady teachers qualified after studying in the universities or in the special training college of Sèvres. There was at first a strong prejudice against these establishments among the families that were accustomed to another sort of feminine education, but it is gradually dying out, though it cannot be denied that, even at the present time, the great majority of girls are still educated in private and congregational schools.

Superior Education.—Of the 25 universities that existed in France before the Revolution, 13 were suppressed in 1793 and have not been reopened since; four new ones have been created, bringing the total to 16. Here they are in the order of their foundation: Montpellier (1125), Paris (1150), Toulouse (1230), Grenoble (1339), Aix-Marseilles (1409), Caen (1431), Poitiers (1431), Bordeaux (1441), Besançon (1485), Nancy (1572), Dijon (1722), Rennes (1735), Lyon (1808), Lille (1808), Clermont (1808), and Algers (1849).

A university consists of four Faculties: Letters, Sciences, Medicine, and Law. At the head of each Faculty is a dean elected by the professors and placed immediately under the rector of the university, who, it must be remembered, is the chief of the academic province of which the university is the centre. The lectures in each Faculty are given by «professors» who must be doctors, and «maîtres de conferences» (tutors or lecturers) who are agrégés (fellows). These lectures are open to all undergraduates that have duly matriculated, *i. e.* who, being in possession of the necessary diploma of «bachelier,» have entered their name on the Faculty's register, and paid the matriculation fee of 100 francs a year. This, with 30 francs for the use of libraries and laboratories, is all that the undergraduates have to disburse. Such small sums of course cannot be regarded as a retribution for the lessons received, but as a kind of duty exacted to ensure the legal status of the student. Officially, superior education, like primary education, is gratuitous.

Two degrees may be taken at a university: The first is the «licence» (the old *licentia docendi*) for letters, sciences and law, and the second the degree of doctor which is the reward of at least one scientific work (thesis) presented and publicly discussed by the candidate that must already be «licencié.» The old medical licence having been suppressed long ago, doctors of medicine make an exception to the otherwise general rule that to be a doctor one must first be a licencié, but the test of their attainments and ability is previously made in progressive examinations during the course of their studies which extend over five years at least.

To the universities proper that have been enumerated above, should be added the Superior medical schools of Amiens, Angers, Limoges, Nantes, Rheims, Rouen and Tours. As regards the University of Paris, one would have a very incomplete idea of it, if one limited it to the four Faculties that have the Sorbonne for their centre. It includes a large number of establishments of which the College de France, Ecole des Chartres, Museum, Ecole des Hautes Etudes, Ecole des Langues Orientales are only the principal. More or less directly connected with it, though not all placed within the authority of the Minister of Public Instruction, are also the Ecole du Louvre, Ecole des Beaux-arts, Ecole des Arts Décoratifs, Conservatoire, Ecole Superieure des Mines, Ecole des Hautes Etudes Commerciales, Ecole des Sciences Politiques. Even if one leaves these schools aside, and only takes into account the former, that are the natural complement of the four Faculties, the University of Paris appears as something unique in the world. To give an idea of its importance it suffices to say that of the 21,033,778 francs annually spent on superior education, 9,952,191 francs, *i. e.*, almost one half, are absorbed by the University of Paris alone, and that the number of its undergraduates exceeds 12,000.

Whether this affluence in Paris is a good thing, may be and has often been discussed; it is a fact that it takes from the provincial universities their best teachers and a large proportion of their students, but at the same time it is undeniable that this very density of the scholastic population of Paris is a strong stimulus to intense intellectual labor: there is no place in the world so replete with illustrious names or so productive of remarkable achievements, both literary and scientific.

III. *Private Education.*—The monopoly of teaching which Napoleon had given to the Imperial University, and which the Royal University retained after it, was abolished, practically in 1830, and officially in 1850 by the Falloux Bill. This bill, though recently modified in many of its clauses, has not been recalled as regards the liberty of teaching.

Since private industry and charity were allowed to compete with the public treasury, the competition has been a sharp one; the development of the national schools was everywhere attended by a parallel increase of the private ones. It is worth remarking, however, that this régime of liberty chiefly served the interests of the Catholics who, opposite the State University of France, built up, as it were, a university of their own, including establishments of the three degrees, primary, secondary and superior. Indeed, so preponderant is their influence in the so-called «enseignement libre», that a private school is generally understood to mean a Catholic school.

The private establishments being as exact a copy as possible of those which belong to the State, there is no necessity to insist much on the subject. Yet a comparison of their respective importance cannot be dispensed with; it will moreover have the advantage of showing that an efficient preponderance is ensured to the National University. As the statistics were made before the recent expulsion of most religious orders, which could not but affect some of the private schools, this comparison is only an approximation; but on the other hand, in most cases the place of departed ecclesiastics having been taken up by Catholic lay teachers, the figures given below may be considered as sufficiently exact. With regard to primary education, the State establishments are far ahead of the others, with 67,340 schools, 100,913 teachers, and 3,671,727 pupils, against 14,331 private schools kept by 41,747 private teachers and receiving 925,301 pupils. It was chiefly in secondard education that the competition of private industry was successful, for the French middle and well-to-do classes are to a large extent favorable to Catholicism. The number of boys is virtually the same in private colleges as in the State lycées and colleges: 86,347 for the former, against 86,371 for the latter. The competition is more successful still as regards the education of girls: the State colleges, it has been said before, attract but a comparatively small numb· of them. Here the Catholics have an undeniable advantage, but they are far behind with their universities. They gave the utmost of their effort in 1875 when they founded three Catholic universities in Angers, Lille and Lyons, and a Catholic Institute in Paris. For these they are wholly dependent upon charitable foundations (superior education being gratuitous, and the matriculation fees being received by the State); so, far from being able to increase them, they experience great difficulty in maintaining what they have created. On the whole, therefore, the superiority of the State establishments is obvious and assuredly sufficient to reward the pecuniary sacrifices of the nation. But in Fra· the religious quarrel has reached almost a crisis; and the fact that the education of the higher classes is almost equally divided between the government teachers and the Catholic masters, seems to many an alarming state of things. What has been called the «crise universitaire» has been and is still daily discussed passionately; and although republicans should shrink from such drastic and unliberal measures, some restriction of the right of teaching may be anticipated—possibly in the near future.

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11. **France—French Language and Literature.** *Origin.*—French is derived from Latin. The groundwork of the language was formed

not with classical Latin but with colloquial Latin spoken by soldiers and colonists. With the progress of culture, Latin had developed a double growth, a vulgar tongue (*sermo rusticus plebeius,* castrense verbum) and a nobler speech (*sermo nobilis*). Not only were the grammatical forms simplified by the former in point of cases and inversions, but each one had its own vocabulary, *e. g.*:

ENGLISH	PATRICIAN SPEECH	VULGAR LANGUAGE	FRENCH
battle	pugna	batualia	bataille
to help	juvare	adjutare	aider
week	hebdomas	septimana	semaine
to eat	edere	manducare	manger
horse	equus	caballus	cheval

As early as the 1st century A.D., vernacular Latin had superseded Celtic throughout Gaul, Brittany excepted. Strabo no longer looks upon the Gauls as Barbarians. Celtic, not being written, was completely swept out of use. It left but very few terms in the Gallo-Romans' speech, hence in French, *e. g.* alauda (alouette), cervisia (cervoise).

Latin was hardly master of the land, when the Germanic tribes pressed upon the border. Rome held them back for a century or so by a system of military colonies (lètes) filled up with Franks and Burgunds. As a consequence Germanic words referring to war began to take root in Roman Gaul. In the 2d century, literary Latin was flourishing, but the middle class declined, Latin culture with it, and in the 5th century patrician Latin was ruined and the vernacular idiom in general use. The work in progress was not stopped by the invading Franks. They forsook their own tongue and adopted that of the conquered (1) because they numbered hardly 13,000 against some 6 millions; (2) because the Germanic tribes had no uniform language; (3) their conversion to Christianity worked in the same direction. Yet the Frankish idiom left more words than Celtic in the vernacular. Outside war terms, the Franks brought feudal institutions for which there were no words in the language of imperial Rome, *e. g.*:

FRANKISH	FRENCH
alod	allen
bann	ban
skepeno	échevin

About 900 words were thus imported. Meanwhile, the syntax was also changing, but not under Germanic influence. The great change consisted in the prevailing use of the Latin prepositions *ad* and *de* in lieu of cases to denote tendency or possession. *Liber de Julio* led to *le livre de Jules; dono librum ad Julium* led to *je donne le livre à Jules.* This analytic process was also operative in the evolution of auxiliaries in the conjugation. In the 7th century, the «Romanic rustic tongue» was built up quite apart from Latin as well as from Teutonic: it had all the constitutive elements of French.

The first text extant of this infant French is known as the *Reichenau Glosses,* of 768, the year when Charlemagne was king. It is a glossary for a Latin Bible, an evident proof that Latin was no more understood even of such as could decipher MSS., *e. g.*:

LATIN	EARLY FRENCH
galea (helmet)	helmo (heaume)
tugurium (cottage)	cabanno (cabane)
caementarii (masons)	macioni (macons)

So, the subjects of Charlemagne spoke Romanic or Early French. The Church did much to spread it: Council of Rheims, 813, Council of Strasbourg, 842. At the latter place, and in the same year, French was used as medium between Louis the Germanic and Charles the Bald. The *Strasbourg Oaths* are the oldest French sentences on record. Poetry gave it its final consecration under the form of *cantilènes,* short lyrico-epic poems to the memory of saints, *St. Eulalie,* 9th century, *St. Léger,* 10th century.

Early French (10th century-14th century).—Let us now look more closely into the phonetic laws after which the new vocabulary was formed. The main rule is the persistency of the accented syllable, in words of popular origin; 2°, the short vowel just before the accented syllable, is left out: sanitatem=santé; 3° the middle consonant, *i. e.* placed between two vowels, falls off: augustus=août. These rules were disregarded by the scholars, who coined words, when they failed to feel the old Latin stress. Then the same Latin word sometimes gave two French words, one of popular making, the other of scholarly formation, *e. g. advocatum*=one avoué, two avocat; *porticum*=one porche, two portique; *fragilem*=one frêle, two fragile; *organum*=one orgne, two organe. These forms, called *doublets,* are about 800 in French.

The chief character of Early French or *langue d' oil* (as distinguished from the *langue d'oc* spoken south of the Central Plateau) is that it is a semi-synthetic tongue with two cases for subject and object, thus half way between Latin purely synthetic with six cases and Modern French purely analytic with no cases. The analytic process was at once more thorough with the conjugation: the auxiliary *avoir* with the past participle brought about all the compound tenses; the auxiliary *être* gave a new kind of passive verb. The future and conditional were original formations, devised by adding the present or the past of *avoir* to the infinitive: *aimerai*=aimer ai; *aimerais*=aimer ais, contraction of *avais.*

Very soon French gained great credit in Europe owing to the political ascendency of the Kings and to the qualities of the language, further evolved than any, Italian alone excepted. Cp. Dante (*de vulgari eloquio* I, 10); Martino da Canale, Brunetto Latini, etc.

The poetry of Early French was chiefly narrative. The poets were called *trouvères,* inventors (makers). Their tales centered round Charlemagne, Arthur, Alexander; hence three cycles of *chansons de gestes.* The masterpiece of the first was the *Song of Roland,* sung by the Normans on the field of Hastings. It contains 201 verses of lines with *assonance, i. e.* vowel-rhyme only. It is the epic of the feudal aristocracy, painted with vigor, life and touches of pathos. In French, the Arthurian cycle produced the poems of Chrestien de Troyes, full of sweet gracefulness. In the classical cycle we find the 'Romance of Troy' and the 'Romance of

Alexander' written in the 12-syllable line which hence took its name «alexandrine.»

With the play of Adam (12th century) the French drama begins its long career. As was the case in Greece, play-acting was evolved from the ceremonies of religious worship. In the 13th century, the spirit of chivalry is waning and the spirit of satire gives birth to a new kind of poetry, the *fabliau,* a comic tale intended for recitation. The most famous is the 'Romance of the Rose', translated by Chaucer. They combine amorous devices, wit and humor.

On the stage, many plays are produced, some of a religious character (*miracles*), others of a distinctly lay and comic vein (*soties, moralities, farces*). Prose for the first time is brought to eminence by chroniclers of great personal worth, Villehardouin (1213) 'Conquête de Constantinople' and Joinville (1318) 'Memoirs.' With their either stern or winning but ever clear and effective diction, the early period comes to a close.

Modern French.—(1). *14th Century.—Renaissance.* (a) The evolution of languages follows the evolution of societies. After Saint Louis' reign, the highest development of the Christian-feudal civilization, a long struggle begins between the mediæval and the modern spirits. The coming victory of the latter is evinced by the triumph of the analytic process: French casts off its two cases. Then followed a period of grammatical confusion, still enhanced by the wholesale invasion of words brought in by translators and all of scholarly formation. All the 15th century was necessary to build up Modern French, just in time to house the ideas and ideals of the Renaissance. (b) The unsettled state of the language told on the value of the writings. Poetry was much enfeebled. Christine de Pisan wrote loose easy verse; the two poets of the period are Charles d'Orleans (+1465) the last of the *trouvères,* whose perspicuous and refined style is still charming: and Villon (+1470?) the first of the moderns, whose frank confessions are both realistic and romantic. Prose won the day with Froissart (+1410), the greatest chronicler of the Middle Ages, the painter of the most varied, picturesque and living fresco, and Commines (+1511) who worked on entirely new lines in his business-like *Memoirs,* where he goes so far as to anticipate Montesquieu. On the stage, the *Miracles* sometimes struck up an eloquent note in a mass of prosaic lines; the *Mysteries* lived on to the eve of the Renaissance and comedy, a completely original start, was brought to life in the farce of *Pathelin* (circa 1465).

(2). *Renaissance.* — (a) The French language went on ripening. Calvin's 'Institution' (1535) testified to its richness, vigor and force. Owing to political influences (Italian wars and marriages) it was spoiled by Italian words and idioms against which Malherbe (+1630) fought with so much success that he overran himself and made the language not only purer but poorer. He reformed verse too, banishing hiatus, run-on lines, and bringing cæsura to chime in with the sense.

(b) Marot (+1544) is the poet of transition. He left the glory to found French classical poetry to Ronsard (+1585) and his friends, the Pleiad, the most shining stars of which, next to him, were DuBellay and Racan. DuBellay wrote the manifesto of the new school in his 'Defence and Illustration of the French Language.' Setting apart playwriting as the province of Jodelle, Ronsard restored all the forms of ancient poetry, ode, elegy, eclogue, hymn, epistle, satire, and sonnet, stanza both after the Italians. He was a true lyrical genius. His style is somewhat strained with erudition. His group did much to make the poetical diction more pure and supple. They lacked neither enthusiasm nor art-feeling, but perhaps some depth of inspiration. Outside their circle, Agrippa d'Aubigné reached the highest degree of vehement indignation, and woe in his 'Tragiques.' The dramatic vein, then so rich in England, was poor in France, in spite of the learned efforts of Jodelle and Garnier in tragedy and Lariney in comedy. A great creator in imaginative prose was 'Rabelais' (+1553) whose *Gargantua* and *Pantagruel* are household names the world over, whose style was so rich and so precise in his studied copiousness. Amyot translated 'Plutarch,' and Montaigne, with easy-going scepticism, wrote the history of his own feelings and thoughts in his 'Essais' (1580): both of them were read by Shakespeare.

Classical Age (1601-1715.)—(a) As to language, a Spanish mania followed the Italian craze. The new words thus naturalized were dearly paid for by bathos and bombast. Malherbe's purifying work was carried on by a worldly set (Hotel de Rambouillet), by the French Academy (Richelieu, 1635) and by grammarians: Vaugelas, d'Olivet. Henceforth, the story of the language would be the story of the influence exerted by great writers. (b) The first part extends to the early plays of Corneille. In satire, Regnier (+1613) was a follower not of Malherbe but of Ronsard and Desportes, with exceptional humor, popular wit and sense. Hardy was a Shakespeare without genius, powerless to stop the growth of the classical drama. De Balzac gave models of oratory prose: he was the Malherbe of written eloquence. He was followed by the church orators Bourdaloue, Fléchier, even by the greatest of them Bossuet (+1706). Other eminent prose writers were in philosophy Descartes (+1680) and LaBruyère (*Caractères,* 1688). Three ladies rose to literary fame, Mme. de La Fayette, with the first psychological novel (1678), Mme. de Sévigné, and Mme. de Maintenon with their 'Letters.'

Poetry, and especially Tragedy, reached classical perfection with Corneille (1606-84) who introduced upon the stage the struggle between passions, between duty and love ('Cid,' 1636), love and patriotism (*Horace*), human love and divine love (*Polyeucte*). A heroic strain pervades matter and verse. To love Corneille is to love greatness: his work is the dramatic song of the human will. Rotrou (+1650) serves for link between Corneille and Racine. Nothing goes farther away from the Shakespearian drama than Racine's tragedy which, in his own words, "is a simple action with no load of matter, never straying from what is natural to run to extraordinary extremes, by degrees pacing to its end, upheld by nothing else but the feelings and passions of the characters." (*Andromache* 1667, *Britannicus, Phèdre* 1677.)

(3). *18th Century.*—(a) People then esteemed that French was fixed forever. But only dead languages change no more. Yet, new words were few in this period: changes in the spelling were advocated (*ai* for *oi*, by Voltaire). The tendency was to an undue strain after polished noble style which often landed authors on cold and somewhat barren regions. (b) In the field of literature, changes were many. The first period, extending to 1750, is one of reaction tempered by respect; in the second, the fierce struggle bursts out and a sudden revival in spirit, if not yet in manner. Comedy ran on its merry career with Regnard (*Joueur* 1696), Dancourt and Marivaux (†1763) who created a comedy and a style of his own,—pleasant skirmishes of feelings not very deep, marvellously adapted to the stage and expressed in a wilful, skimming, subtle, playful sort of diction that has kept his name «marivaudage.» Tragedy sank deep with Crébillon and could do little more than floating with Voltaire (*Zaïre* 1732, *Mérope* 1743). The 18th century is a great age for prose. Fontenelle (†1757) taught the public respect for science and gave scientists a taste for good writing. As an interpreter of science to the many, he was a forerunner of the *Encyclopédie*. Voltaire took the hint (Newton). Then, in his so-called *Romans*, he scattered all over human thought and feeling the satirical sparks of his wit. His 'Letters on the English' are filled with the sceptical spirit of Bolingbroke. In history, he was not a discoverer but a sagacious writer, (Siècle de Louis XIV.'). Later on, he returned to verse and excelled in *satires* and *epistles*. His vast *correspondence* is the marvel of a versatile mind. His influence was paramount against Christianity and, in spite of himself, against monarchy. Two names only shone as bright as his: Montesquieu (†1755) and Rousseau (1712-78). Montesquieu created the philosophy of history with 'l'Esprit des Lois' (1748). Rousseau had still more influence, and one of a distinctly sentimental nature. His paradoxes are responsible for much in the course taken by the Revolution. His 'Discourse on the Origin of Unequality' 1755) contrasts the so-called *état de nature* with the evils of civilization. In 'la Nouvelle Héloïse,' he enriched French literature with the style of natural descriptions. The 'Contrat Social' is a theory of democracy and 'Emile' a treatise on education. Most revolutionists were Rousseau's disciples. Diderot (—1786) and d'Alembert (—1783) were the two editors of the *Encyclopédie*, a general review of human knowledge conceived in the reforming spirit of the time.

The Revolutionary period, opened by the mirthful satire of Beaumarchais ('Mariage de Figaro') was not favorable to literature; orators caught the public ear (Mirabeau) and the only great poet was revealed only after his death, André Chénier (—1794 'Idylles, Iambes') who poured his rich new wine in old amphoras.

4. *19th Century.*—(a) The Revolution, romanticism, foreign imitations, scientific progress, inventions and journalism were so many causes of new verbal annexations in prose and breaking up antiquated restraints in verse. (b) The death of Chateaubriand and a new revolution (1848) fitly divide the century into two parts. In the former, Chateaubriand is master and king: the 'Génie du Christianisme' quickened a much needed reaction and *René* was the first to catch the melancholy contagion. He displayed his descriptive powers in 'Martyrs.' He was the greatest poet of French prose. Joseph de Maistre supported the same cause with philosophic vigor and stern eloquence. Another reviving spirit was that of Mme. de Staël who, by interpreting *Germany* to France, gave birth to modern criticism (1810). The soul of poetry returned to French literature with Lamartine 'Méditations,' 1820), Vigny ('Poems,' 1822,) Musset and Hugo, the sonorous echo of this universe, the greatest lyric poet perhaps of all literature: 'Odes,' 'Ballads,' 'Leaves of Autumn,' 'Contemplations,' 'The Legend of Centuries.' In opposition with the lyrical self-confessions of romanticism, Gautier surrendered himself solely to the picturesque object. On the stage, Hugo comes out again first ('Hernani,' 'Ruy Blas'), but being over lyrical, the romantic drama was short-lived. Two other literary forms took an unprecedented extension: the novel and history. In its brimful stream the novel was fed with all the living waters of the literary summits: there, George Sand was queen and Balzac king supreme, in fact, the French prose Shakespeare. History was born anew in the works of Thierry and by turns thoughtful with Quinet, stern with Mignet, lyrical with Michelet, business-like with Thiers, philosophical with Tocqueville, achieved wonderful work. By degrees romanticism subsided into the tamer Parnassus school, and Flaubert being the link, naturalism rose from the very excesses of pure fantasy: Zola, Maupassant.

On the first steps of the 20th century, the position of the French language is not quite that of undisputed eminence in the world, as it was at the end of the 18th century. But recent departures in poetry and in prose tend to show that the French language is still evolving in ever-renewed fruitfulness.

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12. **France—French Art.** *The Sources of the Renaissance.*—Art in France, as in all European countries, emanated—in its two essential forms, sculpture and painting—from architecture. Frescoes and statues, exclusively of sacred legends, served to decorate the churches and palaces. It was but gradually—during the last five centuries only—that French painting espe-

cially, has been divided into historical painting, landscape painting, genre, and still life, and that sculpture has, according to Spencer (who explains the evolution of the history of art by the law of differentiation), become «heterogeneous» through the variety of subjects, both realistic and ideal, of which it treats.

Mosaics play a prominent rôle in the decoration of basilicas, and later of Christian churches; Byzantine influence extended to iconography and to the miniatures in missals. The development of art, from the Roman churches of the 11th century to the Gothic cathedrals of the 13th century, attained unprecedented perfection. The sculpture of the cathedrals of Chartres, Amiens, Rheims, and Paris—by their simple and exquisitely naturalistic forms—realized the highest ideals. The decoration of the façades and the portals, like a living encyclopedia, fully reflect the faith and the aspirations of an age of earnest religious belief. All the industrial arts, ornamental sculpture, cabinet-work, church windows, missals, and goldsmiths' work, were in unison in the middle ages in France. The director of the work was, at the same time, sculptor and painter as well as architect. In the 13th century French decorators turned aside from Byzantine rigidity and archaism (Sainte Chapelle de Paris, and Donjon of Coucy). Then the workmen were employed in decorating the dwellings of the nobles. Charles V. and the Duc de Berry exercised a great influence over the French school. The court of the Duc de Bourgogne vied with that of France in the magnificence of its art; calling itself the great Bourguignonne school. The Chartreuse de Champniol, near Dijon, is the most significant example. On the other hand the "ravaux," ordered by the popes during their sojourn in Avignon, were not without their influence on French decorators, bringing them in contact with Italian artists.

Jean Fouquet, a portrait painter, limner, and fresco painter, connected with the court of Louis XI., made this progress still more apparent. Jacques de Litemont decorated the chapel of the House of Jacques Cocur in Bourges. The sojourn of the court on the banks of the Loire brought a great many artists to Touraine and those from Italy brought with them the new lessons they had learned from antique art.

Jean Bourdichon of Tours and Jean Perréal, brought back by Charles VIII. when he returned from his expedition to Naples, rivaled the ultramontane artists.

With Francis I. Italian decoration and style reached their culmination: at Fontainebleau, the king placed a great many painters and artists skilled in stucco under the direction of Pri.natice, which resulted in the beautiful gallery of Francis I.—one of the most perfect «ensembles» that the Renaissance has produced. Under Henri II. and Catherine de Medici, the school of Fontainebleau followed their lead. While French architects and builders attached to the kings of France erected the Chateaux of Gallon, Blois, Meillan, Chenonceaux, Fontainebleau, Ecouen, Anet, Chambord, and lastly the Louvre and the Tuileries, which have made the names of Pierre Lescot, Philbert Delorme, and Jean Goujon illustrious, their wonderful tombs and fountains are to be seen everywhere. Conspicuous in French sculpture are the names of Michel Colombe, and of Ligier Richier, and later, in the reign of Francis I., that of Jean Goujon (who was the first, in France, to do bas-relief), and of Germain Pilon.

The 17th Century.—During the great expansion of the Renaissance, wherever the influence of the Clouets (portrait painters of psychical insight) predominated, French art maintained the greatest independence, notwithstanding the official pressure brought to bear in favor of Italian art. At the end of the 17th century, art had but one head—the king: and he expressed but one idea: absolute power. French art became monarchical, reflecting the monotonous majesty of the sovereign, and his servile flatterers, who could and did say of the state: «It is I.» It was now necessary to have a dwelling proportionate to these excessive pretentions. Architecture, painting, and sculpture basked in the sunshine of royalty. It is not quite natural for people to submit to such rigid rules. Even the gardens became monarchical in style, everything was imperial, theatrically pompous; then followed the portraits of a Rigaud, a Nateuil, and even the pompous divinities in the garden of Versailles. The methodical minister, Colbert, formed a comprehensive plan for the protection of art. François Mansard, who built the palace of Mazarin, was imitated by Claude Perrault who constructed the splendid colonnade of the Louvre; and above all by Hardoin Mansard, his nephew, who designed the palace of Versailles, and the chapel and the dome of «Les Invalids.»

Sculpture, in its turn, was held in leading strings, Giradon, Coysevox, Nicolas Coustou, and Lemoyne designed great works along these lines. It was only the genial Pierre Puget whose ardent and passionate temperament would not yield to discipline. Thus he lost the favor of the public, who leaned towards the style of LeBrun in his great decorative enterprises. It was these artists who peopled with marble Versailles, Trianon, Marly, and Saint-Cloud.

In painting there was the same love of display, except in the works of the Lenian brothers, who portrayed the peasant. Simon Vouet, in the reign of Louis XII. ushered in LeBrun. Nicholas Poussin, whose style in historical landscapes is unsurpassed, lived in retirement in Rome, where he formed the style of Claude Lorrain—a wonderful analyzer of light,—aside from this movement in which even the austere Philippe de Champagne and the suave Le Sueur took but little part, LeBrun is the artistic spirit the 18th century in France. The position of Director of the Academy having been created for him, he grouped the artists as he wished. To him is due the stately gallery of Apollo in the Louvre, and his artists Lemoine, Monnoyer, Audron, Berain, Bourdon, Coypel, la Hire, Jouvenet, Van der Meulen, Regaud, and Largilliere painted portraits in a wonderful dashing style. Decorative art reached its apogée in the Gobelins manufactory of tapestries supported by the government, and in the cabinet work of the Boule family.

Exceptionally original talent was now seen in engraving—I refer to Jacques Callot.

The 18th Century.—A very natural reaction from the pompousness of the 17th century resulted in the piquant grace and the sensuality of the 18th. Caprice and subtile delicacy took the place of dull etiquette. «Prettiness» replaced «the Beautiful.» Art declined. The «Rocaille» and «Folies» styles succeeded. Nevertheless Gabriel, the architect, did not as yet abandon the deep-rooted traditions of his predecessors which he embodied in the façades of the Place de la Concorde. Soufflot, in the reign of Louis XVI., inspired by antiquity, built the Sorbonne in that style. But architectural style now aimed rather at «comfort.»

Sculpture was flourishing, after the style of Jean Baptiste Lemoyne. Two eminent sculptors, Pigalle and Houdon, partially escaped this craze, especially Houdon who made such a powerful bust of Voltaire. But the idol of the boudoirs was the voluptuous Clodion, whose very worldly creations seem to be caressed by the hand of Love himself.

Painting was in every way typical of the taste of French society in the 18th century. The pastorals of Franc Boucher; the fascinating «Fetes galantes» of Watteau; the charming nudes of Fragonard, sounding the praises of woman; the great Chardin, a man of the middle class, who escaped the false manner of his time, which engulfed Joseph Vernet, Hubert Robert, Oudry, Lancret, and Pater, painters of marines, of landscape, of the chase, and of gallantries; the sentimentality of Greuze, and the archness of Madame Vigee Le Brun, are offset by the keen penetration of the portrait painter Quintin Latour, a capricious pastel artist.

The 19th Century.—Another reaction took place. David revived the ancient Greco-Romano, and his horror of the license taken by Boncher led him to adopt a very severe style of art. His influence on his time was great. The David school, which had its origin in the painting of 'The Crowning of Napoleon I.,' includes the names of Drouais, Gidoret, Gros, Guerin, Gerard, Leopold Robert, and also Ingres.

Jean Dominique Ingres detached himself completely from the heroic style of his master. He was a forcible and skillful draughtsman, psychological, intense, a sensual «feministe,» and excelled the fascinating founder of French Classicism, but like him he confined himself to an æstheticism which sprang from his «esprit» which was inferior to his temperament.

The gentle and pure Prudhon was inspired, as well as David, by antiquity, but from a different point of view, that of vague dreaminess. Romanticism made its appearance with Gericault, the spirited and bold colorist of 'The Shipwreck of the Medusa.'

Romanticism, therefore, burst forth with a flourish of trumpets. Delacroix made his appearance,—lyrical, agitated, masterly, and ever restless, an excellent colorist, and a dramatic pessimist: he is Byronic, reminds one of Berlioz, ranks with Shakespeare, and anticipates Wagner. Songeur Fulgurant is the embodiment of lyric art separated from schools and epochs. Almost at the beginning of the century Delacroix foretold the end. He was ignorant of the broken tones, which had been slightly discerned by Andrea del Sarto and Watteau, —the theory of complementaries as applied to pictures. This resulted in Delacroix being (1830) fully imbued with the Impressionist revolution which developed towards the year 1865. The feverish earnestness of his great spirit enabled him to surpass Ingres, produce a contrary current throughout the entire country,—a stiff breeze of independence. He repudiated codes and dogmas, and taught that the law of art is the scrupulous cultivation of individual expansion.

The struggle between Classicism and Romanticism was violent, and it soon gave place to another enemy—Realism. Romanticism spontaneously engendered from the soil an admirable school of Romantic landscape—Theodore Rousseau, who set his skies aflame as with precious stones and blood: Daubigny, self-contained and affected: Troyon, an animal painter as vigorous as a Dutchman: and Dias, florid, the votary of a muse too studiedly grounded. These landscape painters, followers of Ruysdael and of Claude Lorraine, possessed—besides the qualities of these masters—great keenness of perception, and the new theory of the vibration of color absorbing the outline without losing the form; and laying less stress on the drawing of the trees and hills than on the feeling for open air values.

And now comes the line of Romantic Realists instituted by Decamps, the orientalist; these will continue in Marilhat and the dainty Fromentin, one of the most limited in range of any of the artists of the Romantic school, and also Daumier, a superb worker in black and white, who, in addition to his celebrated lithographs, did innumerable small panels which are very expressive, thrillingly tragic, and of a grand and sombre spirit. The Romantic Realist Courbet—the grandson of the bitter Gericault — followed; then came Edouard Manet.

Camille Corot, however, the follower of Poussin, bathed his scenes from Virgil, in a diffuse, angelic, and superb light. The damp, chilly charm of the morning, the veiled mysteries of the evening, are the themes he chose. Corot is a unique master in French art. He has a very fascinating, delicate and consummate charm.

Another man standing alone is Jean François Millet, known as being the interpreter of the sad figures of peasants in the fields. He died in the settlement at Barbizon.

Courbet modified the trend of Romantic art; he took the lead in Realism, and was an artless, vehement and capable leader, forming his views directly from life, of excellent health, and in the first rank of historical painters. His style was degraded owing to the influence of the followers of Ingres, and he was fully imbued with the spirit of Flandrin—the conventional and insipid painter of the nude,—

and by Manet,—the Franz Hals of French soil. Round him are grouped Ribot and Bonvin.

At first under the influence of Velasquez, Goya, and Franz Hals, Manet tried his skill and found the bent of his genius. He eliminated all bitumen from the pallette, which left only the infinite combinations of the seven prismatic colors. He transformed Romantic Realism into a vision of modern life, and was noted for representing the manners and customs of the second Empire. He is not understood. The well known and conscientious critic, le Cafouent, paid him tribute 20 years after his death. His 'Olympia' has at last been placed in the Louvre. Manet broke off all connection with the Impressionists, but before taking this important and reactionary step he restored to their rank two illustrious men who, in the midst of Realism, mark the return towards mystic dreaminess: one of them is Gustave Moreau who carried out the heroic and legendary ideals of Eugene Delacroix in the dreamy magnificence of the Hindoo palaces, in the luxurious hieratisms of Hebraic royalty, and in the fabulous Hellas. He was a visionary idealist. The other one is Puvis de Chavannes, so long misunderstood, who is the greatest fresco painter of the 19th century, the author of Sainte Genevieve of the Pantheon, and of the celebrated mural decorations of the Sorbonne. He was not only a great painter, but a great poet. Impressionism now became noted This style however, was followed by neither Fantin-Latour —devoted to Wagner and Virgil, and an earnest and serene portrait painter,—nor by Carriere—happily inspired to paint his Maternities in mono-chrome. To explain better the spirit of these designs let me say that Carriere did not permit himself the use of color.

Impressionism is a special study of light. Claude Monet, a fellow-worker with Manet came into notice about 1867; he encouraged landscape painting founded on the vibratility of ambient light. The Impressionist school took its name from a picture by Monet, modestly entitled 'Impression,' which was ridiculed. The name of this work so ridiculed became a rallying point. Luminous effects predominate in the vibrating marines of Claude Monet. His pictures (a series of cliffs, of mill-stones, of poplars, and of cathedrals), copied at every hour of the day, all from the same angle, are different aspects of the same theme under the effects of the sun's rays. Monet employs the method of separating the tones; under his brush inanimate objects volatilize into iridescent and versicolored phantoms.

Near Claude Monet struggled Sisley, Renoir, and Camille Pissarro, who immediately fell under the spell of the «Petits Maitres,» forerunners of the Impressionists, Boudin and Lepécié.

If Monet affiliated with Claude Lorraine and Watteau, Renoir followed the 18th century and Boucher, but a Boucher of a different power. Exceedingly appreciative of female beauty he embodied it in creatures charmingly natural and glad to be alive, and he thus expanded only beautiful flowers of flesh under the rays of light, that they seemed to drink in at every pore. He was the great painter of the 'Moulin re la Galette,' the gem of the Caillebotte gallery, Luxembourg Museum. Berthe Morisot left a series of water-colors, exquisite, spirited and of refined taste, painted in a style between that of Manet and Renoir.

Alfred Sisley was like Claude Monet, with the exception that he laid much less stress on the experimental demonstration of a theory of art. His subjects, the environs of Paris, are noted for the quick and accurate perception and the light touch with which they are treated. Camille Pissarro sang, in a generous and frank spirit, of shepherds, market-gardens, and Norman villages.

To these names let us add that of Mr. Degas, one of the most keen, and least charitable observers of the life of to-day, a careful student of jockeys an unkind humorist, and a wonderful draughtsman; and also those of Messrs. Raffaelli, the late Monticelli, Lebourg and Guilla.

The teachings of Impressionism, even though denied by the corrupt followers of Ingres, Cabinel, and Bouguereau who was greatly Italianized, and by Meissonier and Gerome, «Petits Maitres» who lose themselves in minutiæ, are of advantage to the liberal minded. Mr. Besnard made some innovations in this direction in his great decorative compositions, and his brilliant portraits, painted in a most fascinating manner, show masterly handling. Henry Martin, a decorator and also a historical painter; Mr. Laurent, a portrait painter; and Mr. Le Sidaner, a landscape painter, all profited from this cleaning of the French palette. And the school of young artists claimed the name of «Neo-impressioniste.»

Before mentioning the names of the young generation it would be well to note those of the «Traditionalists» who defend—and sometimes with great ability—the academic traditions. They are the pure and Giorgionesque Henner, a painter of nymphs with ivory bodies; the classical Delaunay; the severe Jean Paul Laurens, portrayer of a civilation that has vanished; the melancholic Cazin with his fine fancy; the vigorous Roll; the delicate and nervous Henry Levy: in fact all the members of the Institute; Benjamin Constant; Bonnat, a pronouncedly pedantic painter, director of the «Ecole des Beaux Arts»; Mr. Detaille who represents military painting, cold and panoramic, never painting a graceful detail; Mr. Carolus Duran, an elegant virtuoso; Messrs. Flameng, Jacques Blanche, and Antonio de la Gandora, a skillful poser of female figures.

All these exhibit in the salons, either in the «Societe des Artistes Francais»—in which the most noted names are those of Messrs. Jules Adler and Hanicotte,—or in the «Societe Nationale» where Messrs. Cottet, Lucien Simon, Aman Jean, Rene Menard, and George Desvalliere compete with them.

This digression ended, we must—in order to describe those who fell heir to Impressionism, —single out two men who stand apart, whose talent though incomplete is not without great merit; Paul Ganquin the painter of Polynesian scenery and luxuriant vegetation in decorative pages, and Cezanne. From them proceed the rising masters of to-morrow who win distinction in the «Salon d'Autonne» and the «Independents»: Messrs. Vuillard, Signac Bennard, Maurice Denis, George D'Espagnat, Dufrenoy and Marquet. All enthusiastic young men of exuberant vigor, working very hard and taking pleasure in it, and who, notwithstanding their exaggerated colorists, do not despair of attaining renown in the true and liberal French school.

The limits of this brief study compel us to name, only, the illustrious draughtsmen, whimsical painters, or humorists, engravers, water-colorists, and lithographers, who recall Daumier, Constantin Guys, Gustave Doré, Avarni, and Toulouse-Lautrée, who bear witness to the originality and fertility of French imagination and humor; they are Bracquemond, Lepère, Chèret, Willette, Odilon, Redon, Forain, and Louis Legrand.

Sculpture.—From Rude to Rodin, including Carpeaux—the three geniuses who represent the entire French sculpture of the 19th century—much vigorous and delicate talent has been seen. Rude raised the standard of sculpture, which was very low at the beginning of this century. Rude was the unique artistic expression of the Napoleonic spirit, so unfavorable to every kind of art. His hauts-reliefs on the Arc de Triomphe de l'Etoile, are immortal.

Besides Rude, Barye,—a powerful animal sculptor,—the classicists David d'Angers, Etex, and Pradier are conspicuous under the second Empire. Carpeaux, the sculptor of the group called 'The Dance,' on the portico of the Opera House, and the bas-relief of 'Flora' in the Flora pavilion of the Louvre, and of a hundred charming «maquettes,» of masterly execution and refined taste, achieved grandeur through grace, style through fancy.

A brilliant constellation of sculptors was seen in the third Republic; Falguiere, delicately expressive; Dalou, severe and profound; Paul Dubois, subtile; Mercié and Trijalbert, who although declamatory in style are each gifted; and Fremiet, a pupil and nephew of François Rude. All these names and those of the «Rodinisants,» and the original genius Camille Claudel, Emile Bourdelle, Desbois, and Maillol, were overshadowed by the formidable genius of Auguste Rodin.

Rodin is the third term of this trilogy relating to Rude and Carpeaux. At first he was discussed, ridiculed, and disowned by the Institute because he purposely distorted his models so as to better display the intensity of ambient light: he conceived and executed his principal works, which are 'The Age of Brass,' 'The Bourgeois of Calais,' 'Saint Jean Baptiste,' 20 busts, and a hundred groups in marble and in bronze, illustrating the sad poems of love, of nervousness and of revery. He overturned all pre-conceived rules, going for his inspiration as far away as Assyria and Egypt, and the middle ages; his Victor Hugo and his Balzac are statues which caused in the artistic world, a sensation not as yet defined.

Architecture and Decorative Art.—The French Revolution that revived all the institutions of the ancient régime, only apparently influenced the teachings of the arts. At first French architecture was under the yoke of the Greeks and the Romans. Deep study of the chief works of antiquity always inspires earnest artists, such as Percier and Fontaine; Vignon who built the Madeleine, and Brongniart, who built the Bourse.

Duban, Labrouste, and Vaudoyer revolutionized architecture. Viollet le Duc is charged with restoring Notre Dame, (1837). With Lassus who restored Sainte Chapelle, he struggled romantically against the «Academie des Beaux Arts.» Labrouste was the first to utilize iron, which may be seen in the 'Bibliotheque Sainte Genevieve'; Ballard was a bold innovator, who built the 'Halles Centrales.'

The wonderful inspiration of Charles Garnier, architect of the Opera house, is typical of the period of the second Empire. Still notwithstanding the modern spirit set forth in the teachings of Viollet le Duc, architecture is not yet emancipated; the ideas of Vignole and of Palladio, who imitated the antique, will disappear but slowly—with Messrs. Mogue de Baudot, and Vaudrenier. After all the rationalistic modernism of Messrs. Plumet, Chedanne, Gennoys, and Binet has erected monuments and dwellings commensurate to our needs, and to the ideas and customs of our time.

The revolution in applied art corresponds to that of architecture. The followers of Riesener, Gouthiers and Jacob will be the «furnishers,» such as Gallé of Nancy,—a cabinet-maker, and glass painter, who most always found his motives in floral naturalism; carvers, and goldsmiths with exquisite taste, such as Messrs. Dampt and Lalique, and lastly the makers of ceramics, Carriérs and Chaplet who rediscovered the art of the wonderful Japanese pottery.

In the foregoing is given a very short summary of the principles of French art.

The 19th century, was one of such great fecundity that, under normal influences, art should take its part in all events, in the great struggles and in the great hopes that agitate humanity in the present day.

Let us say in conclusion, that art can now, less than ever, be said to be separated from life. French art is no longer, and does not wish to be, a thing apart from or aside from life. It is in itself the expression of life, not only in vague generalities, but in the most contingent phenomena.

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13. **France—French Music.** Such were the multiplicity and inaccuracy of the popular forms of primitive French music still in vogue in the Middle Ages, that in the beginning it is only possible to single out the peculiar mode

of expression that each temperament fashioned for itself. For instance, the *Trouveres*, who are considered the creators of lyric art, were hardly more than second-rate musicians who, being poets, sought in song a musical cadence with which to embellish their verses.

Religious music, which had long since been sustained by the voice of the organ, gradually found its way into the interior of churches and alone was quite representative of the mystic mentality of the Middle Ages. Even though it still adhered to liturgical chants which in form and style are subject to invariable musical modalities, it nevertheless began to be more flexible; slowly it expanded and assumed a fervor, an accent, a character hitherto unknown. The time was already near at hand when Josquin Desprez and, after him, Goudimel, were about to enrich with sound the wonderful gifts of life, order, easy grace and spirited joy that illumine the popular French soul.

However, it was outside of the Church that, as early as the 12th century, great interest was manifested in musical invention and research. Adam de la Halle, who, it seems, was the first to conceive melody in several parts, carefully represents that period in which music «d'ensemble,» if we may so express ourselves, already constituted one of the elements of popular amusement.

In the 14th century, during the reign of Charles VI., the instrumental resources of music began to increase greatly, and the minstrels, interpreters who at times were happily inspired, introduced the charming viol. Although very crude in the beginning, stringed instruments were destined to become more flexible, more expressive and more numerous, and those who played them gradually acquired a more delicate, more shaded touch. This evolution eventually gave rise to the first French chamber music, an art that was greatly advanced through the harpsichord, of which Couperin, Daquin, Dandrieu and the great Rameau were perfect masters.

Choral and religious music—which in the 14th and 15th centuries was at times so boldly realistic—was quite as fully and as cautiously developed. During the reign of Louis XII. it was revived by Josquin Desprez, who imparted to it inimitable earnestness and grace, and whether the subject were farcical or pious his motetts for several voices were simple masterpieces of juvenile spirit or emotional gravity. Of Goudimel, who was Palestrina's master, and of Clement Jeannequin, to whom we are indebted for that brilliant production, 'La Battaille de Marignan,' we can only say that in musical language of singular vividness, sincerity and splendor, they have portrayed both the fervent and the picturesque life that surrounded them.

The descriptive talent to which they owed their greatest success, the graceful and brilliant ease that was so preëminently theirs, were also characteristic of the musicians of the 17th and 18th centuries, who used them most freely, at the same time adapting them to the polite requirements of the time. Lulli, Daquin and Couperin at the harpsichord or on the stage showed the limitations of this intellectual spiritual art. Rameau, too, the learned, emotional composer of 'Dardanus' and 'Castor and Pollux,' dominates this brilliant epoch with all the noble pathos and tenderness of feeling that he was the first to bring into the life of music. Technically his work left its imprint upon one of the best periods of French musical history, the time when the beauty of instrumental composition and the varied power, then unknown, of the orchestra, asserted their harmonious influence.

After Rameau's death two other illustrious names lent glory to the close of the 18th century—those of Monsigny and Grétry. If the work of these two musicians, one of whom, Grétry, had a very adequate conception of dramatic truth and movement, does not sensibly elevate French tradition, at least it maintains therein a just solicitude for natural expression and sincerity. It was precisely this commendable solicitude that Méhul was a little later on to make his own, heightening it by the inspiration that he imbibed from the heroic spectacle of the great popular episodes of the Revolution.

French music of the 19th century retained the complex impressions of preceding epochs and, accordingly as the perverted taste of the multitude or the creative originality of great artists predominated, it reflected either the preference of the masses or the choice of the classes. In fact, all the different impulses that impart such brilliancy and tone to this century may be found mirrored in its music, being interpreted by various temperaments, some of which were among the finest identified with French art. The epopœia of the First Republic found in Méhul its most veracious and enthusiastic historian. An ardent admirer of Gluck, whose noble sincerity touched his heart, Méhul, well known to the men of his time, offered a miscellany of passion, valor and ingenuity that raised his work to the level of lyric composition. Undoubtedly the hymns that he composed during the troublous times of the Revolution savor a little of the grandiloquent, pompous air that it was the custom to impart to the smallest efforts in the line of creative thought. This is also the case with his opera 'Joseph,' which impels emotion because of the clearness, breadth and simplicity of its style. Besides, it was at this time when Italianism was so prevalent, that Méhul ably defended the traditions of Gluck, and for this reason alone should he claim our allegiance.

He and Gossec were the last representatives of this sober classicism, and Méhul struggled against the «maestri» with whom the versatile multitude, tired of heroism, began to be infatuated. But he seemed powerless against a fatal reaction. A brillant society eager to be restored to luxury and splendor and to be pleasantly entertained, required a rapid, showy, flattering sort of art which was introduced by fascinating Italian virtuosi, and Rossini and Spontini, assisted by Boïeldieu, Auber and Herold, transformed it and adapted it more closely to French style and taste, thus definitively naturalizing it. Of the Italians who invaded French theatres, Rossini was the most spiritual and most skillful. His cleverness, although extreme, was never enervating; he was both elegant and versatile and his quick, piquant music exerts a seductive influence to which one readily surrenders. If, where he aspires to genuine pathos, as in the opera 'Guillaume Tell,' Rossini's style is stilted and bombastic, in the score of 'Il Barbiere di Siviglia' he is fanciful, sprightly and eminently graceful, although a bit vulgar, hence his prolonged popularity.

But as much may not be said of Meyerbeer, who, like Rossini, won enthusiastic recognition on the French lyric stage. Although a native German, he inherited neither the heart nor the disinterested sincerity of the Latins nor the passionate, daring ardor of which the musical German is such a worthy exponent. Anxious to please, rather than to be original or to introduce novelties, he certainly knew how to cater to the taste of a public that wanted nothing but brilliant fiction. This rapid composer, to whom we owe 'Les Huguenots,' 'L'Africaine,' 'Le Prophète' and so many other productions, was also—the two attributes being singularly compatible—a technician of consummate skill; but these attributes seem rather to envelop than permeate his pompous, diversified music, somewhat grand at times and of which the great Schumann said: «It is all composition, outward show, hypocrisy!»

Rossini, an Italian, and Meyerbeer, a German, were, therefore, the admitted masters of the hour and the leaders of French musical fashion. Frenchmen unhesitatingly acknowledged the supremacy of these two foreigners over our dramatic music; and, at the time, the utter superficiality of contemporary life was more conducive to the discouragement than to the stimulation of artistic vocations. Of a care-free, brilliant temperament, the French adopted the course that seemed to beckon them to success, and as music of the touching, more learned type was not wanted, they produced comic opera.

What, then, should be retained of this period that was so poor and yet so well filled with musical history? Boïeldieu, Auber, Herold and Adam labored to endow our stage with animated, pleasing productions which breathed more or less of grace, sentiment and color. Some were successful in this line, notably Boïeldieu, whose 'Dame blanche,' M. Alfred Bruneau says has «much easy cleverness, chivalrous charm and spiritual sentimentality,» and Auber, who was the merriest, the smartest and most garrulous of all.

In order to conform to a mawkish conventionality French music had, as it were, to become subservient to the mediocrity of the public to which it catered, hence it was but timely that a powerful personality, revolting against the fashion and spirit of contemporary society, should transfigure it by imparting to it a love of strength and life. It was the hour of Romanticism. . . . What Victor Hugo was to do for literature, what Géricault and later Delacroix were to accomplish for painting, Hector Berlioz did for music. It is to him that, in this century, French inspiration owes the most famous and the most fruitful if not the finest of its tendencies.

Ardent, passionately fond of strife, Berlioz carried into it unparalleled enthusiasm and independence. The multitude treated him with indifference or hostility, but he stood his ground and each of his works continued to broaden the narrow limits within which, before his time, French music had been confined. Spontaneously he supplanted the affected elegance of his predecessors, their nervousness, their conventional agitation and the poverty of their musical resources, by a cordial sincerity, a pathetic sensibility, an ardent, noble inspiration, and a wealth of technical invention that place him first among our symphonists. The majestic 'Symphonie fantastique' and the terrifying 'Requiem' bespeak the excellence of his descriptive genius and lyric ability; the beautiful 'Enfance du Christ,' calm and peaceful as a fresco, shows us what a tender, delicate painter he can be, but it is in the 'Damnation de Faust,' and even more so in the 'Troyens,' that his full talent manifests itself. In these works he is no less compassionate than severe. He seemed to have inherited from Gluck a majestic and tragic simplicity in expressing the griefs or hopes of mankind. He was known as a trembling observer, an ardent, audacious delineator of the nature which he understood how to portray with a thousand daring orchestral strains then unknown, and we behold him posing as a depicter of the the human heart!

Underestimated during his lifetime, Berlioz nevertheless ruled the future of French music. If he did not inspire those who came after him, at least the example of his work impelled them to turn to nature and to life. Thus it was with Félicien David, composer of 'Le Désert,' that melancholy, expressive work, with Ambroise Thomas and Charles Gounod, the author of 'Faust' and of 'Mireille,' a pleasing musician with an easy, attractive style, and of whom Alfred Bruneau said that «he had created a language of tenderness that was deeply agitating.»

Finally came the admirable Bizet, another undervalued genius. The genuine candor, vivacity, daring, passion and sincerity that gave the French mind its individuality, fell to the lot of the composer of 'Carmen.' But it was only at his death that these were observed, and it was a tardy enthusiasm that was shown for the scores—masterpieces indeed—of 'Carmen,' wherein brilliancy and dramatic truth abound, and of 'L'Arlesienne,' which breathes of tenderness and life.

Two movements to which French music owes some of its most beautiful strains seem to have been simultaneously under way during the last 25 years of the century. The one, illustrated by names that are justly celebrated and popular, is characterized by the advancement of dramatic music; the other, perhaps more glorious, although less well known, is the revival in France of the symphony. The excellence of the former was attained through the efforts of Reyer, Massenet, Saint-Saëns, and later still through the labors of Bruneau, Gustave Charpentier, Leroux and Erlanger, whereas the latter movement has been immortalized by the names of César Franck, of Lalo and of Chabrier, while Vincent d'Indy, Paul Dukas, Guy Ropartz, and a few others have made its influence felt down to date.

In the line of dramatic music few countries have been able to show such a diversity of temperaments, and this is attested by the efflorescence of the works that have rendered the French lyric stage peerless. To be sure, these great operatic composers could not all boast of being innovators: some yielded complacently enough to the exigencies of a public that loves ease above all else, while others were powerless to withstand those influences by which their individuality was sometimes circumscribed.

It is in this sense that Reyer may be said to have been the first disciple of Richard Wagner in France. While it is true that the author of 'Sigurd,' a sincere, energetic musician, seems to have inherited from Wagner and Berlioz, as also from other sources, a love of pathetic sonority, dramatic passion and picturesque coloring, he is nevertheless an essentially French composer. If he has not Wagner's decided German labyrinthian scope and the heroic, masterful touch which, at times, cause the masterpieces of this genius to assume titanic proportions, he tempers his romantic tendencies by a thoroughly French sense of equilibrium and equipoise. Moreover, whatever Reyer may lack in the way of grandeur, he makes good in that of sense and clearness. The score of 'Salammbo,' emotional, strong and remarkably well carried out, is a most eloquent example of the order that he knows so well how to preserve in his noble, forceful lyricism.

If, like Wagner, Reyer desires to impress and to affect, Massenet seeks only to captivate, which he does by easy means. Diffuse, sensitive, elegant and refined, he appears as the restorer of gallant music, the best musical interpreter of delicacy and grace. 'Manon,' 'Esclarmonde,' 'Thaïs' and 'Ariane' manifest the skill with which he portrays the charm and the sensualism of love. His talent, however, is rather meagre. Although deeply appreciative of the eloquence of melody, he is hardly a symphonist. He sings and the orchestra dutifully sustains his song. With the exception of 'Marie-Madeleine,' which is perhaps his most beautiful work, his operas seem to be principally *suites*, although often exquisite ones, of «accompanied airs.»

On the other hand, Camille Saint-Saëns, who is a symphonist in the fullest sense of the word, likewise belongs to one and the other of the summary classifications heretofore indicated. A fascinating technician, conducting with rare power and marvelous presence of mind that many-voiced instrument, the orchestra, he has some of the finest qualities of the classic French mind: clearness, proportion, and will. He may be accused of lacking the spirit and adventurous freedom that is generally peculiar to men of genius and, reasonably enough, he may also be said to be more scientific than passionate or humane, but he is none the less a master.

In the 'Symphonie en Ut avec orgue,' and in some of his symphonic poems—expressive forms to which he was for a long time devoted—he gave forth his full power, and we admire the breadth and ease of his constructive and logical ability. In 'Henry VIII.' and 'Samson et Dalila' he is the ardent dramatic composer who, with consummate skill, places the expressive resources of the symphony at the service of theatrical action. Saint Saëns deserves to be called, above all, a great harmonist.

But the mention of these three great names that reflect such honor upon our dramatic music at once calls up others, as, of late years, there have been many able contributors to this very French form of lyric art. Alfred Bruneau, the austere, pathetic composer of 'Messidor,' 'L'Attaque du Moulin' and 'L'Ouragan'; Gustave Charpentier, to whom we are indebted for 'Louise' and those beautiful symphonic pages of the 'Vie du Poète' and the 'Impressions d'Italie,' impregnated them with a vivid, realistic romanticism; Bourgault-Ducoudray, Leroux, P. L. Hillemacher, Vidal and many others have devoted their splendid, expressive talents to the French lyric stage.

But, side by side with the advancement, however glorious, of lyric drama, came the magnificent revival of the symphony in France. Whilst the dramatic composers were contributing to the stage beautiful works which, presented in the effective setting of light and decoration, imparted to the plastic art a share of their expressiveness, there appeared on the scene César Franck, a man of simple, calm, emotional genius. Although in his day he also wrote the memorable dramatic poems 'Ruth,' 'Rebecca,' and 'Les Béatitudes,' that were pure and luminous as the Gospels, César Franck ennobles and simplifies music by restricting its horizon to the human heart. If he robs it of some of the picturesque descriptiveness that is one of its most attractive charms, it is to render it more sensitive, more humane, more chaste, it is the better to harmonize it with the misery, the hope, the blighted aspiration of a soul straining after the infinite. All the woes, all the joys that in turn can depress or animate the heart of a man, when he is a believer and a genius combined, are described by Pascal in a few lines which, to perpetuate them, César Franck put to music. He wrote a sonata, selections for organ and piano, a *quartette*, and a *quintette*, all exhaling passion, grief and faith, also a *Symphonie* and *Chorals* which are ardent, despairing, divine and may be said to be admirable dramas without words.

This power of symphonic expression that indicates César Franck's masterful talent, characterizes the work of two other composers, Edouard Lalo, and later, Chabrier, who, like Franck, were not duly recognized in their own time. Lalo's 'Symphonie espagnol' and 'Namouna,' and Chabrier's 'Gwendoline et Briseis' attest, under different temperaments, marvelous polyphonic richness. Saint-Saëns, Lalo and Chabrier were, it seems, the first in France to extend to the stage that new form of lyric expression wherein the orchestra becomes not the complement of song, but the very soul of the production.

César Franck's excellent artistic perception, the serenity of his life and the philosophical example of his work were no less ennobling in their influence than was his musical genius, and to all who have approached him this master bequeathed some of his earnestness, his depth, his discipline and his dignity. They have inherited his faith in pure music, and to-day they zealously propagate French symphonic tradition, on the stage as well as in concert. Vincent d'Indy, the most faithful of all to these teachings, has elicited applause for 'Fervaal' and 'Wallenstein,' strong, serious works in which musical power equals character. To Guy Ropartz we are indebted for Psalms and a fine *Symphonie*. Paul Dukas, the most personal, has pushed orchestral science and the power of independent musical expression to the extreme limit. In his 'Apprenti Sorcier,' which is dazzling, abstruse and heavy, intelligence eclipses sentiment.

However, it were rash to claim that the latest French music still bears the impress of César Franck's moral and technical influence. On the contrary, it displays a brilliant individuality and a contempt, lucky at times, for the traditions of the masters. Of all these musicians, the strongest, the only one who now deserves notice, is Claude Debussy, whose ardent, subtle, expressive music is that of a pagan and a sensualist quite destitute of humanity, as understood by Beethoven; it excites more sentiment, is more penetrating and more mysterious than any others and seems to assimilate the bewitching charms of nature that it so admirably reveals. 'L'Après-midi d'un Faune' and 'Pelléas et Mélisande' represent two important dates in the history of French music, and will probably prelude a renaissance of the descriptive music in which France has always excelled.

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PAUL-LOUIS GARNIER.

14. **France—The Drama.** Dramatic art, more than any other, is the reflex of its time and surroundings and the mission of the stage has ever been to reproduce, after duly magnifying them, those sentiments and ideas that have exerted the strongest influence over the mind of a people at each successive period of its history. This has been the case in France, as elsewhere, and to follow the evolutions of the French drama is to trace those of French society itself.

In the Middle Ages mysticism and religion were the foundation of popular life, hence the stage was eminently religious and its *mysteries* and *miracle plays* depicted Scriptural legends and the Passion of Jesus Christ. But, by degrees, profane life reasserted itself and engendered the Gallic spirit pervading the *allegorical satires* and *moralities*. The gay farce, 'L'Avocat Pathelin,' is a standard model of this style.

The Renaissance being the revival of antique types, dramatic themes were thenceforth taken from Greek tragedy and Latin comedy instead of the Bible, and this revolution begun by Jodelle and Robert Garnier in the 16th century, was carried into the 17th first by Rotrou and then by Corneille, being finally completed by Racine and Molière.

Corneille, sublime and bold, adapts himself but poorly to the rules set down by Aristotle, especially the three unities, but Racine, graceful and pleasing, conforms to them wonderfully well. Classicism is largely made up of effacement, if not servility, and is quite satisfied to clothe modern characters in antique raiment. It bids the contemporaries of the great king, the simple, rugged heroes of Corneille and the delicately complex heroines of Racine express themselves in the alexandrines of the classic stage and presents the psychology of great chieftains and their love in the guise of Greek and Roman fable.

Molière portrays perhaps even more vividly the period in which he lived. His comedy wears a mask, his most extravagant farces are but a shield for the heaviest tragedies. Domestic troubles, conflicting interests or opinions, the delineation of the most unbridled passions or the vilest conceits are presented to us in a medium whose effect it is to emphasize contrast: his work is in chiaroscuro and he exaggerates in relief the vices he holds up to view. An Alceste, a Harpagon, a Tartufe or an Argan can readily evoke, as the poet says:

> Cette mâle gaieté si triste et si profonde
> Que lorsqu'on vient d'en rire on en devrait pleurer
> (A. de MUSSET).

The 18th century, although rich in ideas, was poor in dramatic authors. The prescribed form of ancient art was disappearing and the new form had not yet been established. Voltaire's tragedies lacked strength and his comedies were purposeless. Classicism became extinct. Shakespeare, whose plays were only clumsily adapted by Ducis and Voltaire, was no better understood by the public than by his translators. Sedaine and Diderot were happier in their bourgeois comedies and showed a tendency, albeit an awkward one, toward society comedy by showing up the social and political conditions of the day, the enactment of the great bourgeois comedy.

Histrionic literature, as well as all other kinds, helped to pave the way for the French Revolution. In spite of the Censure, Beaumarchais attacked those men who «have taken the trouble to be born, but nothing more,» and, in the imperishable character of «Figaro,» immortalized a type of the populace which had fallen to be so little and had just begun to demand their old position.

During the revolutionary disturbance theatrical representations were an additional spur to revolt and Marie Joseph Chénier(a dramatist of the hour, endowed his heroes with the souls of sans-coulottes. Toward the end of the Republic and under the First Empire the drama in France was neglected as an art; it failed. The scene of tragedy was far greater and more real; it was shifted to the battlefields of Russia and Germany. Some very acceptable comedies were written by Andrieux, Collin and d'Harville, but there was not one original writer of great drama.

To the 19th century was reserved the glory of seeing a new form of dramatic art arise. The influence of foreign literature triumphed over the classical conventions; Shakespeare and Byron, Goethe and Schiller were set up against Corneille and Racine. Unheard-of liberties were taken; paraphrasing such as Delille's was scorned; a spade was called a spade, and that without any apology. Of course, such innovations raised a storm. Alfred de Vigny was hissed for his unvarnished translation of Othello, and Hugo was severely upbraided for daring to mention the «private-staircase» in the first lines of 'Hernani.'

Hence the necessary reaction of romanticism. Tragedy was replaced by drama, the old notion of the unities of time and place was cast aside, only the unity of action being retained, and heroes were borrowed from mediæval legends, the banks of the Rhine, the mysteries of Venice or the *romanceros* of Spain. A Ruy Blas or an Esmeralda, a Ruy-Gomez or a Lucretia Borgia was brought forward and in some of deMusset's fanciful creations could be traced the dim outlines of a Perdita or a Marianne. Nor was this all; contemporary life was mirrored in certain *Proverbes*, the 'Caprice, Il ne faut jurer de Rien' and in Alexander Dumas' 'Antony.'

From that time onward all varieties of drama were presented in uninterrupted succession, but the kind that appealed most strongly to the public was that which depicted contemporary society. Emile Augier pictures to perfection the spirit of the French *bourgeoisie* from 1830 to 1870, the business man being portrayed in the 'Effrontés' or in 'Maitre Guérin,' and the absurdly vain in the character of M. Poirier, while in 'Vautrin' and 'Mercadet' Balzac holds up to view the parasites of modern society.

Belonging to our own day and side by side with Sardou, who is admirable in stage technique but only mediocre as a psychologist, and Labiche, who is a skillful and finished writer of vaudeville, is Alexandre Dumas, Fils, who strikes out into *problem plays*. The problems that are stirring society to its very depths are exploited, discussed and analysed; the limelight is thrown upon the social status of the courtesan, the illegitimate child and the girl-mother, the worlding and the prostitute. The stage begins to act as though it meant gradually to get a hold on public opinion and to bring about reforms in legislation and morals.

This last mentioned style of dramatic art is daily gaining ground and is being strongly encouraged.

However, it is by no means the only kind patronized. Indeed, rarely has there been found in the history of French letters a larger or a worse variety. Seldom have brutality and bestiality been more highly indulged than in the wrestling matches of so-called athletes and boxers and even bull-fights where the æsthetic and dramatic character is supposed to predominate. Seldom, too, does one come upon literature inferior to that of the concert-cafés or of certain vaudevilles where all the author's genius has expended itself in combining suggestive deshabille with ribald joke and indecorous acting. Far too many look upon blackguardism as the *ne plus ultra* of dramatic art and some works, although abounding in humor, do not escape this ban. But these new theatrical fashions which, it must be admitted, are of foreign origin, are certainly not among the greatest boons conferred by the craze for copying foreign models.

However, in them, the undesirable element is merely superficial. Our theatrical men have never been more concerned with the questions of the hour nor more bent upon catering to the public taste. For every light operetta and amusing vaudeville performance we have ten heavy plays that cause one to think, that start ideas and are leading toward a radical reform. If divorce has given rise to a few humorous works it has been the theme of a great many serious ones wherein its advantages and its dangers have been exploited. We have Paul Herview showing in the 'Loi de l'Homme' and the 'Tenailles' woman's present state of subjection; Abel Hermant, Emile Fabre and the Brothers Margueritte, the ones inimical and the others favorable to the reform, showing us the family irremediably divided and human personality emancipated and reclaimed.

Or again we have François de Curel telling us in the 'Repas du Lion' of the bitterness of social strife and in the 'Nouvelle Idole' of the beauty and severity of science. Then, in his 'Avariés' and 'Avortment,' Brieux sets forth the great medico-social problem, daring to excuse, perhaps even to justify, the killing of the unborn infant whose coming into the world would bring naught save shame and misery to its mother and itself, while in the 'Robe rouge' the pharisaism of human justice is challenged. On all sides society is being summoned to the theatrical bar. Again the drama 'Biribi' depicts a revolt against the *penitenciers militaires* and the *compagnies de discipline;* the popular verdict passed upon the play determined the enactment of a reform of the law as to these *compagnics disciplinaires.*

A further character of this dramatic reform apart from the varied and conflicting opinions it has excited, is that foreigners have been given generous recognition. The French public has made the acquaintance of Ibsen, Tolstoi and Gehrardt Hauptmann, and under the impulse of younger men Anthony, King Lear and Julius Cæsar have been retranslated, fitted for the modern stage and have shown the French public a new and hitherto unknown Shakespeare. Marvellous stage-settings—an imitation of English excess—form the frame in which the characters of these masterpieces move and live, but for the historian their interest is that each drama is a revelation to the public of a new and foreign spirit.

Judging from the present, the future of the French stage may be easily conjectured. At no other time has it manifested such effervescence, such vitality, and the French world at large is subject to no more powerful influence than that exerted over it by the stage. It is the chief literary expression of our time and bids fair to remain so for long. See DRAMA.

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GUSTAVE RODRIGUES.

15. **France—The Army and Navy.** The President of the Republic controls all land and sea forces. He appoints officers of all grades and presides over the council of national defense, which includes the President of the Cabinet Council, the Minister of War and Minister of the Navy with their chiefs of staff, the Minister of Foreign Affairs and the Minister of Finance.

Military expenses are annually estimated in the budget (a statement of national income and expenditure), and in 1906 they amounted to 718,690,800 francs for the War and 325,000,000 for the Navy Department.

THE ARMY.

The Minister of War is the head of the administration of the Army. He is assisted by a general staff comprising four departments, devoted respectively to mobilization and general organization, the investigation of foreign armies and of the theatres of operation, army instruction and military operations and military transportation; and three sections, namely, the staff personnel, the historical, and the African section.

A geographical service insures the making and publishing of topographical maps dealing with France, Algeria and foreign countries.

The chief of staff is assisted by three immediate subordinates, one of whom conducts the geographical service.

The Central Administration of the Army includes the several branches of the War Department: infantry, cavalry, artillery, engineering, administrative services, the «powders and saltpeters,» medical service, colonial troops and the *contrôle* service, which verifies ministerial orders, decrees, etc., for the entire service.

In the study and investigation of plans and reforms the Minister is still further assisted by several technical boards, committees and sections. He is president of the *Conseil supérieur de la guerre* (a board that deliberates on questions of mobilization, concentration, supplies, etc.), the vice-president being the commandant selected from the principal *groupe d'armeés* (*i. e.* all the armies operating in one theatre of war and under the supreme command of one general), the other members of the board consisting of eight generals with high commands in mobilization, and also the chief of the general staff.

The Army comprises the active army and its reserve, the territorial army and its colonial troops.

Recruitment.—Every Frenchman owes his country personal military service which is equal for all. It is of 25 years' duration, two of which must be spent in the active army, 11 in the reserve of the active army (with two calls to four weeks' drilling); six in the territorial army (one call to 15 days), and six years in the reserve of the territorial army (one call to one day).

Annually, all young men who, before January 1 have completed their 20th year, are called to the army. Those who are or who have become unfit for armed service are classified in the *services auxiliaires* (any services performable by noncombatants) and are assigned to duty in the *dépôts du territoire*, in the departments, in the artillery, engineering and *intendance* establishments, etc.

Besides those summoned to enter the service the army counts a certain number of re-enlisted soldiers. Corporals, brigadiers and soldiers may re-enlist for one year, 18 months, two years, two and one-half years and three years. The noncommissioned officers of the metropolitan or home troops and all the soldiers of the colonial troops may re-enlist for four or five years, until they will have completed 15 years of service.

Territorial Organization.—With a view to the recruitment, mobilization, organization and assignment of troops, France is divided into 19 «military districts» numbered from 1 to 20 (Algeria-Tunis being the 19th). The headquarters are at (1) Lille; (2) Amiens; (3) Rouen; (4) Le Mans; (5) Orleans; (6) Châlons; (7) Besançon; (8) Bourges; (9) Tours; (10) Rennes; (11) Nantes; (12) Limoges; (13) Clermont-Ferrand; (14) Lyons; (15) Marseilles; (16) Montpelier; (17) Toulouse; (18) Bordeaux; (19) Algiers; (20) Nancy.

Paris and Lyons are the seat of special military government.

Each of these military districts (except the 19th) is subdivided into eight smaller districts (four in the 6th and 20th), each of which corresponds to an active regiment, a regiment of reserves and a territorial regiment of infantry.

Each regiment has a permanent place for mobilization, where the men required for active service meet and where the regiment's supplies and rolling stock are kept. It draws its reservists from a certain limited district which is its regional subdivision for reserves.

With a few exceptions France is divided into as many of these sub-districts as there are units of organization in each arm (145 for the active infantry, reserve and territorial regiments).

In every regional subdivision a recruiting bureau directs the men of the reserve and of the territorial army, assembles them for drill and summons them for mobilization.

The military districts answer as regional subdivisions of reserves for their *brigade d'artillerie* (two regiments to each corps except the 6th); the cavalry, engineering, light infantry and zouaves have special limited subdivisions.

Hierarchy and Recruitment of Officers.—No one can be admitted to a grade unless some form of military duty be connected with it; the duty is distinct from the grade. Colonels make appointments to the rank of corporal or brigadier and petty officer (sergeant, sergeant-major and adjutant in the infantry and engineering; sergeant, sergeant-major and adjutant in the other arms). Officers are promoted by order of the President of the Republic.

Officers are recruited (1) From the petty officers admitted after competitive examinations to the military schools of St. Maixent for the infantry, Saumur for cavalry, Versailles for artillery, engineering and the train, and who, after a year these schools, pass a successful graduation examination. (2) From the young men who, after a competitive examination, are admitted to the Polytechnic (artillery and engineering) and the School of St. Cyr (infantry and cavalry), and who, before entering these schools will have finished a year's service in the regiment.

The *officers of the reserve of the active army* are recruited from the young men admitted to certain schools—the *Ecoles forestières* for training administrators of the forests belonging to the state and to the communes; the *Ecole des manufactures* for training private engineers and manufacturers; the *Ecole des mines*, which cannot be entered save after a stage in the Polytechnic and the *Ecole des Ports et Chaussées* (in which former Polytechnic students are prepared for civil engineering) and after having completed a year's service in a regiment, and also from those of the contingent who, agreeing to take three supplementary periods of training during their stay in the reserve, submit to a competitive examination at the end of their first year of service. The students then follow a special six months' course in the regiment, and if at its completion they pass a successful examination, they finish their fourth year of service as officers of the reserve.

In time of peace, promotion in the active army is made in the following manner: all sub-lieutenants having held that office for two years become lieutenants. The promotion is made one-third by selection and two-thirds by seniority for the rank of captain, and half by selection and half by seniority for the rank of major of infantry or major of artillery. To the higher grades, those of lieutenant-colonel, colonel, major-general and lieutenant-general, promotion is by selection.

Make-up of the Active Army.—The active army comprises metropolitan or home and colonial troops. It has a total strength of about 28,000 officers and *assimilés* (*i. e.* noncombatants ranking as officers), 528,000 corporals and privates and 123,000 horses.

The *gendarmerie* is 24,000 strong; the infantry about 350,000; the cavalry 60,000; the artillery 72,000; the engineering 13,000; the train 6,800, and the administrative troops are 14,700.

At the head of the great units is the staff of the army, the first section of which includes 110 lieutenants-general and 22 majors-general, on the active list or unemployed.

The second section is formed of generals placed in the reserve.

The personnel of the staff service is made up of officers not on the rolls of a statutory organization (640 at most in time of peace) who have successfully followed the course at the War Academy and have received the staff college certificate.

Troops.—The *Infantry* is composed of 163 regiments, of which 145 are called *subdivisional*, that is to say, drawing their reservists from one of the regional subdivisions, having three battalions of four companies (some have a fourth battalion with a variable number of companies); the 18 other regiments with four battalions are called *regional* because, for recruiting purposes, they draw from a military district.

The subdivisional regiments have a supernumerary staff of field officers, eight captains and four lieutenants, who contribute to the officering of the corresponding regiment of the reserve, 30 battalions of light infantry with six companies (12 being Alpine battalions); four regiments of zouaves with five battalions of four companies, plus two depot companies; four regiments of Algerian rifles with six battalions; two foreign legions with six battalions; five battalions of light infantry for African service; four companies for the Sahara oases; four *compagnies de discipline* (punishment companies); one regiment of the Paris fire brigade with two battalions and six companies.

The regiments of metropolitan infantry are grouped into 80 brigades and 40 divisions, numbered from 1 to 42 (numbers 37 and 38 being missing).

The *Cavalry* comprises 89 regiments with five squadrons; 13 of Cuirassiers, 31 of Dragoons, 21 of light cavalry, 14 of Hussars, six of light cavalry for African service, and four of Algerian cavalry. The regiments stationed in France constitute 19 cavalry brigades attached to the army corps and eight independent cavalry divisions composed of two or three brigades.

The *Artillery* includes 18 battalions of artillery having a variable number of batteries, the total being 113, and 40 regiments of field artillery constituting 20 brigades (one to an army corps), with 442 mounted, 52 horse and 14 mountain batteries. The regiment numbered lowest in each brigade usually has 12 mounted batteries forming two half regiments (with two groups of three batteries each), each assigned to one of the two divisions of the army corps. The other regiment, which generally has three groups of three mounted batteries and one group of two horse batteries, constitutes the *corps artillery* of the army corps. Two horse batteries are attached to each of the eight independent cavalry divisions. The artillery includes, moreover, 10 companies of artificers or laboratory men and three companies of workmen.

The field batteries have four guns of 75m/m. Besides the troops, the special artillery staff, assisted by administrative artillery officers, is destined for the service of establishments (schools, arsenals, etc.).

The *Engineering* branch of the army comprises a special staff and seven regiments, six of engineer soldiers and one of railroad engineers; that is, 26 battalions, 20 of engineer soldiers, three of railroad engineers, one of æronauts, one of telegraph operators and one detailed to service in Algeria. The train includes 20 squadrons of three companies. The administrative troops consist of 21 sections of clerks for staff and recruiting duty, 25 sections of workmen, mechanics, etc., and clerks, enlisted as such, for military service, and 25 sections of hospital orderlies.

The *Gendarmerie* embraces 27 departmental legions and the *gendarmerie* of the city of Paris, which has three battalions of infantry and four squadrons of cavalry.

Besides the troops, must be included the personnel of the various services; of the *contrôle* service (whose duty it is to watch over and inspect the *administration* or the *gestion*); the *intendance*, the medical service, the corps of administrative officers, the veterinarian corps.

the "powders and saltpeters," military justice, the interpreters' corps, etc.

Reserve Troops.—These comprise 145 regiments of infantry and three battalions formed of the supernumerary officers of the 145 subdivisional regiments of the active army, and the officers, corporals and privates of the reserve; 30 battalions of reserve *chasseurs;* 40 regiments of reserve cavalry; 41 reserve squadrons; and, to each artillery brigade, 12 reserve batteries, namely, 216 battalions.

Colonial Troops.—These are connected with the War Office and destined, principally, for the Colonies. One part constitutes in France an organized army corps of three divisions. The Colonial troops are distributed as follows:

France: 12 regiments of infantry, three of artillery, five companies of workmen and one company of artificers or laboratory men.

Indo-China: Four regiments of infantry, four of Tonkinese rifles, two of Annam rifles, one battalion of Chinese rifles, one of Cambodian rifles, two regiments of artillery and two mixed companies of workmen and artificers.

Eastern Africa: One regiment of infantry, three of Malagasy rifles, one of Senegalese rifles, one of artillery and two companies of mixed workmen.

Western Africa: Three regiments of Senegalese rifles, one of Congo rifles, one battalion of Zinder rifles, one regiment of artillery and one company of drivers.

China and China Reserve: Two regiments of infantry, one of Tonkinese rifles.

The Territorial Army.—The troops of this army may, when mobilized, be detailed to garrison fortresses or fortified town posts, lines of halting-places, strategic points and coast defenses. They may also be formed into brigades, divisions of the army corps destined to remain in the field, and finally may be drafted as part of the active army.

The Infantry comprises 145 regiments of three battalions, that are connected with the active corps of their subdivision, seven battalions of light infantry with four companies (on the Alpine frontier) and 10 battalions of zouaves (Algeria).

The Cavalry varies in the number of squadrons which it allows to a military district, there being usually one squadron of Dragoons and one of light cavalry and three territorial squadrons of light artillery for African service.

The Artillery in an army corps consists of two territorial groups, each corresponding to one of the active regiments of field artillery, and 15 territorial groups of foot artillery distributed among 11 military districts (on the frontiers and seacoasts).

In each army corps there is also formed a battalion of engineers and a territorial train squadron.

Finally, to these troops must be added 31 battalions of custom-house inspectors, seven battalions, 19 companies and 14 sections of custom-house inspectors detailed to duty at fortresses, 45 active companies and 16 sections of *chasseurs forestiers* (riflemen recruited, on mobilization, from the personnel of the forestry department), and three companies and 25 sections of *chasseurs forestiers* assigned to fortress duty.

THE NAVY.

The Minister of the Navy is assisted by a general staff composed of three sections. The object of the first is the study of foreign naval forces and coast defenses. Among the duties of the second is to arrange for the defense of military ports, naval strongholds, metropolitan and colonial coasts, to secure coast protection by submarine-mines and to look after the torpedo and submarine flotillas. Finally, the third section superintends the preparations for military and naval operations, the mobilization of the fleet and all that concerns naval training.

Besides the general staff there is a hydrographic service comprising seven sections.

The Administration of the naval forces includes: (1) The department of the armed fleet (personnel and administrative services); (2) The building department of the fleet, comprising the branches of naval architecture, naval artillery, hydraulics and *bâtiments civils.* We must add the departments of finance and *comptabilité* (accounts), *contrôle* (keeping of muster-rolls, etc.), navigation and maritime fishing, and the establishment called *Invalides de la Marine.*

The principal schools in which the *cadres* and specialties are taught are: the Naval Academy, naval school, school for midshipmen, for torpedo gunners, for torpedo officers and engineers for sea-coast practice, for practical gunnery and steerage, for armed seamen, for paymaster cadets (administrative), for medical service, etc.

The Navy establishments outside of military ports and navyyards are the foundry at Ruelle, the artillery factory at Indret for machines and boilers, and the iron works at La Chaussade. Moreover, the Navy places some of its orders with private business concerns.

Territorial Organization.—For the administrative service of ports and the governing of young men under *inscription maritime* (naval registration) the coast of France is divided into five *arrondissements maritimes,* with headquarters at the five military ports of Cherbourg, Brest, Lorient, Rochefort, and Toulon.

Algeria and Tunis form a sixth naval district.

Each arrondissement is divided into two or three sub-districts, the latter having headquarters at Dunkirk, le Hâvre, Cherbourg, St. Servan, Brest, Lorient, Nantes, Rochefort, Bordeaux, Marseilles, Toulon, and Corsica.

Each sub-district is under a paymaster, who has charge of the *quartiers,* while in each *quartier* resides a passed assistant or assistant paymaster of the Navy, commissioner of the *inscription maritime,* who has for his special agents seamen exercising police duty in the maritime domain, also coast-guards and naval gendarmes.

A vice-admiral or maritime prefect is at the head of each of the five *arrondissements maritimes,* his authority extending along the coast line of the arrondissement and over all the departments represented within the territory that he governs.

He is assisted by a rear-admiral, chief of staff in charge of the navy-yard, a resident commissioner, a chief of naval ship-building, a chief of hydraulics, a director of submarine defenses in charge of torpedoes and torpedo-boat sea-coast defense, a director of *mouvement du port* (*i. e.* of vessels entering and clearing of the port), a chief of artillery and a chief medical officer.

All these officers, except the director of vessels entering and clearing the port, form a part of the administrative council of the navyyard.

The navyyards include a central shipbuilding factory, docks, dry-docks, covered or uncovered ship-yards, magazines and workshops. They also provide storage for disarmed or reserve ships.

The reserve ships are 1st, 2d or 3d class, according as their armament fits them for setting sail in 8, 15 or 30 days.

In each of the five great military ports is a station for reserve men and *disponsibles* (unattached men) of the navy.

Sea Forces.—(a) *Personnel.*—The personnel is made up of staffs and crews.

The staffs are composed of 2,050 naval officers, 327 engineers, 153 naval ship-builders, 27 hydrographers, 253 paymasters, 344 surgeons, 54 apothecaries.

There are, moreover, 364 reserve naval officers. The crews comprise the officers of inferior rank, quartermasters, sailors, engineers, etc., numbering about 53,000 strong and assigned to duty along various lines, viz.: practical gunnery, musketry, steerage, manœuvring, carpentry, sailing, and caulking.

Naval officers are recruited from four sources: (1) From the naval school, into which, after a competitive examination, young men from 14 to 18 are received. At the end of two years they are named naval cadets, and after a year at sea become midshipmen; (2) From the Polytechnic, which furnishes four midshipmen a year; (3) From the petty officers, who, after an examination, are appointed ensigns; (4) From deep-water captains, admitted as auxiliary ensigns and who may become commissioned ensigns.

Midshipmen, after two years' service in that grade, become ensigns.

For the grade of lieutenant it is necessary to have served two years at sea as ensign, promotion being one-third by selection and two-thirds by seniority.

For the grade of commander promotion is half by selection and half by seniority, and for the higher grades of captain, rear-admiral and vice-admiral, it is now by selection only.

Recruitment.—The annual quota of naval recruits is jointly supplied by the *inscription maritime* in conjunction with voluntary enlistments and the applications made by young men to the recruiting board.

All fishermen and men engaged aboard merchant ships are on the *inscription moritime* and are bound to naval service; they number about 100,000.

Between the ages of 18 and 50, those on the *inscription maritime* are at the disposal of the State; before the age of 20 they cannot be called to active service except in case of war and by order of the President of the Republic, but once they have attained that age, if they have not entered the navy before the legal date set for such entry, they must submit to a seven years' service, including five years of active duty and two of *disponibilité* («status of men allowed to return to their homes before the completion of their full term of service»). The five years' duty includes an active service of variable length, not exceeding three years, most of the time being spent in respites, exemptions, or unlimited leave of absence. During the reserve period, the *inscrits* (those registered on the *inscription maritime*) cannot be levied unless by order of the Head of the State.

The *inscrits* enjoy certain privileges; they are exempt from the *droit de potente* (license tax), the *redevance personelle* (rent-tax), and they have the temporary grant of parts of the shore, are given pensions and receive pecuniary aid from the *Caisse des Invalides.*

The administration of the *inscription maritime* is conducted on the sea-coast according to arrondissements, sub-arrondissements, and *quartiers* in charge of naval paymasters.

There are two classes of reserves in the maritime army: (1) The reserves of the naval crew; (2) The *inscrits maritimes.*

The reserves of the naval crew are those who have voluntarily enlisted in the naval army or have been assigned to it by the law of recruitment and remain thus assigned for 10 years from the date of their entrance into the service.

In time of peace *inscrits* from 25 to 35 not in actual service may be recalled for two periods of four weeks' practice.

(b) *Vessels.*—The naval fleet comprises 35 battleships, 9 of which are in reserve, 1 is on trial and 10 are in the course of construction; 26 armored cruisers, 7 of which are in the reserve, 2 on trial and 4 in the course of building; 25 1st, 2d and 3d class cruisers, 14 of which are in reserve; 58 torpedo-catchers, 15 of which are being built; 19 gunboats, 8 of which are armored; 9 despatch boats; 9 torpedo gunboats, 40 seagoing torpedo-boats; 215 1st class torpedo-boats, 70 of which are being built; 40 2d and 3d class torpedo-boats; 39 submarine boats, 14 of which are in the course of construction, and 45 submersibles, the greater number in the course of building.

The vessels are distributed: (1) Between the squadron of the Mediterranean and the Levant; that of the North and the naval divisions of Tunis, Algeria, the Atlantic, the Extreme East, Indo-China, the Indian Ocean and the Pacific; (2) Between 14 torpedo flotillas: 2 of la Manche, 3 of the Ocean, 5 of the Mediterranean, 2 of the China Sea, 1 of the Indian Ocean and 1 of the Atlantic. Besides the torpedoes, which vary in number, these flotillas generally carry 1 torpedo gunboat and 1 or 2 torpedo-catchers. (3) Between 6 submarine flotillas: 2 of la Manche, 1 of the Ocean, 2 of the Mediterranean, and 1 of Cape St. Jacques Saïgnon, an important *point d'oppui.*

Submarine mines, batteries, lines of torpedoes, etc., protect these *points d'oppui* of the fleet which serve as a base of operations and are Cherbourg, Brest, Lorient, Rochefort, Toulon, Bizerta (Tunis), Saïgnon, Fort de France (Martinique), Diego Saurez (Madagascar).

Finally, the coasts are protected by 12 ironclad coast defense vessels. To the ships heretofore enumerated we must add 11 gunboats, 9 torpedo launches, 12 transports, 6 *oviso* transports and small vessels used for port service, stations and schools.

The number of guns on board the different vessels of the fleet is about 3,700.

LIEUTENANT-COLONEL ROLLIN,
Of the General Staff.

16. France—French Railways. *Historical,* 1823-1859.—The principles underlying the present system of railways in France will perhaps be made clearer by a brief account of the several phases that have preceded it.

The earliest experiment in railroading on French soil was a line between Andrezieux and St. Etienne, intended solely for coal and freight and operated by horse traction. The grant for it was made in 1823 by a simple royal ordinance. It was a grant in perpetuity, without subsidy or guarantee. About the same time grants were made on the same conditions for several other small lines.

In 1832 the first locomotive made its appearance. This was on the line from St. Etienne to Lyons, and thenceforward passenger service was added to freight traffic.

The Government, divining the future importance of the new mode of transportation, worked out a general scheme of trunk lines and submitted it to parliament. The first debate brought out two contrary principles which were destined to clash frequently thereafter. According to the one principle the State ought to construct and operate the railways; the other principle was that of private enterprise. After some fruitless discussions several grants were made, but a financial crisis which followed forced the recipient companies to ask for a revision of their contracts. The State had to assist them, and in 1840 it guaranteed to the Paris-Orleans Company, for 47 years, 4 per cent. interest on a maximum capital of 40,000,000 francs. This was the beginning of an arrangement which afterwards became general.

The law of 1842 decided on the creation of the trunk lines radiating from Paris to, respectively, Lille and Belgium; Nancy and Strasburg; Lyons and Marseilles; the centre of France, Bourges and Toulouse; Tours, Bordeaux and Bayonne; Nantes; Rouen and Havre; and lastly from Bordeaux to Marseilles by Toulouse, and from Mulhouse to Lyons by Dijon.

The State undertook the acquisition of a part of the lands, the departments being responsible for the remainder. The State built at its own expense the embankments and other artificial works and the substructures of the stations. The companies had to furnish the permanent way and the working stock, which at the expiration of the grant were to be bought by the State at an expert valuation. The work was begun and pushed forward energetically, but in a short time a financial crisis precipitated by speculation endangered the existence of the companies. The Republican Government of 1848 proposed repurchase, which was not accepted.

The Empire from the first favored an amalgamation of the various companies, the large number of which was a cause of weakness and of inconvenience to the public. By a series of decrees it constituted the great corporations, unifying the conditions of their contracts and extending the duration of their grants to 99 years. In this way were founded the principal French systems, whose grants expire as follows: That of the Northern Company in 1950; of the Orleans in 1956; of the Southern in 1960; of the Eastern in 1954; of the Western in 1956; and of the Paris-Lyons-Mediterranean in 1958.

Feeling their position strengthened, the companies accepted grants for secondary lines, to serve as feeders to the main lines, and from 1852 to 1857 more than 2,000,000,000 francs were expended, when a fresh financial crisis supervened.

At the end of 1858 the situation was as follows:

LENGTH OF LINES.

In operation	8,770 k.
Granted	16,174 k.

EXPENDITURE.

By the State and sundry	780 millions
By the companies	3,334 millions

1859-1875.—The situation of the companies having become critical, the Government, on 11 June 1859, induced parliament to ratify agreements between the State and the companies of the following nature:

In order to restore the companies to the situation they had enjoyed before the grants of secondary lines, the system of each was divided into two sections, called the old and the new systems. The capital appropriated to the new system received a guarantee of 4.65 per cent. interest for 50 years, beginning with 1865. Working expenses were included in a single account. Beyond a certain sum, representing the dividend guaranteed to the old system and the redemption of its capital, the excess of the net profits had to be expended on the new system, so as to cover partly, at least, the revenue guaranteed by the State, which was advancing the difference. This scheme has been named the «Overfall» (deversoir). The sums advanced by the State for the guarantee were regarded as loans, the companies paying interest on them at 4 per cent.

On the other hand it was specially agreed that after 1872 the companies should share with the State such portion of their revenue as exceeded a certain fixed figure, called the «partition point.» This figure was determined so as to allow the old system a higher dividend than at first, and to ensure to the new system, over and above the redemption charges, a revenue of 6 per cent.

If at the expiration of the grant the companies should prove to be debtors to the State, their working plant was to be assigned for the repayment of the sums due. Moreover, the State might redeem the grant at the end of 15 years by paying for the remainder of the time an annuity determined according to the revenue of the preceding seven years. The working plant was to be bought in at an expert valuation.

Such were the chief clauses of these agreements which enabled the companies to place their finances on a firm basis and to add about 700 k. yearly to their lines in operation.

At the close 1875, in spite of the loss of 800 k. with Alsace-Lorraine, the system «of general interest,» that is, the main system, showed the following development:

LENGTH OF LINES.

In operation	19,744 k.
Granted	26,423 k.

EXPENDITURE.

By the State and sundry	1,412 millions
By the companies	7,991 millions

To faciliate the economical construction of lines, a law, dated 12 July, 1865, had authorized the departments and communes to create secondary lines for themselves in their neighborhood. These railways, which were called «lines of local interest,» attained, in 1875, to an extension of 1,500 k., representing an expenditure of 41,000,000 francs.

1875-1883.—During the preceding period, alongside of the great companies, a number of minor companies had sprung up, such as that of the Charentes, that of the Vendée, of Dombes, of the North and East, etc.; but their position had become very much embarrassed. Several of these lines—of «general» as well as of «local interest»—were connected with the systems of the great companies. The Company of the Charentes, one of the most important among the minor organizations, showed an annual deficit of from 4,000,000 to 5,000,000 francs. The Government submitted to parliament for its ratification an agreement whereby the Orleans Company was authorized to buy up the Charentes Company, and other secondary lines, taking over their indebtedness under certain guarantees. At this particular time there was a great deal of ill-will toward the companies in parliament and the agreement was thrown out, Government being invited to introduce a repurchase bill, which was voted in 1878. The State thus acquired the Charentes Company, and several others, which formed the original nucleus of the State System. The cost was 500,000,000 francs, and it was covered by the issue of the 3 per cent. redeemable.

Since 1876 Government had been preparing a scheme for completing the railway system. Several commissions were at work on it, and in 1879 M. de Freycinet, Minister of Public Works, procured their consent to a scheme which provided for the construction of 8,700 k. of new lines, and 8,300 k. of lines granted but not yet operated, or a total of 17,000 k., within a period of 10 years.

The cost per kilometer was estimated at 200,000 francs, making a total sum of 3,400,000,000, or an annual outlay of 340,000,000 francs, a very reasonable figure compared with the outlay for the companies during the period 1855-1865, when it averaged 430,000,000 francs a year. The Freycinet Scheme, as it has since been called, refers to the whole of these new lines, together with considerable works to be carried out in the ports.

The agreements of 1879 began to be carried out at once, but the operation of the first lines showed a deficit, which, added to the cost of constructing the new lines, considerably increased the burden on the State. It became necessary, therefore, either to proceed more slowly with the work, or else to have recourse to a financial operation to ensure the completion of the proposed lines.

Owing to a recent crisis it did not seem feasible to make a loan. The State accordingly fell back on the credit of the companies, and the Government, in spite of lively opposition, succeeded in 1883 in carrying through parliament a fresh set of agreements which regulate the French railway situation to-day.

The main features of these agreements may be summarized thus: (1) The companies accept the grant of about 1,200 k. of new lines. They undertake to supply, in addition to the working stock and plant for these lines, a sum of 25,000 francs per kilometer, the rest of the cost falling on the State. The companies agree to carry out the works according to plans approved by Government and to advance the necessary funds which shall be repaid by annuities. (2) In regard to guarantee the previous distinction between the old and the new systems is done away with. There is only one account for working expenses. The net proceeds from this account are assigned by each company to the service of its debt and to the payment of a guaranteed minimum dividend. If there is a deficiency, the State gives its guarantee. If there is a surplus, it is used for the repayment of the advances made by the State as guarantee, and after the extinction of that debt it goes to the shareholders until the dividend touches a figure known as the «reserved» dividend, after which the profits are divided in the proportion of two-thirds for the State and one-third for the company. (3) With a view to reducing the amount of the annuities guaranteeing the interest, the companies are authorized to carry over till a fixed time the deficits on new lines to a special account, called «Account of Partial Operation,» where the deficit is covered each year by an issue of bonds. (4) A settlement was carried out in respect of the «Initial Outlay» account of the old systems, and also of the value of the stocks, on 31 Oct. 1882. However, the companies may still, by obtaining a simple ministerial authorization, execute supplementary works and charge them to Initial Outlay. (5) The companies which had used the guarantee of interest under the agreements of 1850 liquidated their debt by constructing works up to an amount agreed upon. (6) The State reserves the right of repurchase at any time. Lines which have not completed 15 years' existence are to be valued according to the actual expenditure on them, and the same rule holds good for supplementary works. In regard to the other lines, an annuity is to be paid, determined, as under the agreements of 1859, by the net profits of the last seven years, the guarantee of interest being included. (7) Finally, the companies agreed to a considerable reduction of the passenger rates, and further promised to revise and unify the slow freight tariffs.

The brilliant situation of the companies in 1883 had raised the hope that the burden of the guarantee would not weigh too heavily on the budget. But a period of depression followed the prosperous years, and it was necessary, in order to reduce the expenditure, to proceed more slowly with the works. Accordingly the completion of the proposed lines seems deferred to 1908 or 1910. Subsequently the receipts gradually rose, and in the last few years the calls on the State guarantee have been decreasing; some companies have even begun repayment. However, it is to be feared that the fresh out-lays imposed on the companies may defer to a still distant date their entire liberation from indebtedness to the State.

SITUATION OF FRENCH RAILWAYS (OF «GENERAL INTEREST») IN 1904.

LENGTH OF LINES.

In operation	39,300 k.
Granted	42,250 k.

EXPENDITURE.

By the State and sundry	5,616 millions
By the companies	11,832 millions

Characteristics of the Present System of French Railways.—We have seen that the railway system which has prevailed in France is rather due to circumstances than to the realization of theoretical ideas.

It is a mixed system, which, while respecting the supreme rights of the State and according it a very extensive control over the companies, leaves the latter as much independence and initiative as are necessary for the proper management of their business.

The companies enjoy a monopoly and operate the lines, while the State continues to own them, and only concedes them for a limited period. Entrusted with a public service the rights and duties of the companies depend on contracts made with the State, which exercises over their management a threefold control, financial, technical and commercial, in virtue of the threefold character of the railway system. The exercise of this control comes under the powers of the Minister of Public Works, who is assisted by various commissions, according to the nature of the questions at issue. The most important of these commissions is the Advisory Railway Board, whose functions are chiefly commercial.

Financial System.—The financial system of the companies is regulated by agreements, viz.: Those of 1883, which are actually in force, and of which the details have been given above. The State, having refused to divest itself of its proprietary rights over the railways, and on the other hand having compelled the companies to construct costly lines, has been led not only to undertake a part of the initial outlay but also to guarantee a minimum interest on the capital invested. Consequently, the State must satisfy itself as to the correctness of the companies' accounts in respect of initial outlay and working expenses, since these determine the amount of the guarantee of interest, and also of the annuity to be paid the companies in reimbursement of their advances. The State also controls the financial situation of the companies. It sees that the issues of bonds are sufficiently guaranteed, and that a right proportion is observed between the shares and the bonds. Lastly, the law of 27 Dec. 1890, places the statutes of the companies' pension funds under ministerial control.

Technical System.—The State intervenes also in technical questions. When the companies are constructing new lines, the plans and estimates must be submitted to the Minister, who has the draught verified, and sees that all the works are planned in accordance with scientific requirements and satisfy the terms of the accepted estimates. Moreover, he causes the execution of the works to be supervised. When the companies wish to improve existing lines or to increase the working stock, they must likewise submit their plans and estimates to the minister's approval. There is government control also over all regulations touching the working of the lines, over the speed of the trains, the limitation of hours of labor, and various internal matters. The railway police is regulated by the law of 1845 and the ordinance of 1846, modified in 1901.

Commercial System.—Railway tariffs affect public wealth too deeply to have escaped government control. To begin with, in the terms of contract appended to the grants, maximum tariffs were laid down for passenger and freight services; these cannot be exceeded by the companies though they may reduce them as much as they please. However, such reductions cannot come into force till they have been confirmed or approved by the minister, who has the right to withhold confirmation or only to accord it subject to certain modifications. This gives the government a means of exercising pressure on the companies in such direction as it may desire.

An elaborate method enables the minister to get information as to the seasonableness of the proposed change, and constant shifting of rates, which is so harmful to the public, is carefully guarded against. In some cases, *e. g.*, of export tariffs or transit tariffs, the ordinary regulations are modified so as to enable the companies to meet foreign competition.

Tariffs.—The terms of contract fix the maximum amount of the taxes which the railway companies are allowed to collect. That is the legal tariff. But the companies have exercised their right of introducing lower tariffs. When freight is conveyed with all the guarantees and under all the conditions laid down in the terms of contract, the general tariff is enforced. But when the public consents to some modifications of those conditions, then special lower tariffs are applied.

The tariffs are based on the rate paid per kilometer or per unit of transportation. This base may be constant, and then the rate is proportionate to the distance traversed, as happens in the passenger service. Or it may vary with the length of the journey, so as to stand, for instance, at 8 centimes for transits below 100 k., 5 centimes for those below 300 k., and 4 centimes for those beyond 300 k. Coal and mineral products were treated thus after 1863. It was a drawback of the system, however, that the rates came higher for journeys of just less than 100 k. than for journeys of just more than 100 k., and this was true also about journeys in the neighborhood of 300 k. To remove this anomaly, it was specified that in no case should the rate in one section exceed the minimum rate in the section following. This rule, however, produced an intermittent scale (barême à paliers), the rate not changing for a number of kilometers.

To get rid of this defect in turn it was decided to adopt the Belgian tariff, so-called because it first came into general use in that country. Here the base varies only when you pass from one section into another. Thus, to return to our previous figures, the first 100 k. are reckoned on the base of 8 centimes, the next 200 k. on the base of 5 centimes, and those beyond on the base of 4 centimes. So that we get a diminishing base. The Belgian system is commonly used in France to-day both for rapid and for slow freight; but such has not always been the case.

At first the tariff had a fixed base, but in order to encourage this and that special traffic the companies introduced for certain freights and between certain stations fixed rates called «steady rates» (prix fermes), lower than those called for by the general tariff. The number of these «steady rates» increased so rapidly, however, that the handling of the tariffs was much complicated. Moreover the principle involved in the «steady rates» was much attacked. Accordingly, after the agreements of 1883 the companies proceeded to recast their tariffs. They were simplified and partly unified; freights were divided into six series; the diminishing base of the Belgian system was adopted; and a slight reduction of rates has been the general result.

However, the «steady rates» have not yet altogether disappeared, for they meet a real need, but their number is much smaller.

Economic and Financial Results of the Agreements.—The Question of Repurchase.—Under the agreements of 1883 the railways of France have attained to a development which seems not far removed from the limits imposed by the nature of the soil and by existing economic conditions, and beyond which they could not perhaps be profitably worked.

For each thousand inhabitants in France there is 1.26 k. of railroad, while England has only 0.86 k., Germany 0.94, Belgium 0.97, and the United States 0.41. Thus France has the lead in this respect. In proportion to area France has 9.2 k. of road for each square myriameter (=6 miles 1 furlong 28½ poles); England, 11.5; Germany, 10.0; Belgium, 22.7; and the United States, 4.3. Here, even setting Belgium aside, the order is reversed.

It must be remembered that, owing to the very variety of the regions traversed by them, the several lines of the French system show marked differences in the importance of their traffic. To become convinced of this one only has to glance at a map on which the thickness of the lines is proportioned to the gross receipts by kilometer. There one will quickly perceive a number of great arteries standing out clearly. These constitute the nuclei, as it were, of the great companies, and they are connected together by a network of other lines mostly slender, and with meshes which are larger or smaller according to the nature of the districts they cover. If the creation of the lines had been left entirely to the initiative of the companies, it is certain that the principal arteries would long have remained the only routes opened up, while their ramifications would have been constructed but slowly. It was the influence of the agreements which enabled the less productive lines to be opened and operated.

From the financial point of view the most important result of the agreements has been the consolidation of the companies' credit. In some instances it has made it possible for them to borrow at lower rates than the State itself could have done. But as the increase of their capital made their indebtedness more burdensome, and on the other hand the operation of new lines caused a deficit, they were obliged to call on the guarantee of interest for sums which before the conventions of 1883 amounted to 545,000,000 francs, and between 1883 and 1903 rose to 951,000,000 francs.

It must be borne in mind, however, that although the sums asked for under the guarantee appear each year among the outgoings of the budget, they are in fact loans bearing interest at 40 per cent. and secured by a valuable working stock; that is to say, they are really very good investments for the State.

Another outcome of the agreements has been that the State has had to liquidate part of its debt. The companies having advanced some of the funds for initial outlay, the State pays them back with annuities of which the sum total is usually much larger than that of the guarantee—evidently an excellent operation for the State.

Moreover, to get an exact idea of the influence of the companies on the budget, one must offset the outgoings with the receipts and savings secured to the treasury by them, which the administration reckoned as follows for 1904:

EXPENDITURE.

Interest on capital borrowed directly	129 millions
Annuities to companies, capital supplied by them	92 millions
Guarantee of interest	27 millions
Costs of control	5 millions
Total	253 millions

RECEIPTS AND SAVINGS.

Repayment of guarantee loans	5 millions
Costs of control	5 millions
Taxes on transportation	108 millions
Shares and bonds	57 millions
Savings for the public service	95 millions
Total	270 millions

These figures leave out of count the guarantee of interest for lines "of local interest."

Thus the account would be found to give a balance of 17,000,000 francs in favor of the State.

The financial position of the companies has distinctly improved of recent years; three of them have entered the stage of repayment, and one, the Northern Company, has never had recourse to State subsidies. If events follow a normal course, one may legitimately expect this improvement to go on increasing progressively, and one may look forward to a time when most of the companies will be free of all indebtedness toward the State.

A glance at the manner in which they discharge their task will show that their «coefficient of operation» is lower than that in any other country, and that on most points they will bear comparison favorably with the best foreign companies. In particular, French engines have been the subject of the most flattering criticisms both in England and in America.

In these circumstances what motives could be strong enough to induce the State to involve itself in the task of repurchase? It is evident from the parliamentary history of French railways that the question has nearly always been regarded from a point of view quite foreign to economics and financial questions. And this seems to be the case to-day.

In reality, State operation of the railways finds few supporters among competent men, and the example of countries adjoining France, where the railways are nationalized, is by no means conclusive. In these very countries indeed the French system has more than once been quoted as a happy union of public powers and private initiative. Consult particularly 'La politique francaise des Chemins de fer,' by R. von Kaufmann.

The highest authorities have always been of opinion that repurchase in existing conditions would be a disturbing operation for the public finances; whereas by the mere action of the agreements the State must necessarily, in the middle of the century, come into possession of a completely developed and liquidated system, and that without opening its purse. It might then dispose as it pleased of the net income of the railways which already amounts to more than 700,000,000 francs, and ought by that time, it has been calculated, to be more than 1,000,000,000 francs. Such will be the final outcome of the agreements, if they succeed in weathering the violent attacks which are once more being made on them.

Statistics.—The development of the lines and the paid-up capital by decades was as follows:

Years.	Length of the lines in operation up to 31 December.	Corresponding Capital of Initial Outlay.
	In kilometers.	In mill. francs.
1830	38	6½
1840	435	146
1850	3,010	1,363
1860	9,439	4,726
1870	17 440	8 168
1880	23,738	11,065
1890	33 550	14 271
1900	38,122	16,442
1904	39,200	17,442

The division among the several companies in 1904 was as follows:

Company.	Average length in operation during the year.	Capital Enlisted: Expended by the Companies.	Capital Enlisted: Subsidies.	Shares and Bonds issued by the Companies: Shares.	Shares and Bonds issued by the Companies: Bonds.
	Kilometers.	Millions	Millions		
Nord	3,765	1,711	100	525	4,425
Est	4,857	1,577	671	584	5,447
Ouest	5,829	1,785	793	300	5,750
Orléans	7,384	1,976	861	600	6,264
P. L. M.	9,283	4,024	1,009	800	13,024
Midi	3,764	1,090	552	250	3,820
Ceintures	173	93	26		
Petits Réseaux	1,392	835		215	567
Etat	2,916	843			
Total	39,200	17,442		3,274	39,298

RECEIPTS, EXPENDITURES AND NET PROFITS.

Years.	Gross receipts with tax taken off.	Working expenses.	Net profit.	Coefficient of operation.	Rates of remuneration on the capital.
	Millions.	Millions.	Millions.	Per cent.	Per cent.
1841	13	8.3	4.7	64	
1850	96	45	51	47	3.75
1860	418	188	230	45	4.87
1870	634	313	321	48	3.95
1880	1,061	538	523	50	4.75
1890	1,154	607	548	51	3.85
1900	1,517	824	693	54	4.10
1904	1,515	787	728	52	4.20

The division for 1904 among the different companies was as follows:

Company.	Gross receipts with tax taken off.	Working expenses.	Net profit.	Coefficient of operation.	Rates of remuneration on the capital.
	Millions	Millions	Millions	Per cent.	Per cent.
Nord	239	128	111	53½	6.19
Est	192	108	84	56¼	3.73
Ouest	192	108	84	56¼	3.26
Orléans	236	111	125	47	4.4
P. L. M.	459	217	242	47¼	4.80
Midi	116	54	62	46½	3.75
Ceintures	16	15	1	94	0.84
Etat	52	38	14	73	1.66
Petits Réseaux	13	8	5	61½	0.6

In these two tables the coeffcent of operation is the relation of working expenses to gross profit. The rate of remuneration on capital has been determined by comparing the net profits with the capital of establishment. The liquidation charges on the capital are not taken into account.

Traffic.—The progressive development of traffic and lowering of rates from 1841 to 1904 was as follows:

Years.	Total distance covered: Passengers.	Total distance covered: Freight.	Mean tariff per kilometer: Passengers.	Mean tariff per kilometer: Freight.	Mean receipts per kilometer.
	Millions of k. passrs.	Millions of Kilometric tons.	Centimes.	Centimes.	Francs.
1841	112	38	7.00	12	26,000
1850	797	462	6.66	7.7	32,700
1860	2,921	3,120	5.64	6.92	45,600
1870	4,272	5,057	4.95	6.14	40,800
1880	5,863	10,350	5.04	5.95	46,000
1890	7,943	11,759	4.40	5.46	35,000
1900	14,063	16,557	3.67	4.69	39,800
1904	13,699	16,551	3.70	4.60	38,600

Division among the companies of the traffic for 1903 was as follows:

Company	Total distance covered.		Mean tariff per kilometer.		Mean receipts per kilo-meter.
	Passengers.	Freight.	Passengers.	Freight.	
	Millions of k. passrs.	Millions of Kilometric tons.	Centimes.	Centimes.	Francs.
Nord.....	1,998	3,401	3.83	3.86	63 671
Est......	1,804	2,276	3.40	4.40	38,917
Ouest....	2,180	1,325	3.60	5.45	32,792
Orléans...	1,988	2,402	3.66	5.01	32,171
P. L. M...	3,480	5,298	4.09	4.57	49,292
Midi.....	1,024	1,221	3.56	5.09	31,381
Ceintures.	216	113	3	7.38	30,000
Etat.....	556	466	3.13	5.14	17,654
Petits Réseaux..	87	82	4.03	8.68	5,651
Total....	13,335	16,585	3.70	4.63	38,489

The number of kilometric passengers or tons, is the sum of kilometers covered by each passenger or by each ton of freight.

M. de Saint Amand,
Engineer to the Chemin de Fer du Nord.

17. **France—French Industries.** In order to study French industries methodically we shall divide them into four classes: (1) Great Industries; (2) Small Industries; (3) Domestic Industries; (4) Agricultural Industries.

1. *Great Industries.*—In the first rank of great industries stand the textile industries, which really include cotton, wool, lame, flax, hemp, and jute, and also a certain number of secondary industries, each one of which consists of two principal branches—spinning and weaving. To avoid mistakes we shall examine them separately.

(1) The cotton industry consists of spinning-mills containing 6,150,000 spindles and 108,000 power looms. Spinning-mills are confined to three centres: Normandy, where they are in the vicinity of Rouen; Nord, where the centres of Lille and Roubaix stand out prominently; and Vosges, including the department of the same name; Meurthe-et-Moselle and the Territoire de Belfort. Weaving, on the other hand, is much more extended, and can be divided according to specialties into 16 districts: (1) Amiens, ribbed velvets; (2) Condé sur Noireau, striped cotton; (3) La Ferté Macé, coutils of various designs; (4) Flers in Orne, stripes and oxfords; (5) Evreux, corsets and bed linen; (6) Haute-Saône, striped weaves; (7) Mayenne, specially for what is called Laval; (8) le Nord, flannels, bedquilts and sateenes; (9) Normandy, shirtings and long-cloth; (10) Paris, napkins and Turkish toweling; (11) Roanne, blue cotton goods; (12) Tarare, muslins and hand embroideries: (13) Thizy, cretonnes and peruviennes; (14) Saint-Quentin, mousselines and gauzes for furnishing; (15) Vosges, cotton-cloth and satinet; and (16) Troyes, cotton hosiery.

(2) The wool industry uses 1,600 heckling-machines of different styles, 2,000,000 spindles in combing mills, 390,000 spindles in the spinning mills of carding, and 55,000 power-looms. A certain number of these looms are used by turns for cotton and for wool. The wool-carding mills are most important and form a separate industry. They are situated in Roubaix and in Reims, and the shoddy-mills are in Elbeuf and Vienne. The representative spinning-mills are at Roubaix, Fourmies, Reims, Vienne and Belfort. As for weaving mills, they have 15 different centres: (1) Amiens, noted for serges called du Barry; (2) Saint-Quentin and Bohain cashmeres and light novelties; (3) Beauvais, tapestries; (4) Tours, blankets; (5) Elbeuf, cloth; (6) Fourmies, colored and mixed weaves; (7) Lisieux, printcloth; (8) Louviers, novelty goods; (9) Mazamet, curried fustians and military cloth; (10) Paris, double-milled goods and sateenes for uniforms; (11) Reims, merinos; (12) Roubaix and Tourcoing, novelties for dresses; (13) Sedan, cloth for clothing; (14) Vienne, novelties for ready-made suits; (15) Vosges, articles for footwear. The wool industry of France is considered the most important in the world.

(3) The silk industry consists of 13,000 bassines for separating the threads from the cocoons, 35,000 power-looms for weaving, and 35,000 hand-looms. The silk mills are situated in Cevennes and Gard; silk is made both by machine and by hand in Rhône and the neighboring departments, and the principal centre for selling it is at Lyons; for ribbons the chief centre is Saint Etienne; and for galoons, laces for shoes, etc., and braids, Saint Chamond and Izieux. A new industry—artificial silk—was first made in 1889 by Chardonnet, its chief centre being Besançon.

(4) Flax and hemp, together with jute, contain—in all their factories—500,000 spindles; and in weaving, 22,000 power-looms and 20,000 hand-looms. The flax-mills are chiefly situated in Nord; the manufacture of thread called «sec» (dry) is in many respects like that called «mouille» (wet). Sewing thread of flax is also made in the same section of the country. As for woven goods, strictly speaking, their manufacture is divided into a certain number of groups, that can be classed as follows: (1) the factories of the Nord, the chief centres of which are Armentieres, Lille, and Bailleul, where smooth goods, colored or white, are made in every width; Dunkerque, Beauval and Flixecourt manufacture jute goods, and several places in Somme awnings and damask; (2) Normandy is celebrated for shirtings, pillow-cases and table covers; (3) Brittany and Anjou for handkerchiefs, canvas, etc.; (4) Vosges for table and bedroom linen; (5) South for coarse cloth. We may add that in all these sections «ramie» silk is manufactured.

It is estimated that the textile industries, properly speaking, employ 825,383 workmen in France, furnishing occupation to 1,053,588 workers on suits and other garments. They also feed as many cotton as silk mills. 2,076 tulle looms are working in Caudry, Calais, Saint Pierre and Lyons. This is the official account of the hosiery business in flax and in wool in Somme, Nord, and Vosges; in cotton in Roanne and Troyes; and in silk in Hérault, Gard and Hautes-Pyrenées. Hand-made lace forms one of the most artistic industries of Puy, Bailleul, Bayeux, Mirecourt, etc. Besides these there are innumerable embroidery factories in successful operation in Saint Quentin, Angers, Tarare, and Nancy, and of passementeries in Lyons, Nimes, and Paris.

(5) After the textiles, the industry which employs the most men in France is the mining of coal. The coal mines are divided geographically into five districts: (1) the coal mines of the North, covering a surface area of about 109,000 hectares, distributed in the departments of Nord and Pas de Calais, in about 40 grants, the chief of which are those of Anzin, Vicoigne, Noeux, Bethune, Lens, Aniche, Marly, etc.; (2) the coal mines of the East, principally near the Moselle, to which are joined the mountainous branches in Savoie where anthracite coal is found; (3) the coal mines of the Oise, which include the basins of Basse-Loire, Vendée, etc.; (4) the coal mines of the centre, the most important after those of the North, which include the basins of Saône et Loire (Autun, Creuzot, Blanzy, Montceaux, Montchanin 875 hectares); those of Allier and Auvergne (Ahun 2,200 hectares; Commentry, 2,480, etc.); those of Loire (Saint Etienne, Saint Chamond, Rive de Gier, Firminy), with a surface area of 25,000 hectares; those of Savoie and Loire, 42,972 hectares; of Nievre, 8,000 hectares; of Allier, 7,367 hectares; of Correze, 5,432, etc.; (5) the coal mines of the South, situated near Lot, Hérault, Gard, which contains several basins, two of which are exceedingly important—that of Aveyron, 12,000 hectares, and Gard, 26,888 (Grand Combe, Besseges, Alais, etc.). Besides these, there are in Hérault the small basins of Neffiez, Ronjan, Graissessac (8,800 hectares), and Bousquet d'Orb (15,129 hectares), and in Tarn, the basins of Carmeaux (8,800 hectares). To coal mining there is always attached the secondary industry, the manufacture of coke and agglomerates.

The great mineral industries of France are naturally near the coal deposits. The only way they can be divided geographically is under the same divisions as the coal mines. But the chief centres can be especially noticed as follows: in Besseges (in Gard) where there are iron mines, are blast-furnaces, foundries, machine-shops, turning-plate factories, smelting works, etc.; Commentry-Fourchambault has blast-furnaces, forges, foundries, wire-mills; there are machine-shops for the manufacture of steel at Montlucon and at several points where these manufactures are exported, extending through Cher, Allier and the Nievre; at Creusot there is one of the most important metallurgic establishments in the world, which is situated in the centre of France. Henrichement is joined to the railway of Bourgogne and Bourbonnais and connected with the canal du Centre by a private railroad. Decazeville is the most important metallurgic centre in the South; here are made rails, various iron merchandise, cast-iron pipes for conduits, boilers, etc.

There are factories in Fives-Lille (Nord) and Givors (Rhone), chiefly making machinery used in the manufacture of silk and plush, steam-engines, locomotives, materials for constructing railroads, pig-iron, and heavy metal work, etc. Indre, in the department of the Loire, makes a specialty of marine constructions, torpedoes, large pieces of cast-iron boilers, etc. In Maubeuge (Nord) are the most important metal works; and there are others in Longwy (Meurthe-et-Moselle), both near Belgium; and in Montataire, which contains other factories besides the one of that name; then comes Creil, celebrated for its parquet flooring, and the remelting of old iron, extensively used in the manufacture of tin; and then again the factories of Frouard, near Nancy, Bagugson in Meuse, and Outreau (near Boulogne sur Mer); Rive de Gier is an important centre for foundries, the manufacture of steel, steam-engines, wheels, and materials for building railroads; Saint Chamond, especially is celebrated for the rolling of iron and steel; and lastly comes Terrenoire, where the pig-iron of Ardeche is made into iron.

The glass industry is brilliantly represented in France. Besides the manufacture of bottles carried on in the glass works of Blanzy, Rive de Giers, Givors, Saint Galmier, Vauxhot, Reims, Epernay, Fourmies, Valenciennes, and some localities in the Jura, mention may be made of the celebrated factories for making plate glass in Aniche (Nord), Chauny and Saint Gobain (Aisne), and those for making cut glass in Baccarat (Meurthe-et-Moselle), where the industry has reached great artistic excellence, in consequence of which a considerable amount is exported.

Mention should also be made of the chemical works for the manufacture of sulphuric acid and soda. These have warranted the erection of quite large buildings; for instance, the chemical works in the North, the works in Saint Gobain Malétra, etc. At all these places there are mineral deposits. Other industries of a chemical character can be included in this group, like that of coloring matter, the most representative of which are Saint-Denis and Rhone; fecula and amidine works, which are all in Nord; white lead, made in Nord and in the vicinity of Paris; tallow candles, chiefly made in the departments of the Seine, Rhone, Hérault, and Bouches du Rhone; dyeworks, always located near textile factories.

Ceramics are among the great industries of France. The manufacture of porcelain is especially centred in Limoges; square tiles in Maubeuge, faïence in Choisy le Roy, Gien, etc. In this group can be classed the manufacture of cements in Boulogne sur Mer, and in the outskirts of Grenoble; and the mining of asphaltum principally found in Savoie.

We can also count among the great industries of France the manufacture of machine-made boots and shoes in Blois, Fougeres, etc.; writing pens and pencils in Boulogne sur Mer; clocks in Besançon; marble-cutting in Cousolre; cutlery in Chatellerault; perfumery in Paris and in Grasse; gloves in Grenoble and its environs; soap in Marseilles and in the North; hats in Lunéville, Paris, etc.; the picture trade in Tours, Epinal, and Paris; the most celebrated manufactures of automobiles in the suburbs of Paris, etc. Certain specialties, such as stalls, on some of which the French have a monopoly, are made in large quantities, and there are a great many tobacco and match factories. Arms are manufactured in Saint Etienne, cannons in Bourges, and tapestries (Goblins) in Paris.

II. *Small Industries.*—The principal small industries for which the French are especially noted—on account of the taste they have shown for this kind of manufacture—are «Articles de Paris,» so called because manufactured in that city or its suburbs. They can be divided into 13 groups: (1) the toy trade—dolls, dressed and undressed, mechanical toys, various games, all kinds of playthings, heads for modistes, cotillon favors, masks, etc.; (2) the manufacture of buttons in horn, bone, vegetable-ivory, papier verni, hardwood, etc.; (3) pasteboard articles, such as bonbon boxes, and all decorative pasteboard articles; (4) false hair and hair work, the demand for which has greatly increased owing the present style of coiffure worn by women, which requires much false hair; (5) fans, certain kinds of which are manufactured in the vicinity of Beauvais; (6) artificial flowers, many of which are exported; (7) the sheath trade, which includes the manufacture of knife boxes, cases for spoon, fork and knife, cases for surgical instruments, pipes, cigars, opera glasses, cases of white manna-ash, and especially jewelry cases; (8) the manufacture of workboxes, which includes certain small articles used by children as playthings; (9) umbrellas, parasols, and horsewhips; (10) combs in horn, buffalo-horn, real and imitation tortoise shell with hinges, gilt backs, carved, inlaid, etc.; (11) feathers, which are chiefly worn on women's hats; (12) portfolios and morocco leather work, which is an industry distinct from sheath-making; (13) fancy articles, such as billiard balls, crucifixes and other religious objects, in ivory or in wood, mountings for canes, lunettes, opera glasses, lorgnettes, knife-handles, games of dominoes, toilet articles, and articles used by smokers, etc.

Let us mention, as essentially French, the industries that owe their existence to fashion, in which Paris reigns supreme, the term «Mode de Paris» being used in many foreign countries to make their productions sell. It is especially the workwoman herself who invents, modifies, improves, and, trying the effect on herself, chooses the best and calls it a new mode. In this industry, ratan, wire, and whalebone are used for forming and supporting hat frames, and these are made in the ordinary factories; the modistes, strictly speaking, select and arrange the materials, flowers, feathers, and laces.

The goldsmith's trade also takes a high rank in France, especially in Paris, not only on account of the large goldsmith shops that make only large pieces—all silverware used to ornament the table and buffets—but also the small goldsmith's shops that make a specialty of knives and forks for fish, mugs, sauce-pans, knives and various kinds of utensils, and also religious goldsmith work, such as brass and pewter plates. To this industry can be added that of argentry, for which certain Parisian firms have acquired quite a reputation.

III. *Domestic Industries.*—Although domestic industries are very prominent in France, it is difficult to locate them, because in so many places they are annexed to the great industries. For example, in the textile industries, a certain number of localities, such as the environs of Lille and the manufacturing town of Cambrai, flax-linen has its home; the workmen use all their skill to get suitable thread from their employers, and then, after weighing it, they take it home; so also in Saint Etienne, the manufacture of silk ribbon is made in great part in the homes of the workmen, whose looms work by electricity controlled from a central factory from which the power is distributed; the same is the case in the entire lingerie industry, concentrated in Saint Omer and in Vosges, the work being taken home under the direction of forewomen and contractors, as is almost all the lace manufactured in Bailleul, le Puy, and other localities; and much of the labor of the 1,000 mouselenne de coton factories in Tarare. The large stores where ready-made clothing is sold have in their employ many men and women who do the work at home. In the small industries, as well as in the large, part of the work can be done in the homes of the workmen. For instance, all varieties of «Articles de Paris» are usually made away from the factories.

Besides these branches of the chief centres, there are other industries that may be considered as family industries in the sense that the manufacturer needs only one, two, or three workmen at most on each article, like real or imitation jewelry, the manufacture of effervescents, pharmaceutical specialties — many of which are exported; dyeing and scouring, etc., and numerous others.

IV. *Agricultural Industries.*—The most important of French agricultural industries is the manufacture of wines, for which France has a world-wide reputation. The departments of Gironde, Cote d'Or, Marne, Drome, Savoie, and Loire yield the most noted vintages, as well as the most abundant, but fine grapes are also grown in the departments of Hérault, Gard, Aude, Gers, Pyrenées-Occidentales, Charente, etc. They can, broadly speaking, be divided into three great classes; Bordeaux, Bourgogne and Beaujolais. Especially noteworthy are the Normandy wines, and the matchless champagne. Next in importance after wines come distilled liquors. There are two kinds of brandy, betterave (beet), manufactured only in the North and consumed there, and wine brandy exported all over tne world—a sufficient guarantee of its worth. This last can be divided into three varieties: (1) cognac brandies, which are called (after the places where they are made), Fine Champagne, Borderies, Bois ordinaires, and Deuxiemes Bois; (2) Armagnac brandies, which are known by the names of Bas-Armagnac, Ténareze, and Haute-Armagnac; (3) Montpellier brandies. The first are made exclusively in the departments of Charente and Charente-Superieur; the second in Gers, Landes, Lot et Garonne; and (3) in Hérault. Besides the above mentioned kinds, in all these wine districts Mare brandy is made with the help of the Mare of the vintage, and in the department of Indre another brand of local brandies, which goes by the name of Calvados, has gained a certain reputation.

Next in importance to brandies is beer. This is not exported, but a greater quantity has been brewed in the last few years. A great many departments in France situated near the frontier have brewed beer after the German fashion so successfully that its general consumption has exceeded that of Munich and Vienna.

The manufacture of granulated sugar is one of the great agricultural industries of France. This gives rise to three different industries: (1) the cultivation of beets for the sugar contained in them, with nurseries for the scientific cultivation of seeds which are exchanged between France and Germany. These extend over the millions of hectares in the North. (2) The manufacture of beet sugar in Nord, Aisne, Somme, and many northern departments that have refineries annexed. (3) The refineries of colonial sugar, which is imported and made into sugar in the ports.

Besides these great manufactures, that form the base of French agricultural industries, we might mention a great many more that are developing rapidly: as the preparation of chickory in Nord, successfully used with coffe; the digging of peat in Somme, used instead of coal; the manufacture of olive-oil in all the southern departments; that of wax and honey which has been greatly extended in the eastern portion of France; butter, which has necessitated the erection of large factories in the district of Avesnes (Nord); the manufacture of biscuits at Marseilles, Nantes, Bordeaux and Suresnes, etc.; chocolate manufacture; glue manufacture, etc.

The manufacture of agricultural machines is an important industry, and notwithstanding the competition of American machines, the making of heavy implements like threshing-machines is carried on on a large scale, especially in Liancourt, Fumay, Vierzon, Dourdan, and Algeria.

Alfred Renouard,
Editor of "l'Industrie Textile."

18. France — Commercial and Banking System. The history of French commerce and industry, like the history of France itself, naturally falls under two heads: the old *régime* and modern times.

Previous to modern times, the development of French industry was limited by the guild-system on the one hand, and on the other by the numerous obstacles, inherited from feudal times, which lay in the way of exchanges from one province to another. Many of those obstacles were still in existence on the eve of the Revolution. However, a progressive element was to be found, ever since Colbert's days, in the royal manufactures. They did not belong to the king, but were protected against the guilds' monopolies by privileges conferred by the crown. We may mention among them the tapestry manufactures of the Gobelins and of Beauvaris and the porcelain factories of Sèvres. The private factories of Aubusson (tapestry); Rouen, Marseilles, Lunéville (earthenware); Lyons (silk), and the glassworks in the Dosges — where glassworkers were long styled *gentilshommes verriers* — also deserve notice.

Foreign commerce was effected principally through the French ports; Marseilles, where the tradition of commercial navigation is as old as the town itself; Dieppe, the birthplace of the famous Angot, and the harbors of the Atlantic, which sent out ships to the New World; the old French colonies in the West Indies; Louisiana, Canada, and the Indian Ocean are witnesses to their activity. The establishment of the *Compagnie des Indies* (1664), shows us the metropolis taking an interest — unfortunately one too weak and too fugitive — in commercial matters. The reader may also be reminded that the commerce between England and France which, if circumstances had been different, might have developed under the treaty of 1786, was at stake throughout the long duel fought by the First Consul and the Emperor against the English people.

The home commerce was necessarily purely local; the means of communication being strictly limited to the rivers, the few canals, and fewer good roads; the towns were compelled to be self-supporting, and the country people had to depend, both for their food and their clothes, on the produce of their labor and on the housewives' industry.

Before the middle of the 19th century the new canal and road systems and the railway and telegraph lines had given an incalculable power to the latent forces of the country, bringing about a complete transformation of industry and commerce. We may here notice that the impulsion thus given to commerce and industry never equaled in France that which made itself felt in England and in America about the same time.

Among the principal characteristics of the commercial revival of the 19th century, we must mention the specialization of goods, the indefinite extension of the fields open to manufactures, a considerable increase in the cash balances and clearing-house statistics, an ever-growing demand for capital and its tendency to concentration and association. Henceforth we see, more and more frequently, societies taking the place of individuals, and joint-stock companies substituting themselves to the ordinary copartnerships (those among the latter which have sleeping partners bear the name of *sociétés en commandite*). The coöperation just mentioned was in France as elsewhere of more frequent occurrence among manufacturers than among tradespeople, and there exists in France in the towns and in the villages a large class of small retailers which ha e the political strength to destroy any great combination that might attempt to drive it out of the market.

As early as the beginning of the modern period, the government had encouraged industry and commerce and given them the institutions they wanted. The *Code de commerce* was issued in 1807. In order to entrust its application to fully competent magistrates the French produced a unique and admirable system of *commercial courts*. The judges of these are returned by an electoral body exclusively composed of those subject to their jurisdiction. Jurisdiction of *Prud'hommes* was organized on the same lines, finally the Chambers of Commerce, to be elected very much in the same way as the courts, were instituted (1803), their functions being to look after the general interests of trade, to advise the public powers when requested, and to lay before them the desiderata of the trading classes. Important rights were conferred upon these Chambers of Commerce, including that of raising certain taxes. One of the most useful works undertaken by the Chambers of Commerce has been their contribution to the organization of commercial education in France. So far that education was practically nonexistent; at the present time it is still comparatively little spread. It is only given in special schools where pupils are admitted after completing their general education.

The interference of the government makes itself felt in another way, more prejudicial than favorable to the expansion of trade, namely by the manifold regulations which are constantly claimed by the working class. The government also has to regulate the system of customs which is largely based on the principle of protection, in France as elsewhere favorable to some producers and a source of grave difficulties to others.

It is practically impossible to give a numerical estimate of the amount of business transacted in France. Mr. Maurice Block put it at 1.000f. ($200) per inhabitant in 1875. It would certainly be more now, even without including the business carried on at the Stock Exchange; to give an example of the latter it was estimated in 1888 by Mr. Neymarck that the stocks negotiated on the Paris Exchange alone reached a yearly total of from 30 to 35.000.000.000f.

As to importation and exportation, the following statistics will give an idea of the commercial movement in France. We first extract a few figures from the tables drawn under Louis XVI. by Arnould, *chef du bureau de la balance du commerce*.

Exportation from France to Holland.

	Exportation from France to Holland.
1658	72.000,000 f.
1716	31,000.000
1787	46,000,000

	Import from England into France.	Export from France into England.	Total.
1686	18,000,000 f.	23,300,000 f.	41,300,000 f.
1716	13,900,000	8,000,000	21,900,000
1787	58,600,000	37,600,000	96,200,000

We may add that the total importation of France in 1787 seems to have reached from 400 to 500,000,000f. as against somewhat less than 100,000,000 in 1716, and the total exportation at the same date from 50 to 500,000,000f. as against a little over 100,000,000f. in 1716. The imperial policy considerably reduced our exchanges with foreign countries, especially with England, with the effect that even under the ultra-protectionist government of the Restoration the figures representing our imports and exports hardly equaled those reached during the last years of the old *régime*.

In the following columns we give the yearly average reached by the *commerce général* and the *commerce spécial* respectively during the five ten-years' periods from 1827 to 1876. (The *commerce général* includes all imports and exports of any sort, coins excluded; the *commerce spécial* only includes among imports foreign goods meant to be consumed in France, and among exports goods wholly or partly manufactured in France and sent to foreign countries. The sums given represent millions of francs.)

	Commerce général.		Commerce spécial.	
	Import.	Export.	Import.	Export.
1827-1836	667	698	480	521
1837-1846	1,088	1,024	776	713
1847-1856	1,503	1,672	1,077	1,224
1857-1866	2,987	3,203	2,200	2,430
1867-1876	4,262	4,202	3,408	3,307
1877	4,570	4,371	3,670	3,436
1878	5,089	4,112	4,176	3,180
1879	5,579	4,270	4,595	3,231
1880	6,113	4,612	5,033	3,468
1881	5,996	4,724	4,863	3,561
1882	5,962	4,764	4,822	3,574
1883	5,887	4,562	4,804	3,452
1884	5,239	4,218	4,343	3,232
1885	4,930	3,956	4,088	3,088
1886	5,117	4,246	4,208	3,249
1887	4,943	4,238	4,026	3,246
1888	5,187	4,298	4,107	3,247
1889	5,320	4,803	4,317	3,704
1890	5,452	4,840	4,437	3,753
1891	5,938	4,730	4,768	3,570
1892	5,136	4,551	4,188	3,461
1893	4,951	4,326	3,854	3,236
1894	4,795	4,125	3,850	3,078
1895	4,920	4,589	3,720	3,374
1896	4,929	4,593	3,799	3,401
1897	5,137	4,803	4,000	3,676
1898	5,583	4,673	4,472	3,511
1899	5,848	5,533	4,518	4,153
1900	3,989	5,522	4,698	4,109
1901	5,606	5,220	4,369	4,013
1902	5,699	5,507	4,394	4,252
1903	6,079	5,577	4,801	4,252
1904	4,072	3,985	4,536	4,475

(The figures for 1904 are only provisional.)

The revival of the French commerce and industry after the Revolution and in the course of the 19th century was bound to have its effect on the working of the banks which, being the organs of the public credit, are the natural auxiliaries of exchange. The financial system of the state has also been subjected to a complete reorganization; public works of all kinds, military expenses, etc., have brought about a considerable demand for capital; all the financial markets have come to share in the greater operations of credit and an ever closer solidarity has been established between the various financial markets themselves. The function of bankers, formerly mere money-lenders to the sovereigns, has thus evolved, being placed by circumstances on a broader basis. Hence it is true to say that, although some banking firms can proudly trace their origin several centuries back, the constitution of the banking system in France was the work of the 19th century.

The French banks are divided as follows: (1) The two official institutions, viz., the Banque de France and the Crédit Foncier; (2) the so-called "Haute Banque" and some credit societies of the same kind; (3) the other credit establishments; (4) the discounting banks. We must point out at once that, from a legal and fiscal point of view, the name of *banquiers* is officially given to financiers whose function is, in fact, that of brokers and who are designated in professional slang by the name of *coulissiers* (as though operating behind the scenes, *dans la coulisse*). The latter name was given to them at a time when they could only practice their business by tolerance, being theoretically excluded from the market by the stockbrokers' privilege.

1. The Banque de France was founded in 1799 by the First Consul and finally organized

by him, as Emperor, in 1806. Its constitution was inspired by that of the Bank of England, but not made similar to it; it belongs to the system which, with some variants, now prevails in most European countries, and is entirely different from that of the United States. The Banque de France has, to begin with, an official function, viz., the issue of bank notes, which it owes to a privilege conferred upon it by law as early as 1803 and renewed ever since (for the last time in 1897). The bank notes are balanced in metal, the sum total in gold and silver being now about 4,000,000,000f. (2,925,000,000 in gold and about 1,060,000,000 in silver); and in bills, the amount which they represent varying from 5 to about 850,000,000f. The limit of the circulation of bank notes, fixed at 4,800,000,000f. in 1897 was raised by a recent law (Feb. 1906) to 5,800,000,000f. They are recognized as legal currency. An invaluable reserve is thus secured which could easily be disposed of in a crisis — as for instance in case of war, by enforcing the currency of bank notes.

The Banque de France has, on the other hand, a commercial function, consisting in the discounting of commercial bills on condition that they bear three signatures, represent a minimum value of 5f. and can produce a minimum interest of 0f., 10c. The rate at which the commercial bills are discounted varies according to the circumstances of the money and financial markets, but the right enjoyed by the Banque de France to reimburse its notes in silver enables it to keep that rate considerably more even than is the case in countries in which gold is the only recognized standard.

The capital of the Banque de France, originally 30,000,000f., has been raised successively to 45, later on to 90, and finally to 182,500,000f. (9 June 1857), in 182,500 shares of 1,000f. each. They are worth today about 3,900f. The banque is administered by a committee of 15 régents, five of whom are to belong to the commercial or manufacturing class and three are to be taken among the *trésoriers payeurs généraux* (the representatives of the French Exchequer in the various *départements*). It has a governor and two subgovernors appointed by the government. The banque has a total of 445 branches in the country.

The following statistics will give an idea of the rate at which bills have been discounted at the banque during the last 50 years:

	MAXIMUM RATE.	MINIMUM RATE.	AVERAGE RATE.
	%	%	%
1854	5	4	4.30
1864	8	4½	6.50
1874	5	4	4.30
1884	3	3	3
1894	2½	2½	2.50
1904	3	3	3

The Crédit Foncier, the governor of which is also appointed by the government, has an organization very similar to that of the Banque de France. Its special function consists in granting first mortgage loans to persons, villages, towns, and *départements*. The Crédit Foncier appeals to the public for the funds necessary to its operations by issuing bonds called *obligations foncieres* or *communales*. It has a capital of 200,000,000f.

2. The firms which compose the *Haute Banque* are often older than the Banque de France itself. We find them at the origin of all great modern enterprises: their heads were the founders of the Banque de France and of the great railway and insurance companies and their successors still have seats in the councils of both. The government rewarded their efforts at the time by creating among them the *barons de la finance*. Most of them have kept up the tradition and occupy an important place in the management of the financial market. The loans and other greater financial operations which they used to claim as their own are now partly in the hands of the financial societies which differ from the credit establishments in the receiving of money deposits; the discounting of bills is but a secondary part of their functions.

3. The discounting banks are organized on the three signature principle and work in connection with the Banque de France. The majority of tradesmen use them and they in their turn apply to the banque where they get their bills discounted. They are of varied importance. Their number, which used to be very great in the provinces, tends to decrease owing to the constant development of the credit establishments.

There are three great establishments of that kind in France, viz.: the Crédit Lyonnais, the Société Générale and the Comptoir National d'Escompte de Paris, which all date from the middle of the 19th century. They occupy an intermediate position between the English joint-stock banks and the greater German societies. The credit establishments appeal to the public for funds, which they keep as deposits, they have created among a large part of the population the habit of having their money deposited in banks, and the parallel habit for bankers of relying for their operations upon the public's deposits as much as, if not more than, upon their own capitals. The credit establishments, like the joint-stock banks, use the greater part of their deposits for discounting purposes, they also devote a certain amount of them to investments and even to loans, although their extreme parsimony in granting the latter somewhat justifies the saying that in France "the credit establishments give no credit." At all events they never subscribe to an issue of commercial or industrial shares except in a very cautious manner and they are no more anxious to make issues of capital themselves than to invest in the ventures of others.

To complete the description of the organs of credit in France we have still to mention: (1) the popular and coöperative banks, as yet but little developed; (2) the land and estate banks (*banques foncières*), the operations of which are carried on in connection with those of the Crédit Foncier; (3) the postal transactions; (4) the savings banks; (5) the land credit establishments, recently created, whose action is still uncertain; (6) the *magasins généraux* where goods can be warranted; and last but not least the colonial banks, which are constituted under special laws and have a half-official existence. The two more important ones are the Banque de l'Algérie and the Banque de l'Indo-Chine.

The French banks are but scantily represented outside of France; there are only a few branches of the credit establishments in England, Belgium, Switzerland, Spain, and in Constantinople. Inversely each year sees the establishment in Paris of new branches of the foreign banks, a consequence of the plenty of capital which has made the French maket in our time the money-lender to the whole world.

It is impossible to give an estimate of the banking operations carried on in France. By the side of the joint-stock-companies whose statistics are made known to the public there exists a large number of private firms whose joint capital certainly exceeds that of the said companies and whose balance-sheets, statistics and other results remain unknown. There is, it is true, a clearing-house *(chambre de compensation)* in Paris, but it is only composed of a dozen members (they were 12 including the representative of the Banque de France, until April 1906, when their number was raised to 13), and the amount of business settled there is far from representing even the totality of operations transacted in Paris alone. We can, however, subjoin the following statistics, while warning the reader that under the conditions of secrecy prevalent in French private banking the returns are given below the full total. They are taken from the tables of the "Chambre de Compensation" from August 1905 to July 1906.

August	1,307,980,105.34 f.
September	1,341,564,109.98
October	1,603,870,535.92
November	1,683,615,955.76
December	1,614,230,136.30
January	1,903,637,453.28
February	1,601,753,330.76
March	1,529,573,040.80
April	2,047,658,568.36
May	2,096,259,438.48
June	1,820,128,657.44
July	2,115,685,423.50
	20,665,956,765.02 f.

The average per day during the same months was given as follows:

August	52,319,204.21 f.
September	51,598,619.61
October	61,687,328.34
November	67,344,638.23
December	64,509,205.45
January	73,216,825.12
February	66,739,722.49
March	56,650,853.36
April	85,319,107.01
May	80,625,363.01
June	72,805,146.29
July	84,627,416.04

Of the three great credit establishments of the state we have of course full statistics which we here append:

Cash, etc.	292,700,000 f.
Loans and reports	915,000,000
Discounted bills	2,389,400,000
Stocks, shares, bonds	139,000,000
Check accounts	3,054,200,000
Creditor accounts	217,100,000
Undue bills	357,800,000

to which we may add a few more figures:

Capital	550,000,000 f.
Reserve funds	159,400,000
Net profit	45,904,052.40
Dividend	41,042,968.75

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19. France—The Colonies in 1907.—*Colonial Possessions in 1870.* On the establishment of the Republic after the defeat in 1870, French Colonial possessions were Algeria, and the Protectorship over 60,000,000 hectares, with 4,500,000 inhabitants. Of these about 3,500,000 were natives who submitted to French authority. In 1907 French trade with the colonies amounted to 560,000,000 francs, of which one-half was accredited to Algeria. The colonies have been converted into an empire across the sea—a greater France—which now comprises (besides Senegal, Guinea, Réunion, Mayotta and St. Mari in Africa; India, Cochin-China, Cambogia, in Asia; the Caledonia Islands and Tahiti, in Oceanica; Guiana, Martinique and Guadeloupe, in America; St. Pierre and Miquelon), Tonkin, Annam, Laos, Tunis, Madagascar, the Ivory Coast, Dahomey, Kongo, the coast of Somalis, the Comoro Islands, etc., 720,344,400 hectares in area (against 52,860,000 for continental France); nearly 45,000,000 inhabitants, of which 00,000 are Europeans, not counting Algeria and Tunisis. The commerce exceeds 1,500,000,000 francs. The report of the minister for the colonies shows an increase from 13,000,000 to 110,000,000 francs, and the reports from all the Colonies bring the amount up to 200,000,000 francs.

These figures suffice to show how France has reorganized the colonial domain that was lost from 1713 to 1763, and in 1815. These possessions are steadily and rapidly increasing. The French colonies are of sufficient importance to merit consideration.

ALGERIA.

France conquered Algeria in 1830, but the conquest took 17 years. It is no longer one colony, but a group of three provinces, governed like the metropolis. Algiers has 90,000 inhabitants; Oran, 90,000; Constantine, 52,000; Bone, 35,000; Philippeville, 20,000. The country consists of three sections: Tell, on a fertile region which includes the cities on the coast, and Kabylie, mountainous and fertile; the high plateaux; and the Desert of Sahara. It is ruled by a Governor-General, prefects, and army officers. The area of Algeria is 670,000 square kilometres. The climate is balmy, and some 12 000 strangers pass the winter season under its blue skies. In the region far from the coast the changes of temperature are more sudden. The population is 4,700,000, of which 700,000 are Europeans. It is the most important of the French colonies. Some 1,900 ships stop at Algiers. Its foreign commerce in 1906 amounted to 66,000,000 francs, against 55,000,000 in 1905. The importations from France average from 350,000,000 to 380,000,000 francs; and its exports amount to 278,500,000 frances. Railroads are to be extended 650 kilometres. The receipts, which amounted to 23,000,000 francs in 1896, have increased to 39,000,000 in 1906. In the departments of Constantine and Alger there are the fewest Europeans. It is well watered. Early fruits and vegetables and grain (hardy wheat and barley) are cultivated. It is rich in cork-trees, forests of oak, iron mines, phosphates of Tebessa, coral, and Spanish grass. In the department of Oran there are many settlers, especially Spaniards. Grapes and wheat are the chief products. The land is watered by the Chelif, the longest river in Algeria. The plateaux serve for breeding sheep. The towns are connected with each other by railroad, and with Marseilles by lines of steamships; also with le Sud, Oranais, Cette and Morocco. In 1847 the celebrated Arab chief, Abd el Kader, instigated the people of Morocco to revolt, but was defeated in the battle of Isly. The security and the development of Algeria require the French to take a prominent part in the affairs of Morocco; a country given over to anarchy, and whose tribes constantly trouble the frontiers.

Sahara borders Algeria. It is arid, but encloses great oasis, which have been made fertile by means of artesian wells. The nomads (Touaregs) have been forced to respect the caravans. The government of Algeria is a heavy task for France, which has become one of the greatest Moslem powers of the world.

TUNIS.

Tunis has been under the protection of France since 1881. In 25 years, by establishing ports, building railroads and roads, and by tilling the soil, this country has been transformed.

It is ruled by a Resident General assisted by delegations of financiers, and by an Advisory Council. It has an area of 13,500,000 hectares, of which 6,000,000 are under cultivation. Its climate is ideal. The land, being better watered than Algeria, is more fertile. The valley of Medjerda is the wheat land. The country is covered with olive trees and vines. The forests of Kroumrie, and fishing along the coast and in the lakes are sources of income. Its population of 1,800,000 is composed of 30,000 French, 25,000 Portuguese, 12,000 Anglo-Maltese, 80,000 Italians, and 4,000 of other nationalities. Of the 637,000 hectares under cultivation, 577,000 belong to the French, who have constructed 1,000 kilometres of railroad and 3,000 of roads. Steamers make the trip between Marseilles and Tunis in 35 hours.

The chief products are grain, wine, olives, oil, hides, oranges, dates, cork, Spanish grass and wool. Importations have increased 170,000,000 francs and exports even more. Its trade with France is 70,000,000 francs. Its report gives 40,000,000.

Tunis is a beautiful city of 250,000 inhabitants, including the outskirts. It is the residence of the Bey, and of the French minister. Its port is Goulette. It is connected by railroad with Bizerte, where a French naval station is established.

The other cities are: Sousse, Sfax, Gabes, and the holy city, Kairouan. The railroad (1,200 kilometres) connects Tunis with the frontier of Morocco by way of Constantine, Algiers and Oran. 1,500,000 tons of merchandise and 150,000 travellers enter its ports every year.

FRENCH WESTERN AFRICA.

Since 1626 France has possessed large territories in Africa, called the Colony of Senegal and Dependencies.

The vast possessions of France in Western Africa, since June 1895, have been under one central government the organization of which united (in 1904) a group of five colonies, each one ruled by a Lieutenant Governor who is under the Governor-General. They are (1) Senegal; (2) French Guinea; (3) The Ivory Coast; (4) Dahomey; (5) Upper Senegal and Niger (the colony of Soudan). To these must be added the political division of Mauritanie, ruled by a Government agent. Titdjilka is its chief city. The Governor-General is assisted by a council appointed by the Government. The seat of this liberal government is at Dakar. The general trade report is 42,000,000 francs. This pays the government expenses and the duties. Dakar has many large structures of public interest, built on made foundations. Its area is 5,600,000 square kilometres. The water-courses are dammed, and on the Ivory Coast and in Dahomey wharves have been built. The Senegal and the Niger are the two great rivers of the country. The climate is very variable and the heat, which reaches 45°, is exceedingly trying. It is inhabited by musulmans and many other races.

Senegal.—Senegal is under two different administrations: (1) that of the coast, where the inhabitants are French; (2) the Protectorate country. The principal city is St. Louis (24,000 inhabitants). The other important cities are Roufisque (20,000 inhabitants), the emporium for peanuts and the centre of business; Dakar (24,000 inhabitants), the centre of navigation; and Gorée, on the island of the same name. The total population is 1,200,000 inhabitants.

Trade has increased from 45,000,000 in 1894, to 100,000,000 francs in 1906. (60,000,000 imports, and 40,000,000 exports.) Of this amount the French importations do not reach 30,000,000. The products exported are chiefly peanuts, gums, india-rubber, almonds; also birds, feathers, and elephants' tusks. The railroad connects Dakar with the Niger.

Senegambia-Niger.—This government extends to Lake Tchad and to Tombouctou. The budget gives a little more than 6,000,000 francs. The principal cities are Kayes (15,000 inhabitants), 911 kilometres from St. Louis—the terminal of the railroad between Senegal and the Niger; Segou, the cotton city and the centre of the india rubber trade; Zinder 30,000 inhabitants. The capital will soon be transferred to Bammako. The cultivation of cotton is developing rapidly in this region.

Mauritanie.—This is a country for breeding cattle and sheep. Salt meats are exported. This territory was annexed to French Western Africa.

Guinea.—Its principal city is Konakry on Tourbo island, opposite the Loos islands, which were recently ceded to France by England. Business houses and stores are numerous. In the last 10 years commerce has increased from 10,000,000 to 35,000,000 francs. (18,000,000 exports; 17,000,000 imports.) The principal products are india rubber (which has increased from 3,000,000 to 12,000,000 francs); palmettos, peanuts, sesamun, hides and bananas.

The Ivory Coast.—The chief town is Bingerville, adjoining the new city of Abidjan, from which the railroad will soon be built as far as Kong (280 kilometres distant). The trade amounts to 10,000,000 francs imports, and 8,000,000 exports. From America is received lard and tobacco. The exports are oil, almonds, india rubber, mahogany and kola nuts. Coffee and cocoa are being cultivated. This colony, whose most important town was formerly Grand Bassam, dates from 1843.

Dahomey.—The seat of the government is at Porto-Novo. The railroad (built for 205 kilometres) will go as far as the Niger. Porto-Novo (76,000 inhabitants) is superseded by Cotonou, which is connected with it by an iron wharf 208 metres long. The products are the same as in the preceding colony. The imports amount to 12,000,000, and the exports to 10,000,000 francs. Great attention is being given to the cultivation of cotton. The natives live on Indian corn, manioc millet and rice.

CONGO.

The origin of the colony of French Congo dates back to 1843; it became a colony in 1881. The present state of Congo, with its dependences, comprises (1) the colony of Gabon; (2) the Middle Congo; (3) Oubanghi-Chari; (4) Tchad. It is governed by a Commissary-General who resides at Brazzaville, and also by a Lieutenant-Governor at Gabon. The general-domain was organized in 1899. Its products are the same as those of the preceding colonies. Trade amounts to 7,000,000 francs imports, and 10,000,000 francs exports.

THE SOMALIS COAST.

This territory was bought in 1858 and in 1862, and settled in 1883. The seat of the government was transferred to Djibouti, and in 1896 the colony took the name of the French Coast of Somalis. It is connected by cable with Perim and large steamers touch here. It is a protectorate. The principal exports are ivory, gold, hides and coffee, amounting to a trade of 11,000,000 francs exports and 8,000,000 francs imports.

The importance of Djibouti is the result of its railroad connection with Addis Abbaba, the capital of Ethiopia. It is the point of departure for caravans, and the products of the country. Djibouti has a population of 600 Europeans and 6,000 natives. Cheik-Said is a French possession, notwithstanding that the Turks have unlawfully placed a garrison there. The island of Perim has the advantage of being supplied with soft water. Its situation commands the entrance to the Red Sea.

MADAGASCAR.

The colonization of Madagascar by the French began in 1642, under Louis XIV. Napoleon III. made a treaty with the queen in 1862. The Hovas having neglected it, the French took the capital, 30 Sept. 1895. The island was declared a colony shortly after the insurrection of 1896-98. It is 2,500 leagues from France, and 150 leagues from Réunion. Its area is 580,000 square kilometres. Although it is as large as France, Belgium and Holland together, it has only 2,500,000 inhabitants, including 850,000 Hovas in the interior, 500,000 Betsilleos in the South, and the Sakalaves in the East. The coast is unhealthy, but thus far the high plateaux have been salubrious.

The annual report amounts to 24,000,000 francs. In 1895 the imports were 14,000,000 and the exports 4,000,000 francs. These figures have increased to 38,500,000 francs and more than 28,000,000, making a total of 65,000,000. The principal exports are india rubber, raffia, cattle, vanilla, cloves, gum, cocoa and coffee. There are important cotton plantations in the west. The native industries consist of the making of rope-bands, lace, and straw hats, and there are many other enterprises. The railroad from Tananarive to Tamatave is in course of construction. Its terminus is connected with the sea by the means of the Pagalanes canal. The principal cities are Tananarive (50,000 inhabitants), Tamatave, the chief port on the east coast, and Majunga on the west coast.

The magnificent roadstead of Diego-Suarez serves as a base for naval operations. The colonization has been directed by General Gallieni, who is an organizer, and ruler, as well as an energetic military leader.

THE COMORES.

Mayotte.—The archipelago of the Comores consists of four islands. Mayotte, the seat of government, has been a colony since 1843; Anjouan has been under our protection since 1886, and the Large Comore and Moheli since 1887. All these belong to Madagascar. The area is 2,124 kilometres. The population consists of 50,000 Musalmens. Mayotte was devastated by a cyclone in 1899. Anjouan has prospered thanks to its vanilla, coffee, cocoa and cotton. Its trade amounts to 1,800,000 francs imports, and 2,400,000 francs exports.

GUADELOUPE.

Guadeloupe has been a French colony since 1674, and suffered vicissitudes in French continental wars. It consists of two islands; Basse Terre, and Grande Terre, separated from it by a short arm of the sea; Basse Terre has but one port (of the same name); Grande Terre has five ports, the principal one of which is Pointe à Pitre. Its trade amounts to 17,000,000 francs imports, and as much in exports, which consist in sugar, rum, coffee, cocoa, vanilla and logwood. Population 140,000. Its dependencies are the islands of Désirade, Petite Terre, Sainte, Marie Galante, two-thirds of St. Martin, and St. Bartholomew.

MARTINIQUE.

Martinique has been a French colony since 1664. The island is 70 kilometres long and 31 wide. It is volcanic, the same as Guadeloupe, and the eruption of Mt. Pelée in 1902 destroyed the city of St. Pierre which had 25,000 inhabitants. The population of Fort de France, the principal city, is 15,000. Its trade amounts to 20,400,000 francs imports, and 15,000,000 exports—about the same as Guadeloupe. The colony has recovered from the disaster, and is resuming its business enterprises.

GUYANA.

Guyana is one of the oldest French colonies It lies between Dutch Guiana and Brazil. It dates from 1674 and it only has 33,000 inhabitants, 12,600 of whom are in Cayenne, the principal city. Notwithstanding that gold has been exported since 1855, ebony forms its chief export. The exports are valued at 13,000,000; the imports amount to 10,500,000 francs. Besides its gold deposits, the country has magnificent forests. It has been neglected because criminals have been transported there. However, it possesses the same elements of growth as its neighbors, British Guiana and Dutch Guiana.

ST. PIERRE AND MIQUELON.

The first French settlements were made there in 1604. These islands were taken from France in 1713 (Treaty of Utrecht) restored in 1763 (Treaty of Paris), and ruined during the war of American Independence. The English banished the inhabitants in 1778. The treaty of 1783 gave France jurisdiction over them. They have only 6,500 inhabitants. The imports amount to 8,000,000, and exports to 10,000,000 francs, and consist of codfish, oil, lobsters and salmon. The islands are the chief fishing station for French vessels on the shores of the Atlantic.

RÉUNION.

This colony dates from 1671. It used to be called Bourbon. Its climate is excellent. It is 71 kilometres long, 51 wide, and has an area of 2,600 square kilometres. Its hot springs of Salazie, Cilaos and Massate are celebrated. In the mountains the temperature is sometimes below zero. The summers are very warm. The island was ravaged by cyclones in 1904 and 1905. There are two ports: St. Denis, the principal one (38,000 inhabitants), and St. Pierre (27,000 inhabitants). Its report is 4,500,000. Imports, 22,000,000 and exports, 20,000,000 francs, consisting of sugar, coffee, vanilla, rum, tapioca and tobacco. The spice trees of the Sonde Islands were introduced there in 1770 by the commissary, Poivre. Its nearness to Madagascar also gives it an outlet for trade. It is thoroughly French. The French of Maurice—its neighbor which has become English—still speak their own language.

NEW CALEDONIA AND NEW HEBRIDES.

France took possession of New Caledonia in 1853. Its dependencies are the Isles of Pines, Loyalty and Huon; but the archipelago of New Hebrides—which is 30 hours' distant from it by steamer, and four days from Sydney—was (February 1907) the subject of a convention which established joint rule with England. The area of New Caledonia is 2,100,000 hectares, of which one-half is mining land, 500,000 hectares of pasturage and lands under cultivation; the remainder is forest. The annual report amounts to 4,000,000 francs. The climate is excellent and favorable for colonization. In August, which is its coolest season, the temperature is as low as 13°. The population is 13,000 colonists, more than 10,000 convicts, and 30,000 natives. No convicts have been sent there since the beginning of this century. The colony is connected with Brisbane, Australia, by a line of steamers and a cable. Its trade amounts to 21,800,000 francs, of which 10,800,000 are imports, and 11,000,000 exports. The latter are the finest quality of coffee, valuable woods, and especially minerals—nickel 130,000 tons; chrome, 45,000; cobalt, 8,000. Blast furnaces are about to be constructed, and the coal and copper mines are being worked.

This colony lies on the route to Australia, San Francisco and Panama, on the one side, and on the other it lies on the route from Panama to Indo-China, and China-Seas. Its vast harbor of Noumea must consequently become the chief port of the Pacific.

New Hebrides.—The New Hebrides, in the same archipelago, comprises 70 islands, whose area is 1,600,000 hectares. The French possess 950,000, and the English 235,000. Agriculture and commerce are in the hands of 400 French colonists, against 100 English—70 of these are only Wesleyan missionaries. These very fertile islands are the granary of the Caledonia islands, a mining country. They are inhabited by 70,000 Canaques and furnish laborers for the same archipelago. It is contended that France has much more right to these islands than England; but Australia wanted them bestowed upon her and the convention of February 1907 established a French-English protectorate over them. It is thought that this *modus vivendi* is only temporary. The situation of the archipelago will assume great importance when the Panama canal is opened.

OCEANICA.

Tahiti.—The colony of Tahiti comprises the archipelago of the Society Isles, the Marquises, the Tuamatou, the Gambiers, the Tubuai, and, in the centre of the Pacific the small island of Clipperton, the advance sentinal of Panama. It is 1,200 leagues from the main land, and has belonged to France since 1842.

Tahiti's climate is charming, and the people are very kindly. It has 30,000 inhabitants. Trade amounts to 4,000,000 francs imports, of which 1,700,000 come from the United States, 665,000 from New Zealand, and 600,000 from France. The exports amount to 4,700,000 francs, of which 80,000 are sent to France and 200,000 to foreign ports. The exports are copra, vanilla, cotton, cocoanuts, oranges, and mother-of-pearl. The colony has no maritime or postal connection with the metropolis. The transportation of mail and passengers, and of most all the merchandise is done by the Union Steamship Company, which connects Tahiti with New Zealand; and by the Ocean Steamship Company, which connects it with San Francisco. These two companies are subsidized by the colony and by France. It is thought that the postal service will be established when the Panama canal is opened.

INDO-CHINA.

Indo-China is the most important of the French colonies. It is 14,000 kilometres distant from France. It is divided into five parts: Cochin-China, settled in 1858; the Protectorate of Cambodia, in 1853; Annam, in 1874; Tonkin, in 1885; Laos (direct possession), in 1893; and Quang Tcheou (off the coast of China), in 1898. The area is 712,000 square kilometres, and there is a population of 23,000,000 of very diverse nationalities—Annamites (three-quarters of the inhabitants); Cambodians and Chinese; Laotians, 132,000 Kiams and 800,000 Mais or Khas (savage tribes). 18,000 of the inhabitants are French. The annular expenditures are 105,000,000 francs, 78,000,000 of which are for the general budget and 35,000,000 for the six countries. Its foreign commerce, which was 205,000,000 francs in 1897, has been 400,000,000 francs since 1904. Nearly 2,000 steamers of 2,250,000 tons and 3,300 of 50,000 tons frequent its ports. American steamers come here for rice. A network of railroads, of more than 2,000 kilometres, is being built—valued at 266,000,000 francs. The public works and the domestic affairs of the colony are progressing rapidly. The principal exports are rice, tea and coal. This colony has not been forced into union, it was naturally united.

Cochin-China.—The area of Cochin-China is 57,600 square kilometres; population 3,000,000, of which 5,000 are French. Saigon is 40 miles from the sea, and one of the most beautiful cities in the far East. Decortications are prepared for three times as much rice as they have. The rice export in 1867 was 14,000 tons; it is now a million. Other exports are pepper, 3,000 tons; cotton, sugar and copra. Cho-len on the outskirts of Saigon, is the most important centre of native and Chinese trade. Tonkin has an area of 174,560 kilometres, and 10,000,000 inhabitants, 4,000 of whom are French. The climate is more supportable than Cochin-China. The chief cities are: Hanoi, 150,000 inhabitants; Haiphong, 15,000, and Namdinh—the commercial, artistic and literary centre—50,000.

Annam-Hué, the capital of the kingdom, and the seat of the French Legation, has 40,000 inhabitants. The area of Annam is 133,760 square kilometres; population 6,000,000. The vicinity of the sea renders the climate very agreeable to Europeans. The chief cities, after Hué, are Tourane, with its mines of coal, copper and gold, and its tea plantations; and Fai-fo, an emporium for native trade, which exports 2,000,000 francs worth of cinnamon to China.

Cambodia.—The area of this colony is 200,000 square kilometres; population 1,800,000, of which 600 are Europeans. The climate is very warm. The products are rice, cotton, silk, pepper, gums, cardamon, sugar, tobacco and the fish caught and salted by the 30,000 fishermen of the great lakes. Cambogia has only one small port—Kampot. The capital is Phrompenh, 60,000 inhabitants. It is a great river port at which steamers stop all the year round.

Laos.—The area of Laos is 300,000 square kilometres; population 1,000,000, of which 500,000 are Thais; 400,000 Khas; 5,000 Khmers; 2,000 Annamites; 300 Chinese; and 150 Europeans. The two capitals are Luang-prabang, 25,000 inhabitants, situated in the northern part; and Vien-charh in the centre Its products are cardamon, benzoin, india rubber, gum-lac, tin. Its gold, iron, salt, and gem mines are to be worked.

Kouang Cheou Wan.—Its area is 1,000 kilometres; population 160,000. The chief town and most important port is Pointe Nivet. Its products are the same as in the southern part of China. It is a free port frequented by 210 ships. The total commerce amounts to 8,600,000 francs. This territory will be connected with Tonkin by railroad. The colony is a base for extensive business transactions, and its commercial activity will extend to the countries which consume rice —those bordering the China seas and the Pacific.

INDIA.

French settlements in India, the chief cities of which are Pondichery, Chandernagore, Yanaon, Karikal and Mahé, are all that remain to us of the immense empire of Dupleix, which has become the Empire of British India. Area 51,000 hectares; population 175,000. The trade amounts to 9,300,000 francs imports, and 28,000,000 exports, consisting of blue-cotton cloth, peanuts, coffee, saffron, tamarins and salt fish. The cities are connected with the railroads of India, and a line of French steamers runs to Pondichery. The population consists of 125,000 natives and 1,000 creoles.

CANADA.

From the fact that French emigration is only 20,000 per year, we must not conclude that the French do not colonize. They know how to please the natives, and the survival of the French spirit in the colonies we have lost is proved by the fact that 2,000,000 Canadians still speak the French language.

LOUISIANA.

There are 1,500,000 French in Louisiana in the United States, and 500,000 in the Antilles, no longer French possessions; as Haiti, half of which France once owned; and there are also many French emigrants in the republics of South America. The following tables show (1) the value of the commerce of the French Colonies; (2) their respective value in economics; and (3) their size, population, expenditures, and commerce (both imports and exports).

TABLE OF THE TRADE OF THE FRENCH COLONIES (1905).

Name	Imports, francs	Exports, francs	Total, francs	Total trade with France, francs	Total trade with French colonies, francs	Total foreign trade, francs
Algeria	....	....	....	....	....	....
Tunisi	....	....	....	....	....	....
Western Africa	96,867,453	56,207,918	153,075,371	68,254,180	4,148,917	80,672,274
Congo	10,379,146	13,932,745	21,311,891	9,188,059	137,201	14,986,631
Réunion	18,184,824	9,708,252	27,893,076	19,070,131	2,049,479	6,773,466
Madagascar	31,198,410	22,850,592	54,049,002	42,298,311	1,679,980	10,070,711
Somalis Coast	771,926	3,096,661	3,868 587	2,891,471	447,748	529,368
Mayotte and Dependencies	11,929,941	19,219,004	30,148,945	193,146	288,386	26,667,413
French Settlements in India	6,356,207	27,185,997	33,542,204	14,033,365	2,311,724	17,297,115
Indo-China	254,560,279	168,757,653	423,317,932	138,697,020	6,010,578	278,610,334
St. Pierre and Miguelon	5,439,521	7,119,311	12,558,832	8,690,483	272,598	3,595,751
Guadeloupe	13,438,419	15,637,471	29,075,890	21,936,229	693,497	6,446,164
Martinique	14,759,172	18,069,422	32,828,594	23,785,955	956,028	8,086,611
Guiana	11,439,375	9,939,491	21,378,866	16,446,556	529,606	4,402,704
New Caledonia	10,726,657	11,070,378	21,707,035	8,582,687	193,518	13,021,030
Oceanica	3,028,161	3,062,569	6,090,730	1,023,250	146,381	4,920,829
Total	489,079,491	384,857,464	873,934,955	378,091,113	19,765,441	476,075,201

TABLE OF THE GENERAL SITUATION OF FRENCH COLONIES.

Colonies	Area in kilometres	Inhabitants		Report for 1905, francs c.	Commerce	
		Natives	Europeans		Exports, francs	Imports, francs
Algeria	670,000	4,000,000	700,000	39,000,000	300,000,000	400,000,000
Tunisi	135,000	1,650,000	150,000	40,000,000	80,000,000	70,000,002
WESTERN AFRICA—						
Senegal	....	....	290	5,710,916.50	40,630,012	51,662,996
Senegambia-Niger	....	....	256	12,809,500.50	40,630,012	51,662,996
Guinea	2,525,000	9,000,000	4,000	5,100,000.50	14,090,743	17,942,974
Ivory Coast	....	....	176	3,000,000.50	7,613,460	9,078,131
Dahomey	....	....	190	5,206,218.14	9,540,066	11,264,258
Congo	1,800,000	8,000,000	580	5,540,006.86	9,938,242	6,978,077
Somalis Coast	36,000	200,000	400	1,175,000.86	10,450,900	7,530,221
Madagascar	530,000	3,000,000	16,200	23,805,000.86	16,271,010	32,898,554
Mayotte	356	9,000	1,018	238,865.86		
Great Comore	1,102	45,000	4	172,100.86	2,381,888	1,715,272
Anjouan	378	15,000	5	113,741.25		
Mohsli	231	9,000	2	28,700.25		
Guadeloupe	1,780	183,000	6,450	5,628,600.90	16,658,297	16,408,801
Martinique	987	200,000	5,400	4,962,128.90	15,104,073	20,389,568
Guiana	80,000	34,000	3,180	2,942,108.34	12,330,391	10,468,081
St. Pierre and Miquelon	242	7,000	6,545	799,246.30	9,552,744	8,306,117
Reunion	2,600	174,000	406	5,279,000.30	19,191,900	21,508,588
Caledonian Isles	20,078	20,000	12,196	3,769,910.30	8,963,895	13,671,998
Oceanica	4,002	28,000	3,061	1,823,745.30	4,678,052	3,907,996
Indo-China	2,200,000	23,500,500	18,246	96,995,756.44	120,448,505	204,253,872
The Indies	588	273,000	78	2,385,328.82	28,059,017	9,319,596
Total	7,203,344	44,697,000	78,683 Fig. incompl.	187,585,870.75	345,903,195	447,304,420

RECAPITULATION OF THE ECONOMIC VALUES OF EACH COLONY (CAPITAL INVOLVED).

	Francs.
Réunion	100,000,000
Guadeloupe	138,000,000
Martinique	100,000,000
Guiana	80,885,000
The Indies	63,241,000
New Caledonia	114,464,000
French Settlements in Oceanica	11,822,000
Saint-Pierre and Miguelon	21,244,000
Indo-China	544,709,000
Western Africa	223,643,000
Madagascar	190,044,000
Comores	13,483,000
French Coast of Somalis	64,300,000
Congo (Capital of the Societies)	60,490,000
Total	1,726,325,000

Thus the increase in value resulting from industrial and commercial enterprises and the investment of capital amounted, in 1907, to nearly 2,000,000,000 francs.

RESUMÉ.

From the above data it can be seen that French domain is of vast extent and is rapidly increasing in value. Its internal affairs, and its business enterprises show a steadily increasing prosperity, and the future outlook is full of hope and involves great responsibility.

M. CHARLES LEMIRE,
Conseiller du Commerce Exterieur.

France, Isle of. See MAURITIUS.

Francesca da Rimini. See DA RIMINI, FRANCESCA.

Francesco di Paula, frän-chĕs'kō dē pō'lä, or **Saint Francis of Paola,** Italian monk: b. Paula or Paola, Calabria, 1416; d. Plessis-les-Tours 2 April 1507. At the age of 13 he was the inmate of a Franciscan convent; and at 19 retired to a cave where he inflicted on himself every species of self-mortification. The fame of his piety having attracted to his cell several emulators of his austere life, he obtained permission to erect a convent, and the new community received from Pope Sixtus IV. the title of the Hermits of St. Francis of Assisi; but the title was changed by Alexander VI. to Minim-Hermits of St. Francis of Paola. The founder established numerous communities in Italy, Sicily, France, Spain, and Germany, but the Minims were never settled in Great Britain or Ireland. To the usual conventual vows, Francesco added one of the most rigorous abstinence — flesh, eggs, cheese, and milk being strictly forbidden the entire year, except in illness. In Spain they were called the Brothers of Victory, in commemoration of the deliverance of Malaga from the Moors. Twelve years after his death he was canonized by Leo X., and the Roman Catholic Church celebrates his festival on 2 April.

Franchetti, frän-chĕt'tē, BARON **Alberto,** Italian composer: b. Turin 1860. He was a pupil in Coccon and Magi, studied at Dresden and Munich, and in 1888 produced his most successful opera ‹Asraele.›

Fran'chise, in law, a right belonging to a subject of exercising a branch of the sovereign or government prerogative, either in virtue of a grant conferring such right, or by prescription, which always presupposes such a grant. The corporate franchise, that is, the right of being incorporated, and of holding fairs, ferries, etc., are among the most important franchises, which are, however, almost infinite. In politics it is the right of voting upon proposed legislative measures, where such measures are accepted or rejected by the people generally; or for representatives to a legislative assembly (the parliamentary franchise) or to a municipal body.

Francia, frän'chä, easel name of FRANCESCO DI MARCO DI GIACOMO RAIBOLINI, Italian painter: b. Bologna 1456; d. there 5 Jan. 1517. He assumed his name of Francia from that of the goldsmith under whom he began his art studies. He was a pupil in painting of the Ferrarese, Lorenzo Costa, and shows the influence of his master's style. He painted portraits and history, his greatest work being the Bentivoglis altarpiece, in the Church of San Giacomo Maggiore, Bologna.

Francia, José Gaspar Tomas Rodriguez da, hō-sā' gäs'pär tō'mäs rō-drē'gēs frän'sē-ä, Paraguayan dictator: b. Asunçion 1756; d. there 20 Sept. 1840. He was sent to the University of Cordova, with a view to entering the Church; but his plans underwent a change, and on his return to his native town with the degree of doctor of laws, he began his public career as a barrister. His high reputation for learning, but still more for honesty and independence, procured him an extensive practice; and he devoted himself to legal pursuits for 30 years. In 1811, when Paraguay threw off the Spanish yoke, he became secretary of the junta appointed by congress. In 1814 he was appointed dictator for three years, and in 1817 he was continued in authority for life. No sooner had he reached the goal for which he had been striving than he began to display the utmost tyranny in his administration. He was kindly disposed toward foreigners, till they excited his jealousy by the culture of Paraguay tea, of which he made a state monopoly. After everything had been placed completely at his beck he seemed, in 1824, disposed to return to milder courses, but a new attack of his constitutional malady led him again to a renewal of his tyrannical proceedings; but as Paraguay had improved under his government, and the inhabitants had become reconciled to his tyranny, he was able to continue his system till his death.

Franciabigio, frän-chä-bē'jō, (the easel name of FRANCESCO DI CRISTOFANO BIGI), Italian painter: b. Florence 1482; d. there 24 Jan. 1525. He was a pupil of Albertinelli, where he met and made a friend of Andrea del Sarto. The two artists painted in collaboration the frescoes in the Santa Annunziata Church at Florence. In these paintings the influence of del Sarto is very apparent, as well as in the ‹Last Supper,› which Franciabigio painted in the refectory of San Giovanni, and the oil painting at Dresden, ‹David and Bathsheba.› He has left many excellent portraits, one of which is in the Berlin Museum.

Fran'cillon, Robert Edward, English novelist: b. Gloucester, England, 25 March 1841. He was educated at Trinity Hall, Cambridge. He was admitted to the bar in 1864 and was on the staff of the London *Globe* 1872-94. His novels are: ‹Earl's Dene›; ‹Pearl and Emerald› (1872); ‹Olympia›; ‹Strange Waters›; ‹Zelda's Fortune›; ‹A Real Queen›; ‹Queen Cophetua› (1880); ‹Under Slieve-Ban› (1881); ‹King or Knave› (1888); ‹A Dog and his Shadow›; ‹Jack Doyle's Daughter›; ‹Ropes of Sand›; ‹Gods and Heroes›; etc.

Francis I., king of France: b. Cognac, France, 12 Sept. 1494; d. Rambouillet 31 March 1547. He succeeded to the throne in 1515, on the death of Louis XII., who died without male issue. As grandson of Valentino of Milan, he put himself at the head of an army to assert his right over the Milanese. The Swiss, who opposed him in his entry into the duchy, were defeated at Marignano (or Melegnano), and Milan fell immediately after this victory. After a short war with England, the famous interview between Henry VIII. and Francis took place, in 1520, in Flanders, which, from the magnificence displayed on the occasion, was called The Field of the Cloth of Gold (q. v.). In the same year, Charles V. of Spain having inherited the empire after the death of Maximilian, Francis laid claim to the imperial dignity and declared war against his rival. In this struggle, however, he met with nothing but reverses. After the defeat of Marshal Lautrec at Bicoca, in 1522, the retreat of Bonnivet, and Bayard's death, Francis was himself, in 1525, beaten at Pavia, and taken prisoner. The fight had been a fierce one, and the king wrote to his mother, «All is lost, except honor.» Led captive into

Spain, he recovered his liberty only at the cost of an onerous treaty, signed at Madrid in 1526; but which Francis subsequently declared null and void. He immediately recommenced war in Italy, met with fresh defeats, and concluded a second treaty at Cambrai in 1529. He once more invaded Italy, in 1536, and, after various successes, consented to a definite arrangement at Crespi, in 1544, by which the French were excluded from Italy, though Milan was given to the Duke of Orleans, the second son of Francis. Francis was a friend to arts and literature, which flourished during his reign; and he was called the "Father of Letters." Justice, also, began to be better administered in his reign. He founded the Royal College of France, the Royal Library, and built several palaces. He was succeeded by his son, Henry II.

Francis II., king of France, son of Henry II. and Catharine of Medici: b. Fontainebleau 19 Jan. 1544; d. Orleans 5 Dec. 1560. He ascended the throne on the death of his father, 10 July 1559. The year previous he had married Mary Stuart, only child of James V., king of Scotland. During his short reign of 17 months were sown the seeds of those evils which afterward desolated France. The uncles of his wife, Francis, Duke of Guise, and the Cardinal of Lorraine, held the reins of government. The latter stood at the head of the clergy, and had charge of the finances. The former had the direction of military affairs; and both used their power solely as a means of gratifying their pride and avarice. Antony of Bourbon, king of Navarre, and his brother Louis, Prince of Condé, provoked that two strangers should govern the kingdom while the princes of the blood were removed from the administration, united with the Calvinists to overthrow the power of the Guises, the protectors of the Catholics. Ambition was the cause of the quarrel, religion the pretext, and the conspiracy of Amboise formed among the French nobility, especially the Calvinists, with the object of removing the king from the influence of the Guises, the first symptom of the civil war. The war broke out in March 1560. In December of the same year Francis died, leaving the kingdom loaded with debt, and a prey to all the miseries of civil war.

Francis I., emperor of Germany: b. 8 Dec. 1708; d. Innspruck 18 Aug. 1765. He was the son of Leopold, Duke of Lorraine. He inherited this duchy from his father in 1729, and six years afterward exchanged it for that of Tuscany, which the death of the last of the Medicis had rendered vacant. In 1736 he married Maria Theresa, the daughter of the Emperor Charles VI. On the death of the latter, he disputed the imperial dignity with the elector of Bavaria, whom France supported, and who took the name of Charles VII.; he was, however, defeated, and Francis reigned peaceably for 20 years. He had 16 children, among whom were Joseph II., who succeeded him, and the unfortunate Marie Antoinette. See Maria Theresa.

Francis II., emperor of Germany, and **I.** of Austria: b. Florence, Italy, 12 Feb. 1768; d. Vienna 2 March 1835. He succeeded his father, Leopold II., in 1792, as emperor of Germany, king of Bohemia, Hungary, etc. At the very commencement of his reign, he had to sustain a war against France, in which he was defeated, and was, in 1797, obliged to sign the treaty of Campo Formio, which deprived him of the Netherlands and Lombardy. Another war taking place with the same power, he was not more fortunate than in the first, and was beaten at Marengo, and lost, by the Treaty of Lunéville, in 1801, all his possessions on the Rhine. In a third campaign, undertaken in 1805, the French were victorious over his armies at Elchingen, Ulm, and Austerlitz; and the Treaty of Presburg still further diminished his territory. Renouncing now the title of emperor of Germany, he took that of Austria, under the name of Francis I. He tried again the fate of battles in 1809; but the defeats of Eckmühl and Wagram led to the Peace of Schönbrunn, to cement which more strongly his daughter Maria Louisa was, in 1810, given to Napoleon I. Notwithstanding this alliance, however, he, in 1813, joined the coalition against his son-in-law and contributed considerably to his overthrow. The treaties of 1815 put him again in possession of the greater portion of his territory, and he reigned peaceably till his death.

Francis I., king of the Two Sicilies, son of Ferdinand I.: b. Naples 19 Aug. 1777; d. there 8 Dec. 1830. Twice during the lifetime of his father he carried on the government of the kingdom under the name of viceroy; first in 1812, when a constitution was granted to Sicily; and afterward in 1820, during the troubles which broke out in Naples and Palermo. He mounted the throne in 1825, and died 1830, without having achieved anything remarkable. He was succeeded by Ferdinand II.

Francis II. (Francesco d'Assisi Maria Leopold), king of the Two Sicilies: b. Naples 31 Jan. 1836; d. 27 Dec. 1894. He succeeded his father, Ferdinand II., in 1859, and attempted to carry out the monarch's policy. His dominions were invaded by Garibaldi in 1860 and Gaeta, his last stronghold, fell in 1861. Subsequently the deposed ruler lived in France in retirement, occasionally organizing abortive expeditions against the Italian kingdom.

Francis Joseph, Charles, emperor of Austria: b. Vienna 30 Aug. 1830. He became emperor 2 Dec. 1848, and found the empire shaken by internal dissensions; and his first step was to promise a free and constitutional government to the country. The course of events, however, compelled him to close the national assembly, and to assume absolute power. He centralized the governments of his heterogeneous nationalities at Vienna, and, aided by Herr Von Brück, inaugurated a series of fiscal and commercial reforms favorable to the interests of the middle classes. In 1853–4, the emperor endeavored, though in vain, to induce the Czar Nicholas to abandon his ambitious designs against Turkey, and further excited that autocrat's displeasure by refusing to assist Russia against the western powers, whose rulers also felt aggrieved because he resolved to remain neutral and declined to throw the weight of his name into their scale. The unwillingness of Austria to make common cause with the western powers has been severely punished, for had she joined the alliance against Russia in 1854, in all probability Louis Napoleon would not have crossed the Alps and dictated the Peace of Villafranca. It is, therefore, more than probable that her reluctance to act against Russia in that war was the cause of her losing Lombardy three years later. At Solferino the emperor gave proof of bravery amounting almost to rashness. In April 1854 he married the Princess Elizabeth Amalie Eugenie, daughter of the Duke Maximilian Joseph, and cousin, on her mother's side, to the king of Bavaria. The plenipotentiaries of Austria, Prussia, and Denmark, assembled at Vienna to consider the terms of a peace, 26 July 1864, which was concluded 30 October. The convention of Gastein signed 14 Aug. 1865, transferring the government of Schleswig to Prussia, and that of Holstein to Austria, was a few days after confirmed by the emperor and the king of Prussia at Salzburg. The emperor issued an important manifesto to his people, 20 September, in which he expressed very conciliatory intentions toward the peoples of Hungary and Croatia. At the beginning of 1866, the armaments against Prussia commenced, and an imperial order was issued 6 May, placing the whole army on a war footing, and concentrating the army of the north on the frontiers of Bohemia. In 1867, the emperor put an end to the hostilities of Hungary by re-establishing the constitution of that country; and on 8 June, he was crowned at Budapest as king of Hungary, with extraordinary pomp. In December of the same year, a new constitution, one of the most liberal of continental Europe, framed by the Reichsrath, was approved by the emperor, and promulgated as the fundamental law of the empire. His only son, Rudolf, committed suicide in 1889, and the emperor's nephew, the Archduke Francis Ferdinand, is heir-presumptive. See AUSTRIA.

Francis, David Rowland, American politician: b. Richmond, Ky., 1 Oct. 1850. He was graduated from Washington University, St. Louis, 1870, entered business and in 1877 established the firm of of Francis Brothers, grain merchants, St. Louis. He was mayor of St. Louis 1885–9, governor of Missouri 1889–93, secretary of the interior under President Cleveland 1896–7, and became president of the Louisiana Purchase Centennial Exposition in 1901.

Francis, Joseph, American inventor: b. Boston, Mass., 12 March 1801; d. Cooperstown, N. Y., 10 May 1893. He was the inventor of a number of life-boats and life-cars which came into general use and by means of which 200 persons were saved when the British ship Ayrshire was wrecked on the New Jersey coast in 1850. It is estimated that in four years as many as 2,150 lives were saved.

Francis, M. E. See BLUNDELL, MRS. FRANCIS.

Francis, SIR **Philip,** British statesman: b. Dublin 22 Oct. 1740; d. London 23 Dec. 1818. He is the best accredited of the candidates for authorship of the 'Junius' letters. He entered the civil service, and was rapidly advanced, owing partly to his abilities and partly to personal influence curiously accordant with partialities shown in the 'Letters.' Suddenly raised to the lofty position of one of the resident India council appointed by Parliament to control those affairs, he went out to India; spent his time there in a furious contest for supremacy with Warren Hastings; was finally vanquished, but achieved a terrible revenge after his return to England, by inciting Hastings' impeachment and coaching Burke; entered Parliament, prepared many pamphlets and made many speeches of much ability and unfailing acrimony. The 'Letters'— savage assaults on the heads of the party in power, up to George III. himself— appeared in the 'Public Advertiser' of London from 1867 to 1772; ceasing with the dispersion of the party faction most liked by Francis, and a year before his great promotion and his departure from England. The case for his authorship is effectively put in Macaulay's 'Essay on Warren Hastings.' See JUNIUS.

Francis of Assisi, ăs-sē'zē, **Saint,** Italian founder of religious order: b. Assisi, Umbria, Italy, 1182; d. Assisi 4 Oct. 1226. St. Francis of Assisi is the founder of the Friars Minor, who are usually styled Franciscans (q.v.). His family name was Bernardone. At baptism he was called John. Whether it was because his father, who was a merchant, was at the time largely engaged in French trade, or because of the saint's own familiarity with the French language, the name Francis eventually superseded that of John. As a youth he was remarkable for his ardent piety and the spotless purity of his life, but is reproached with a worldly vanity in dress which his wealth enabled him to indulge in. A change of heart came over him in consequence of a year's confinement as a prisoner of war; a serious illness helping the transformation. He began to dispose of his property for the purpose of repairing dilapidated churches. Irritated by his extravagance his father treated him with the greatest cruelty; the trouble ending by the saint's abandonment of everything, even his worldly apparel, and he assumed the dress of a common laborer. His zeal for church restorations grew in intensity, and being no longer able to devote his own patrimony to the work he obtained the necessary means by begging; he himself laboring at the buildings with his own hands. His affection was lavished also on the poor and especially upon lepers. He lived in the extremest poverty, practised the greatest austerities, and for a time was looked upon as a madman. Distinguished and learned men, however, began to associate with him and follow his way of life. Though not a priest (and he never became one) he began to preach everywhere on the necessity of penance. As those were the days in which Barbarossa was raging against the Church, both religion and morality needed reformation, and the preacher was eagerly listened to by all classes. When the number of his followers increased, the desire to institute a new religious order developed, and for that purpose he betook himself to Rome, but Innocent III., then sovereign pontiff, treated the proposal with indignation. Francis persevered, and the request was granted. The new community, known first as the Preachers of Penance, increased with astonishing rapidity, and at the first general chapter more than 5,000 friars assembled; some from the humble classes of life, others already famous in Church and state. The foundation of the order coincided with the great Lateran Council, the spirit of which was against the formation of any new religious order. In spite of this, however, there seemed to be a tacit consent to allow the new movement to proceed. It was when Pope Honorius finally gave the necessary authorization that Francis met the Spanish canon Dominic, who was in Rome to found his own Order of Preachers, commonly known as Dominicans (q.v.). The two saints met in church and instinctively recognized each other, becoming immediately most devoted friends. The visions and miracles reported of Francis are bewildering in their number and character. In the hope of martyrdom he made several attempts to preach the gospel to the Mohammedans. His prayer and austerities were continued, his ecstasies frequent, and while on Mt. Alverno he received on his person what are known as the *stigmata*, namely, bleeding wounds on the hands, feet, and side, corresponding to the marks on the crucified body of the Saviour. Wherever he went he was honored as a saint; and his preaching was irresistible in its pathetic and stirring appeals to repentance. The rule of life he laid down for his followers was based on the strictest poverty, that is, no property, and dependence on the alms of the faithful. This extreme rigor almost immediately brought dissension in the order. Parties were formed, and the Friar General Elias, who had been appointed by Francis, was its bitterest opponent, going so far as to leave the order and to side with Barbarossa, who was then in open warfare with the Church. Nevertheless, the friars continued to increase in number and to spread everywhere, preaching the gospel and carrying the faith into distant countries. Besides his order for men, he established another for women, commonly known as the Poor Clares, so called from Saint Clare, the first superior. There is still another section called the Third Order of Saint Francis, for men and women living in the world, who follow a mitigated and adapted form of the rule of the friars. All three have given a vast number of saints and scholars to the Church. Francis died at the age of 45, 19 years after the establishment of his order. The extreme beauty, simplicity, and amiability, and perhaps the poetry, of the saint's character, but especially his love of created nature, have had the effect in our own days of developing a singular cult for him on the part of many outside the Catholic Church. The movement was started by Paul Sabatier, a French Calvinist minister, and Franciscan societies for the study of the life of the saint and of everything connected with him have been established in several countries of Europe.

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Francis de Sales, sālz, Fr. săl, **Saint**, French prelate, founder of the Order of Visitation: b. of a noble Savoyard family, in the château of Sales, near Geneva, 21 Aug. 1567; d. Lyons 28 Dec. 1622. He was educated by the Jesuits at Paris, studied law at Padua, and having a strong bent to theology and a religious life, entered the Church. Earnest and successful as a preacher, he was sent in 1594 with his kinsman, Louis de Sales, to preach in the duchy of Chablais, and bring back, if possible, to the Roman Catholic Church the followers of Calvin. He had a large measure of success. His conferences with Théodore de Bèze, Calvin's successor, at Geneva, were, however, without result. He went to Paris in 1602, preached there with great success, and steadily refused the offers of dignities made by the French king. The same year he was appointed bishop of Geneva, and taking St. Charles Borromeo as his model, applied himself zealously to the reform of the diocese and its monasteries. He was disinterested and free from worldly ambition, and declined the offer of a cardinal's hat and the renewed invitations of the king of France. In 1610 he founded the Order of the Visitation, of which the first directress was his friend, Madame de Chantal. His best known works are the 'Introduction to a Devout Life,' which has been translated into many languages, and 'A Treatise on the Love of God.' He was canonized by Pope Alexander VII. in 1665. See 'Life' by Camus.

Francis Xavier, zăv'ĭ-ėr, Fr. ksăv-ē-ā, **Saint**, Spanish Jesuit missionary: b. Castle of Xavier, Navarre, 7 April 1506; d. Island of Sancian 2 Dec. 1552. Saint Francis Xavier was born in Spain, of one of the noblest families of the kingdom of Navarre. After the usual collegiate studies in his own country, he went to Paris for a course of philosophy in the University. In spite of his extreme youth, his extraordinary ability secured for him a professorship in the affiliated College of Beauvais. It was in Paris that he met the man who shaped his destinies, Ignatius of Loyola (q.v.). Abandoning his professorship, he took up the study of theology, practised the rudest austerities, bound himself to a life of evangelical poverty, chastity, and obedience, and with Ignatius and five other companions established what is known as the Society of Jesus.

The original purpose of this organization was to evangelize Christians living in the Mohammedan countries of the East. Failing in that, they offered themselves to the Pope and were employed by him in most responsible trusts in various parts of Europe, which, however, they combined with labor in pest houses, prisons, and among the abandoned poor. A demand coming from John III. of Portugal for 10 missionaries to evangelize the new Portuguese possessions in India, Francis Xavier was chosen, but went alone, invested, however, with the dignity of Apostolic Nuncio, a dignity which he sedulously kept out of sight.

The day after the command was given to go he left Rome for Lisbon, making the journey on foot, preaching and teaching on the way. In Portugal his influence was so instantaneous and so great that the king purposed to keep him in his dominions. But nevertheless Xavier set sail for the East, 7 April 1541, having refused even to see his own relatives before leaving. The journey meant more than a year of great sufferings, and he reached Goa only on 6 May 1542. The ignorance and immorality which prevailed there were deplorable and a complete and immediate revolution in conditions followed his arrival.

Then began his series of amazing apostolic journeys. They can only be appreciated by recalling the methods of travel of those days: the perilous character of the seas through which he continually sailed, and the savage or barbarous nature of the people he had to evangelize. From Goa he went around Cape Comorin and Ceylon, then back to Goa again, then through every principality of Hindustan, off through the scattered islands of the coasts, until he reached the distant Moluccas; establishing missions everywhere, and managing all the complicated and multiplied works which necessarily resulted. The story of his life is simply a series of surprising evangelical conquests, bringing thousands to Christianity by the efficacy of his preaching, the prodigies he wrought, and the extraordinary sanctity of his life.

On 15 Aug. 1549 he reached Japan. He remained there only two years and four months, but succeeded in penetrating almost all the little kingdoms into which the country was then divided; breaking down the opposition of the Bonzes who were the chief enemies of the Gospel, winning vast numbers to the faith, and establishing his followers in the favor of both rulers and people. The sway which he exerted over the Japanese mind may be inferred from the reverence with which he is still regarded there. The thoroughness with which he and his successors taught Christianity is evidenced by the fact that 25,000 Catholics were found in Japan after three centuries of persecution. They had handed down the faith from father to son without any ecclesiastical ministrations.

To obtain laborers for this new field he returned to Goa in 1551. We then find him venturing on a new project, attempting to win China to Christianity. Its conversion he thought essential for the maintenance of the faith both of India and Japan; for the corrupting influences in both those places he considered to be largely due to their relationship with China. He never reached that country but died on the Island of Sancian, about six leagues from Canton, being only 46 years of age. This last fatal voyage had lasted nine months.

His entire apostolate in the East extended over only 10 years, but he is said to have planted the faith in 52 kingdoms, preached the Gospel through 9,000 miles of territory, and baptized more than 1,000,000 persons. Fifty years after his death Pope Paul V. by a bull, dated 25 Oct. 1605, declared him blessed, and, 16 years subsequently, Gregory XV. canonized him, but on account of the pontiff's death, which occurred just at that time, the bull of canonization was issued by Urban VIII. on 6 Aug. 1623. He is honored in the Church on 3 December and is usually styled "the Apostle of the Indies." The devotion to him is universal and countless churches are erected under his invocation. His relics are still preserved in Goa, and in 1859 the body was found to be incorrupt.

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Francis'cans, the designation borne by the members of the three great religious orders founded in the 13th century by St. Francis of Assisi. The first of these orders is that of the Friars Minor, known as the Greyfriars, and in France as the Cordeliers. The second order is that of the Poor Clares, called in Italian *Povere Donne* (Poor Ladies), and in France the Clarisses. The third order is that of Penance, or Tertiaries.

1. Francis, keenly alive to the evils which in his day seemed to threaten the very existence of the Church and society, strove to counteract their baneful influence by establishing an order, the members of which were to observe the most absolute poverty, and to be devoted to the service of the Church. The goal which he aimed at was to reproduce the ideal of the divine life on earth, therefore neither he nor his were to possess anything temporal, but were to go about doing good and preaching to all the world the kingdom of heaven. A little band of disciples to the number of seven, aglow with enthusiasm, gathered around the saint, and the little chapel of Sta. Maria degli Angeli, near Assisi, which he called Portiuncula, "the little portion, or inheritance," was the place where the order was first planned. It was truly a humble origin, an insignificant beginning, but Francis had a presentiment of the future world-wide extension of his order. In 1210 he obtained from Innocent III. a verbal approbation of the rule he had drawn up for it. Forthwith it appeared how accurately he had gauged the wants of his age, for his order sprang at a bound into popular favor. So rapid was its growth that 10 years afterward at a chapter held near Assisi, more than 5,000 of his religious assembled, and not half a century had elapsed when they counted missionaries in every known country, as may be learned from a bull of Alexander IV. in 1258. In 1260, when a chapter presided over by St. Bonaventure was held at Narbonne, the order had 1,400 houses. At the dissolution of the monasteries in England there were 65 houses of Franciscans, and even in 1680, in spite of severe losses in Protestant countries, the order numbered 100,000 members. The order is ruled by a general minister, who, with his council or *definitorium*, resides in Rome. It is divided into provinces to govern which provincials are elected. Each province is composed of a certain number of houses or convents, whose superiors are termed guardians.

Owing to the absolute nature of the poverty prescribed by the second rule drawn up for the first order and approved by Honorius III. in 1223, some of St. Francis' immediate followers showed tendencies inimical to it even in the saint's lifetime. After his death these tendencies became more marked, and were covertly connived at and effectively encouraged by the second minister-general, Elias of Cortona. This was the rift in the lute which widened as time went on. Some zealous upholders of the purity of the rule, such as St. Anthony of Padua, Adam de Marisco, Cæsar of Spires, protested against all innovations, and labored strenuously to maintain intact their sacred inheritance, receiving the distinctive name of Cesarines, but eventually returning to the body of the order in 1256. Other reforms were initiated, such as that of Peter of Maccerata, 1294; that of Philip of Majorca, 1308; that of John of Vallées, 1336; and others. They met with varying success, until in 1415 a final split took place, one section of the order adopting the mitigations which had been introduced in the matter of poverty, this being the bone of contention all through. They became known as the Conventuals, while the members of the other section were called Observants, as observing faithfully the Franciscan traditions. These latter still adhere strictly to the original austerity of their rule. St. Bernardine of Sienna, St. John Capistran, and St. James de la Marcha were mainly instrumental in promoting the interests of the Observance. In 1517 Leo X. issued his famous bull, *Ite et vos in vineam meam,* decreeing that a general minister of the whole order was to be chosen from among the Observants, and that the Conventuals were to elect a master-general. The Observants, however, did not satisfy the zeal of some, and thus we find certain groups, such as the Reformati, originating in Italy; the Alcantarines, or those who follow the reform of St. Peter of Alcantara, in Spain; and the Recollects.

There were now the two great families of the first order, the Observants and the Conventuals, these latter being governed, as said above, by a master-general, and notwithstanding their dispensations in regard to poverty, they have always rendered important services to the Church. The great Pope Sixtus V. was himself a Conventual.

In 1525 there arose a third family, known as the Capuchins (q.v.).

The Franciscans did not devote themselves exclusively to the apostolic life. From the first they took an active and leading part in the study of Holy Scripture and in all the branches of sacred and secular learning. They have filled with honor the first chairs in the most celebrated universities. Such great names occur among them as Alexander of Hales, St. Bonaventure ("the Seraphic Doctor"), Blessed John Duns Scotus, called "the Subtle Doctor," who as defender of the Immaculate Conception became the leader of the Franciscan school, Francis Mayronis, and Nicholas de Lyre. In England during the centuries immediately preceding the Reformation, there were 67 friars professors at Oxford and 73 at Cambridge, among them being Adam de Marisco, Duns Scotus, Roger Bacon, the pioneer of the modern discoveries in the physical sciences. Thomas de Celano, who wrote 'Dies Iræ,' and Jacopone da Todi, author of 'Stabat Mater,' were Franciscans. Nuncios, legates, archbishops, 50 cardinals, and 5 popes have been chosen from among the Franciscans.

The relations of the Franciscans with America began with its very discovery. Father Juan Perez, guardian of the Franciscan monastery at La Rabida, the adviser and personal friend of Columbus, with several companions, accompanied the discoverer in 1493. The first convent was erected for them at what is now the city of Santo Domingo, on Haiti; another arose at La Vega, on the same island. Connected with these convents were the first schools in the western hemisphere.

Owing to the enthusiasm among the religious in Spain, and to the docility of the Indians, the order spread so rapidly in the West Indies that King Ferdinand found it advisable to issue a decree forbidding the erection of a new convent except at a distance of at least five leagues from one already existing. In 1505, only 13 years after the discovery, there was a sufficient number of convents to form a province, under the name of Holy Cross. The first diocese to be erected was Santo Domingo, in 1504; its first bishop was Father Juan de Padilla, a Franciscan.

After the Spaniards had set foot on the mainland, the king, ever anxious for the spiritual welfare of the aborigines, sent over a great number of friars under the leadership of Father Juan de Quevedo, who was appointed bishop of Darien, the first bishop on the American continent. The Franciscans entered Venezuela in 1508, Brazil in 1519; in 1535 they were able to form a province in Peru, whence were founded the missions farther south in the Andes and Pampas. Saint Francis Solanus, called the Apostle of Peru on account of his extraordinary missionary labors, evangelized these regions; he died at Lima in 1610.

In 1521, if not before, the first Franciscans came to Mexico. Together with 12 friars known as the Twelve Apostles of Mexico, there labored here from 1533 to 1572 the famous Brother Gante. He wrote a catechism in the Aztec language, erected over 100 churches, and with one companion frequently baptized 8,000 Indians in one day. Many schools were erected, in which often as many as 600 and 800 boys received an elementary education. Owing to their stainless lives, abstinences, and contempt for gold, the friars obtained marvelous results among the natives. In 1535 the 70 convents in Mexico were organized into a province. At the end of the 16th century there were three provinces; others have been formed since then, besides several missionary colleges, whence zealous missionaries set out to convert the natives to the north, notably in Florida, New Mexico, Arizona, Texas, and California.

Florida was the first of the States that beheld the Franciscan garb. Five friars came with Narvaez in 1528; their superior, Father Juan Suarez, was the first bishop in the United States. In the course of time the missionaries succeeded, though not without heavy sacrifices of life and labor, in establishing flourishing missions all along the coast and in the interior as far west as Mississippi and as far north as Georgia. In 1634 there were 34 friars, who maintained 44 mission stations, where they attended to about 30,000 converts. These missions suffered greatly by invasions from Carolina and Georgia, and when Florida was ceded to the English in 1763 they ceased to exist.

Arizona and New Mexico were first visited by Franciscans in 1539; in the course of time a great many missions and churches were established, to most of which were attached schools for boys, as we learn from an official report of 1632. Beginning with 1689, about 160 friars labored in Texas up to the time of the Mexican independence, when the missions were ruined.

The Franciscans came to California in 1768 under the renowned Father Junipero Serra. The first mission founded was San Diego. Up to 1823, 21 missions were organized, forming a chain which extended a distance of over 700 miles. At the height of mission prosperity 30,000 Indians lived under the paternal guidance of the friars; they were fed, clothed, and educated, with no expense to the government, the missions supporting themselves by agriculture and stock-raising; everything was manufactured at these establishments by the Indians. In 1834 the Mexican government began to confiscate the missions and took them from the control of the friars; this work was finished by 1846 and brought about the complete destruction of the once so flourishing missions.

While the Spanish Franciscans were thus extending their labors in the south from the Atlantic to the Pacific, other bands of Friars Minor were emulating their example in the north. Champlain induced the French Franciscans, formerly called Recollects, to come to Canada as early as 1615. Thence they penetrated into Maine, New York, Pennsylvania, Michigan, Illinois, Minnesota, and Wisconsin. The best known of these missionaries is Father Louis Hennepin. He accompanied La Salle on his expeditions, and was the first to publish a description of the Niagara Falls. While a captive among the Sioux he saw and named the Falls of Saint Anthony. About this time we find the English Franciscans laboring in Maryland and adjoining colonies for full half a century. In the beginning of the 19th century the Rt. Rev. Michael Egan, a Franciscan and first bishop of Philadelphia, intended establishing a province of his order in Pennsylvania, but he died before accomplishing his design. In 1845 Franciscans from the Tyrol came to Cincinnati; in 1854 Italian friars formed a community in western New York, and in 1858 German friars settled in Illinois. The "Kulturkampf" was the cause of many more coming to the United States.

At present (1905) there are in the States 1,033 Franciscans, who are distributed as follows: The Custody of the Immaculate Conception (New York city) in the Eastern States has 8 houses, with 37 members; the Province of the Holy Name (Paterson, N. J.), also in the Eastern States, has 12 houses, with 132 members; the Province of Saint John the Baptist (Cincinnati, Ohio), chiefly in the Central States, has 33 houses, with 343 members; the Province of the Sacred Heart (Saint Louis, Mo.), in the Central and Northern States, has, including the houses in California and Arizona and the Polish communities in Wisconsin, 44 houses, with 521 members. Most of these friars are engaged in regular parish work; some preach missions throughout the States; others are on the Indian missions in Michigan, Wisconsin, California, Arizona, and New Mexico. They also conduct one seminary (Allegany, N. Y.) and six colleges (Allegany, N. Y., Cincinnati, Ohio, Teutopolis, Ill., Quincy, Ill., Pulaski, Wis, Santa Barbara, Cal.).

The Conventual Friars Minor came to the United States in 1851, and at present (1905) form a province in New York and New Jersey numbering 120 members. Besides these there are in the States 134 Franciscan Brothers and some 7,800 Sisters, all belonging to the third Order of Saint Francis. In 1897 the four abovementioned groups, namely, Observants, Reformati, Alcantarines, and Recollects, who had always been under the same minister-general, dropped their distinctive traits and are now known simply as Friars Minor or Franciscans. They number at present (1905) 16,801, are distributed into 77 provinces, and have 1,498 houses. In 1893 the Conventuals numbered 1,462, which number has since decreased, and had 172 houses.

Consult: Shea, 'Catholic Church in the U. S.'; Hammer, 'The Franciscans in America'; Engelhardt, 'Franciscans in California'; 'Franciscans in Arizona.'

Rev. P. Hugoline Storff, O.F.M.

Franck, César Auguste Jean Guillaume Hubert, sā'zar ō-gust zhŏn gē-yōm übār, fränk, French composer: b. Liège 1822: d. Paris 1890. He studied in the conservatory of his native town and at Paris, and in 1872 succeeded his master, Benoist, as teacher in the Metropolitan Conservatory. His talent as a composer was for a long time unrecognized, and in 1846 his oratorio 'Ruth' fell flat. Twenty years later it was revived and created a furore, and Franck found himself leader of a new school. The popularity which his works still enjoy at Paris has to some extent spread to the United States, where his oratorio 'Les Beatitudes' has been much appreciated.

Francke, August Hermann, ow'goost hĕr'män frän'kė, German Lutheran clergyman and philanthropist: b. Lübeck 22 March 1663; d. Halle 8 June 1727. In 1692 he obtained the professorship of Oriental languages at Halle, which in 1698 he exchanged for that of theology. A pupil of Spener and the teacher of Zinzendorf, Francke belonged to the ranks of those who carried forward the pietistic movement; his activity, however, took the practical direction of founding, endowing, and organizing various educational institutions at Halle. Among these were a school for the poor, a pædagogium, a burgher school, a Latin school, and a seminary for training teachers for these establishments, all founded in one year, 1695; and with them was associated an orphanage, which became in the course of time the most important of all Francke's institutions. At the time of his death his schools were frequented by more than 2,300 pupils. Francke's principal aim was religious instruction, but he founded also a printing-office, and an apothecary's shop, and taught natural science and physical exercises and manual trades. At the present time all Francke's foundations exist with but little alteration; in addition to those mentioned there are also a real-gymnasium, two schools for girls, and a free school. The number of pupils is more than 3,000 annually. See 'Lives' by Kramer (2d ed. 1885); Stein (2d ed. 1886).

Francke, Kuno, American educator: b. Schleswig, Germany, 27 Sept. 1855. Was educated at Kiel; came to the United States and has been professor of German literature in Harvard University for many years. His notable book 'Social Forces in German Literature' appeared in 1896; followed by 'Glimpses of Modern German Culture' (1898); 'History of German Literature' (1901); etc.

Francken, Frans, fräns fränk'ĕn (called The Younger), Flemish painter: b. Antwerp May 1581; d. there 6 May 1642. After a trip to Italy he was received into the Guild of St. Luke at Antwerp, where he worked at first in the brilliant colors of the old masters and later in the realistic style of Rubens. Most prominent European galleries have examples of his art.

Francken, Frans (called The Third), Flemish painter: b. Antwerp 1607; d. there 2 Sept. 1667. He was admitted to the Guild of Saint Luke in 1639. His works, patterned after Rubens, are unsigned and therefore difficult of identification. Specimens of his religious subjects are to be seen at Augsburg ('Moses Striking Water from the Rock') and Vienna, Liechtenstein collection ('John the Baptist Preaching'). In later years he also conducted a linen-draper's shop. He was a son of Frans Francken called The Younger (q.v.).

Franco, Giovanni Battista, jō-vän'nē bät-tēs'tä frän'kō, Italian painter, called Il Semolei: b. Udine 1510; d. Venice 1580. He visited Rome, where his Venetian manner was much influenced by that of Michelangelo. He was a very busy and uneven artist, doing his best work in decorative lines. Upon the victorious entry of Charles V. of Spain into Rome in 1536 he embellished the triumphal arch with scenes descriptive of the city's history. His principal canvas is a 'Baptism of Christ' in the Venetian Church of San Francesco della Vigna. His etchings, including such plates as 'The Adoration of the Shepherds' and 'The Scourging of Christ' (after Titian), are by many preferred to his paintings, which are criticised for defects of color.

Franco-German or **Franco-Prussian War,** the stupendous conflict between France and Germany in 1870–1, which resulted in the total defeat of the French, the overthrow of the Napoleonic dynasty, the establishment of the Third Republic in France, and the consolidation of Germany into an empire under the leadership of Prussia.

The remote causes of this war are to be sought in the jealousy which had long existed between France and Prussia, and which was strengthened on the side of France by the Prussian defeat of Austria in 1866, which secured to her rival the unquestioned leadership in Germany. The immediate occasion of the war occurred in June 1870, when Gen. Prim, commanding in Spain after the deposition and abdication of Queen Isabella, offered the crown of that country to Leopold of Hohenzollern, a prince belonging to the reigning house of Prussia. It was thought in France that the acceptance of this offer would endanger the balance of power in Europe, and more particularly would threaten the safety of France, by putting Prussia in a position to attack it both in the east and in the south. Accordingly, the government of Napoleon III. demanded of the king of Prussia that he should forbid the candidature of the prince. The prince voluntarily retired from his candidature, but the French ambassador offensively insisted that this renunciation should be formally made by the king, and a guarantee given that the candidature would not be revived. This demand was refused, and a formal declaration of war by France against Prussia was received by Count Bismarck, the chancellor of the North German Confederation, on the 19th of July. The war was welcomed by both sides with equal enthusiasm. While the French were the first in getting their troops to the frontier it soon became manifest that instead of being in a complete state of readiness, as the minister of war had declared, the army was defective in almost everything essential to its equipment. Owing to the prevalence of the system of paying for substitutes who never appeared, and were yet registered as belonging to the army, it was also discovered that the numbers of the army did not reach anything like the amount at which they were represented in the official estimates.

In contrast to this the arrangements for mobilizing the Germany army, which had previously been tested in Prussia in 1864 and 1866, were again found to work admirably. Each section of the army was completely organized in the headquarters of the district which it occupied in time of peace, and was only sent to the frontiers after being furnished with everything it required. In addition to this, Prussia, against which country alone the war had been declared, was not only joined according to treaty by all the states of the North German Confederation, but also by those of the south, upon whose neutrality, perhaps even upon whose alliance, Napoleon and the French had counted. The whole of Germany north and south was thus in arms, and was able to muster forces far outnumbering those of the French. While the whole French army brought into the field at the commencement of the war numbered no more than 310,000 men, the troops of the Germans in the field amounted in all to 477,000, to which must be added strong reserves ready, with the exception of such as were necessary to protect the interior and to resist a threatened landing on the north coast by the French fleet, to be brought to the scene of war at any time, giving a total strength on the side of the Germans of more than 1,000,000 of men.

The German forces were divided into three armies; the First Army had its headquarters at Trèves under Gen. Steinmetz; the Second Army occupied the Bavarian Palatinate under Prince Frederick Charles; while the Third Army, under the Crown-prince of Prussia, was stationed in northern Baden. The cavalry of each army, instead of being attached in separate divisions to each of the corps d'armée composing the army, were in this way massed together into one body, and in this formation rendered very important services during the war. The commander-in-chief of the whole forces was King William of Prussia, who was supported by a staff of general officers, with Von Moltke at their head. The French army, under Napoleon himself, had its headquarters at Metz, and two advanced divisions were stationed on the borders of France and Germany, the one in the north on the Saar, under Gen. Frossard, the other farther south at Weissenburg, under Gen. Douay. The first overt act of war took place on 2 August, in which a part of the northern division of the French army, in the presence of Napoleon and the prince imperial, compelled a few Prussian troops belonging to the First Army, after some hours' firing, to evacuate Saarbrücken. After this Von Moltke assumed the offensive. His plan was to unite the three armies in the line of the Moselle in order to attack the enemy's centre with the view of obtaining the shortest line of operations in the direction of Paris, and in this he was completely successful. On 4 August the army under the crown prince defeated the advanced southern division of the French army at Weissenburg, and on 6 August MacMahon's army at Wörth; on the latter date also the first and second German armies had routed the northern division of the French army at Forbach, with terrible loss on both sides. In two separate armies, commanded respectively by Marshal Bazaine and Marshal MacMahon, the French retreated. To prevent their union Steinmetz and Frederick Charles pursued Bazaine, defeated him at Courcelles on 14 August, at Mars-la-Tour on the 16th, at Gravelotte with awful slaughter on the

18th, and shut him up in Metz. The crown prince and his army following MacMahon, advanced to Nancy; there reinforced by a newly formed army under the crown prince of Saxony, they advanced on Châlons, where MacMahon's army had been reorganized and strengthened, and was expected to retreat on Paris. Following instructions, however, MacMahon moved northward to make a descent upon Metz and relieve Bazaine. He was overtaken near Beaumont, and on 27 August and on the days immediately succeeding a number of engagements and strategic movements resulted in MacMahon's army being surrounded at Sedan on 1 September, by a force of overwhelming numbers. On the following day both army and fortress were forced to capitulate. Forty generals, 4,000 officers of all grades, and 84,000 soldiers became prisoners of war. Among the prisoners was Napoleon III., who was unexpectedly found to have been present with the army of MacMahon. On the day after the battle he had a personal interview with King William of Prussia, who assigned to him Wilhelmshöhe, near Cassel, as a place of residence during his captivity.

At the news of this disastrous defeat the Parisians in an outburst of rage demanded the dethronement of the Napoleon dynasty, and on 4 September a republic was proclaimed. A government of national defense presided over by Gen. Trochu, military governor of Paris, was formed, but before any effective measures could be adopted Paris was invested by the Germans on 19 September. A day or two before a delegation from the central government had escaped from Paris and established themselves at Tours, where they were joined on 9 October by Gambetta, who escaped from Paris by balloon. It was some time before the French were able to organize a new army, and in the meantime, 27 September, Strasburg fell into German hands and on 28 October Metz, which had been invested by the second German army under Prince Frederick Charles, capitulated. By the beginning of November war in the open field had been resumed at various points: in the north, in the southeast, and on the Loire in the neighborhood of Orleans. The army of the Loire, under Gen. Aurelle de Paladines, compelled the Germans to evacuate Orleans on 7 November, but was unable to follow up this temporary success, and on 4 December and on 12 January was severely defeated by Prince Frederick Charles. The army of the north, under Gen. Faidherbe, which had been hastily formed to attempt the relief of Paris, after many gallant attempts which were checked by the first German army under Gen. Manteuffel, was finally defeated at St. Quentin on 19 January. In the east and southeast the results were equally disastrous to the French. Gen. Werder defeated the French troops under Cambriels in the Vosges, the irregular forces under Garibaldi in Burgundy, and at Héricourt on the Lisaine on 15, 16 and 17 January kept in check the army of Bourbaki until the approach of Manteuffel compelled Bourbaki and 84,000 troops to escape into Switzerland, where they were disarmed and remained till the conclusion of the war. Meanwhile Paris had held out for a much longer period than even the most sanguine on the side of the French had expected. Desperate sallies were frequently made, but not in sufficient strength to have any decisive effect. On the failure of the last sally on 19 January, Gen. Trochu resigned and was succeeded by Leflô as head of the government of defense, and by Gen. Vinoy as commander of the troops of Paris. But by this time the city was at the point of starvation, and after a three weeks' bombardment was in such a desperate condition that the government could no longer help seeing that a capitulation was inevitable. The terms were settled on 28 January, the chief being that all the forts around Paris should be immediately handed over to the Germans, and that the city should pay a contribution of 200,000,000 francs ($40,000,000). An armistice of three weeks was at the same time concluded, to allow of the election and assembling of a National Assembly to decide upon war and peace. This armistice, however, was not to extend to the scene of war in the southeast until a separate arrangement had been made regarding it. Here the fortress of Belfort still held out, but at last, on 16 February, it agreed to capitulate. The garrison, on account of its gallant defense, was allowed to march out with full military honors. On the same day the armistice became general. The fortress of Bitsch in the department of Moselle, did not surrender till after the conclusion of the preliminaries of peace.

The elections for the assembly had taken place on the 8th; it met at Bordeaux, and on the 17th appointed M. Thiers head of the executive; and on the 21st he arrived at Versailles with a diplomatic commission to negotiate for peace. After the armistice had been thrice prolonged the preliminaries of peace were signed at Versailles on 26 February, and accepted by the assembly at Bordeaux on 1 March. On the same day the German troops entered Paris; on 18 January King William, who had taken up his residence at Versailles, had by acclamation been proclaimed Emperor of Germany. The principal terms of peace were: (1) That France should cede to Germany one fifth part of Lorraine, including Metz, together with the whole of Alsace except Belfort and the surrounding district. (2) That France should pay to Germany a war indemnity of 5,000,000,000 francs ($1,000,000,000). (3) That certain departments of France should remain in the occupation of the Germans, and should not be fully evacuated until after the payment of the whole indemnity. The definitive treaty of peace, which was signed at Frankfort on 10 May and ratified on the 21st, confirmed in all essential particulars the preliminaries of Versailles. The last instalment of the war indemnity was paid on 5 Sept. 1873, and France was completely evacuated by the Germans on the 13th of the same month.

François, Kurt von, koort fōn frän-swä, German explorer: b. Grand-duchy of Luxembourg 2 Oct. 1853. After active service in the Franco-Prussian war, he joined, with the rank of lieutenant, the Wissmann expedition to explore the river Kassai, a tributary of the Congo, and subsequently published his work 'In the Interior of Africa, the exploration of the Cassai, during 1883-5' (1891). He then explored with Grenfell two southern tributaries of the Congo and published his 'Exploration of the Tschuapa and Lulongo' (1888). He was on his return promoted to be leader of an expedition which the government despatched to the German colony of Togo, and 1890–1 accompanied the military expedition into South Africa and in 1892 traversed the Kalahari Desert.

François, Luise von, German novelist: b. Herzburg, Saxony, 27 June 1817; d. Weissenfels 24 Sept. 1893. Her first considerable story, 'The Last Reckenburgerin' (1871), was very warmly praised by the critics for its power in character delineation; it was followed by: 'Frau Erdmuthen's Twin Boys' (1872); 'Climacteric Years of a Lucky Fellow' (1877); 'Judith the Housekeeper' (1868), a peasant counterpart to 'The Last Reckenburgerin,' and next after that her best story. She wrote a 'Popular History of the Prussian War of Liberation, 1813–15'; and a comedy, 'Woman's Station' (1882).

Fran'colins, a genus of small partridges of Africa and southern Asia, much resembling the American bobwhite in behavior. One species (*Francolinus vulgaris*) used to be common in the south of Europe, but has been exterminated.

Franco'nia, Germany, a district lying to the east of the Rhine, and traversed by the Main. After the dismemberment of the Carlovingian empire this district became attached to the German division, and ultimately formed one of the grand-duchies of Germany. Between 1024 and 1125 it furnished a series of emperors to Germany. (See GERMANY, *History*.) It was one of the ten circles into which the empire was divided by Maximilian I. in 1512. Its capital was Nuremberg. In 1806 it was partitioned among Würtemberg, Baden, Hesse-Cassel, the Saxon duchies, and Bavaria. The last received the largest share, and still retains the name in the three circles of Upper, Middle, and Lower Franconia. (1) Upper Franconia has an area of 2,702 square miles and pop. (1900) 607,903. Baireuth is the capital. (2) Middle Franconia has an area of 2,925 square miles and pop. (1900) 815,556. The capital is Anspach. (3) Lower Franconia has an area of 3,243 square miles and pop. (1900) 650,758. Würzburg is the capital. The name of Franconia has been rendered familiar to the traveler and the geologist by its picturesque scenery, which has procured for part of it the name of Franconian Switzerland, and by its caverns, filled with fossil bones, among the most remarkable of which is König Ludwig's Höhle (King Louis' Cave), between Baireuth and Muggendorf.

Franconia Mountains. See WHITE MOUNTAINS.

Fran'gula, the bark of *Rhamnus Frangula*, used in medicine as a purgative.

Fran'gulin ($C_{20}H_{20}O_{10}$), a dyestuff extracted from the root, bark, fruit, and seed of the alder buckthorn (*Rhamnus frangula*). It is a bright yellow, silky, crystalline mass, without taste or smell, which fuses on heating, and can be sublimed in golden needles. It is not soluble in water, and though soluble in hot alcohol separates very completely on cooling. It dissolves in alkalies with a purple color, and is decomposed by sulphuric acid with a succession of colors. It forms lakes with metallic hydrates, and dyes silk, wool, and cotton. In its chemical constitution it is a glucoside, and it is probably the same as *cascara sagrada*.

Frank, Jakob, yä'kōb fränk (properly **Lebowicz**), Jewish pseudo-Messiah: b. Galicia 1720; d. 10 Dec. 1791. The name Frank was obtained during travel in the east from the Turks, who employed the word as a generic term for an European. Originally a distiller, he settled, after his eastern journey, in Podolia, where he professed himself a second Messiah, basing his teachings, in opposition to the Talmud, on the Sohar, the source of the Cabbala. He finally removed to Offenbach, where he lived regally on the gifts of adherents, and finally became a Roman Catholic. His death by apoplexy broke down popular belief in his immortality. The sect of Frankists persists in Poland, Turkey, and Moldavia, its tenets being a Judaized form of the Roman Catholic faith.

Frank, Royal Thaxter, American military officer: b. Gray, Maine, 6 May 1836. He was graduated at the United States Military Academy in 1864, and during the Civil War was brevetted major and lieutenant-colonel for bravery at Fredericksburg, 13 Dec. 1862. He was in command of the Artillery School at Fortress Monroe 1888–98, and was promoted brigadier-general in 1898.

Frank'enstein, or the Modern Prometheus, a psychological romance, by Mary Wollstonecraft Shelley (daughter of Mary Wollstonecraft Godwin and wife of the poet Shelley), published in 1817. It has a morbid power which makes it one of the most remarkable books of its kind in English. Frankenstein conceives the idea of creating by mechanical means a living being, who, independent of the ills of the flesh, shall be immortal. Like Prometheus of old, he hopes to bring down a vital spark from heaven to animate the human frame. After a long series of laboratory experiments, in which he sees himself gradually approaching his goal, he succeeds. But his creation turns out to be not a blessing but a curse. He has made a soulless monster, who will implacably pursue Frankenstein and all his loved ones to the dire end. In vain the unhappy scientist flees from land to land, and from sea to sea. The fiend he has brought into existence is ever on his track, and is the evil genius of his whole family. Finally, in an ice-bound sea, worn out by his hideous experiences, he dies, and over his dead body hovers the horrid shape of the man-machine. The monster then leaps over the ship's side, and disappears in the ice and mist.

Frankfort, Ind., city, county-seat of Clinton County; on the Louisville, N. A. & C., the L. E. & W., the St. L. & K. C., and the Vandalia R.R.'s; about 40 miles northwest of Indianapolis, and 91 miles southwest of Fort Wayne. It is in an agricultural section, and its chief manufactures are flour, crackers, lumber, tiles, bricks, agricultural implements, and some furniture. Natural gas is used extensively for light and heat. The trade is chiefly in the manufactured articles and grain, fruits, and vegetables. The city has a fine public library and a well organized system of public schools. The electric-light plant is owned by the city. Pop. (1900) 7,100.

Frankfort, Ky., city, capital of the State of Kentucky, county-seat of Franklin County; on the Kentucky River, the Chesapeake & O., and the L. & N. R.R.'s; about 50 miles east of Louisville and 65 miles southwest of Cincinnati. The city was founded by Gen. James Wilkinson (q.v.) in 1786, and for a time it was made the seat of his intrigues when he was trying to detach Kentucky from the Union and affiliate it with Spain. When Kentucky was admitted as a State in 1792, Frankfort was made the capital. During the Civil War it was for a time the headquarters of the Confederate forces under Braxton Bragg (q.v.). On 4 Oct. 1862 Richard Harves was inaugurated here as the Confederate governor of Kentucky. In 1900 there was great excitement in Frankfort as to who was elected governor of the State. It was decided that William Goebel was the governor-elect. In the midst of the agitation Goebel was assassinated. Frankfort owes much of its present prosperity to its location in the "Blue Grass" section of the State. Its chief manufactures are flour, whiskey, lumber, carriages, twine, shoes, furniture. The city is the trade centre for an extensive region; the river is navigable and by artificial means it is made to furnish a large amount of water power. The city contains the State arsenal, a State Home for Feeble-Minded Children, the State penitentiary, the State Normal School for colored pupils, and Saint Joseph's Academy. The State government buildings and the State library with over 100,000 volumes add to the interests of the city. Franklin cemetery contains the grave of Daniel Boone (q.v.) and other noted men connected with the history of Kentucky. Pop. (1900) 9,487.

Frank'fort-on-the-Main, măn, Prussia, the capital of a district of same name, on the Main, 20 miles above its conflux with the Rhine. It is divided by the river into two unequal parts; the one on the north bank, called Frankfort proper, being considerably larger than the other, which is called Sachsenhausen; and the two communicate by a stone bridge. Frankfort was formerly fortified; but most of its outworks are now converted into gardens and promenades, and it is entered by nine gates. The principal streets are wide; there are also many squares and a number of large buildings; among which may be named the Rœmerberg, or old palace, in which the emperors of Germany were elected, and place of the assembling of the Diet; the Taxis palace, a place of residence of the emperors; the Sallhof, a modern imperial palace; an academy of painting, and the Senkenberg Museum. Its manufactures include carpets, table-covers, oil-cloths, cotton and silk fabrics, woolen stuffs, jewelry, tobacco and printer's black. It has also large printing, lithographic and stereotyping establishments. Frankfort was founded by the Franks in the 5th century. Charlemagne, who had a palace in this city, summoned a council in 794, and it was surrounded with walls by Louis I. in 838. It was the capital of the Eastern Franks from 843 to 889, when Ratisbon was selected. Frederick I. was elected at Frankfort in 1152. From that time it became the place of election of the emperors. Frankfort was made a free city in 1257. The bridge over the Main was built in 1342. Frederick of Prussia signed a treaty known as the Union of Frankfort, with the empire, France, and Sweden, at this city 13 May 1744. The French captured it 2 Jan. 1750, and again in 1792; but the Prussians wrested it from them 2 Dec. 1792. It was bombarded by the French 12 July, and surrendered 19 July 1796. It formed part of the Confederation of the Rhine in 1806. Napoleon I. erected Frankfort into a duchy in 1810. The Declaration of the Allied Powers was issued at Frankfort 1 Dec. 1813. By the Congress of Vienna, in 1815, it was made one of the four free cities of Germany, and the seat of the Germanic Diet. It was made a free port in 1831. The constituent assembly, elected in 1848, held its sittings at Frankfort. It was occupied by the Prussians 16 July 1866, and is now incorporated with Prussia. Pop. (1900) 288,489.

Frankfort-on-the-Oder, Prussia, the capital of a district of the same name, province of Brandenburg, 48 miles from Berlin. Its university, founded in 1506, was in 1811 transferred to Breslau. Manufactures are woolens, silks, leather, earthen-ware, tobacco, mustard, etc. Near it is Kunersdorf, the scene of the victory of the Austrians and Russians over Frederick the Great (q.v.) in 1759. Pop. (1900) 61,835. The district has an area of 8,000 square miles, with a population of 1,000,000.

Frankfort Black, a fine black pigment used in copper plate engraving. It is said to be made by burning, in the manner of ivory black, the lees of wine from which the tartar has been washed.

Frankfort Land Company, 1686. Francis Daniel Pastorius, an able young German lawyer, had joined the sect of Pietists (q.v.), and to escape from the atmosphere of Lutheranism, concerted with his co-religionists an emigration to America. A number of wealthy and distinguished Germans and Dutchmen were induced to join; but they soon gave up the idea of emigrating themselves, and wished Pastorius instead to head a colony of German and Dutch Mennonites and Quakers to a land where they need not be harried. Pastorius had made Penn's acquaintance in England, had become a Quaker, and wished to be near Penn; some Crefeld merchants bought from Penn 15,000 acres near Philadelphia, and in 1683 Pastorius conducted a colony thither, and at once laid out Germantown (q.v.). In 1686 the Frankfort Land Company was organized, and bought 25,000 acres more.

Frankincense, frank'ĭn-sĕns (O. F. *francencens;* Mod. Lat. *francum incensum*), a name given to various oleo-resinous substances. The frankincense employed in religious ceremonies (called also *incense* and *olibanum*) is a gum resin obtained from *Boswellia thurifera* (or *serrata*), a tree somewhat resembling the sumach, belonging to the *Amyridaceæ,* and inhabiting the mountains of India. The frankincense so highly prized by the Greeks, Romans and Jews was probably chiefly of this variety. Substances derived from other trees, such as Croton and Protium, are frequently employed as substitutes for *olibanum.* American turpentine, from which Burgundy pitch is obtained by melting and straining through a cloth, is frequently called frankincense. The frankincense familiar to pharmacy is procured from the European silver fir.

Franking Privilege, that of sending postal matter gratis. In England peers and members of the House of Commons had it till 1840, and till 1837 could also frank their friends' letters wholesale, and even leave franks with them to use at will. In the United States it was first accorded to Revolutionary soldiers in actual service; then to the executive body, chiefs of departments and bureaus, and some special clerks;

and all public documents were franked. Senators and Congressmen, postmasters for official correspondence, also had it; likewise newspaper exchanges and petitions to Congress; and later, exchanges of the Smithsonian institutions, and medals and testimonials to soldiers. The first four presidents had it for life, and it has been granted to the widows of ex-presidents. It was totally abolished from 30 June 1873, an allowance of stamps being made to the departments; but restored a few years later for public documents, seeds to constituents, etc. There is a penalty of $300 for unlawful use of envelopes marked "official business."

Frankl, Ludwig August, lood'vïg ow'goost fränkl, Chevalier von Hochwart, Austrian poet: b. Chrast, Bohemia, 3 Feb. 1810; d. Vienna 14 March 1894. His literary début was made with 'A Lay of Hapsburg' (1832), a series of historical ballads, followed (1836) by the romantic epic 'Christopher Columbus'; the biblical romantic poem 'Rachel' (1842); a poem 'The University' (1848), the first publication in Austria not subjected to the official censorship; 'Don John of Austria,' a heroic poem (1846); 'Lyric Poems,' and 'Epic and Lyric Poetry.'

Frank'land, Sir **Edward,** English chemist: b. Churchtown, England, 18 Jan. 1825; d. Norway 11 Aug. 1899. He made the discovery of the union of organic radicles with metals, announcing in 1850 the preparation of compounds of zinc with methyl and ethyl. From this he deduced the conclusion that an atom of the metal could only attach itself to a definite number of the atoms of other elements, which discovery led to the theory of "equivalents." He was appointed professor of chemistry at Owens College, Manchester, in 1851, and there developed the process of making water gas. Becoming professor of chemistry in the Royal School of Mines in 1865 he turned his attention to water analysis, the purification of sewage and the means of preventing pollution. Subsequently he proved that compressed gases are capable of giving out a flame of constant spectrum, from which he concluded that the photosphere of the sun was atmospheric. He also investigated the chemistry of foods. He published 'Experimental Researches on Pure, Applied and Physical Chemistry' (1878); 'Water Analysis for Sanitary Purposes' (1880).

Frankland, Percy Faraday, English chemist: b. London 3 Oct. 1858. He is a son of E. Frankland (q.v.). In 1880 he became demonstrator and lecturer on chemistry at the School of Mines, a post which he held till his appointment in 1888 as professor of chemistry in University College, Dundee. In 1894 he became professor of chemistry in Mason College, Birmingham. His published works, which deal mostly with micro-chemistry, the chemistry of fermentation and bacteriology, include 'Agricultural Chemical Analysis' (1883); 'Our Secret Friends and Foes' (1894, on micro-organisms); 'Micro-organisms in Water' (1894); 'Life of Pasteur' (1897); and many lectures and papers in the transactions of various societies. In several of his works he has been assisted by his wife, the sister of the philanthropist Arnold Toynbee (q.v.).

Franklin, Benjamin, American statesman and philosopher: b. Boston, Mass., 17 Jan. 1706; d. Philadelphia, Pa., 17 April 1790. The youngest son of the 17 children of a Boston tallow-chandler named Franklin was born a subject of Queen Anne of England, and on the same day received the baptismal name of Benjamin at the Old South Church in that city. He continued for more than 70 of the 84 years of his life a subject of four successive British monarchs. During that period, neither Anne nor either of the three Georges who succeeded her had a subject of whom they had more reason to be proud, nor one whom at his death their people generally supposed they had more reason to detest. No Englishman of his generation can now be said to have established a more enduring fame, in any way, than Franklin established in many ways. As a printer, as a journalist, as a diplomatist, as a statesman, as a philosopher, he was easily first among his peers

On the other hand, it is no disparagement of the services of any of his contemporaries on either side of the Atlantic, to say that no one of his generation contributed more effectually to the dissolution of the bonds which united the principal British-American colonies to the mother country, and toward conferring upon them independence and a popular government.

As a practical printer Franklin was reported to have had no superiors; as a journalist he exerted an influence not only unrivaled in his day, but more potent, on this continent at least, than either of his sovereigns or their parliaments. The organization of a police, and later of the militia, for Philadelphia; of companies for extinguishing fires; making the sweeping and paving of the streets a municipal function; the formation of the first public library for Philadelphia, and the establishment of an academy which has matured into the now famous University of Pennsylvania, were among the conspicuous reforms which he planted and watered in the columns of the Philadelphia *Gazette*. This journal he founded; upon the earnings of it he mainly subsisted during a long life, and any sheet of it to-day would bring a larger price in the open market probably than a single sheet of any other periodical ever published.

Franklin's Almanack, his crowning work in the sphere of journalism, published under the pseudonym of "Richard Saunders,"— better known since as Poor Richard,— is still one of the marvels of modern literature. Under one or another of many titles the contents of this publication, exclusive of its calendars, have been translated into every tongue having any pretensions to a literature; and have had more readers, probably, than any other publication in the English or indeed in any other language, with the single exception of the Bible. It was the first issue from an American press that found a popular welcome in foreign lands, and it still enjoys the special distinction of being the only almanac ever published that owed its extraordinary popularity entirely to its literary merit.

What adds to the surprise with which we contemplate the fame and fortunes of this unpretentious publication, is the fact that its reputation was established by its first number, and when its author was only 26 years of age. For a period of 26 years, and until Franklin ceased to edit it, this annual was looked forward to by a larger portion of the colonial population and with more impatience than now awaits a President's annual message to Congress.

Franklin graduated from journalism into diplomacy as naturally as winter glides into spring. This was simply because he was by common acclaim the fittest man for any kind of public service the colony possessed, and especially for any duty requiring talents for persuasion, in which he proved himself to be unquestionably past master among the diplomatists of his time.

The question of taxing the Penn proprietary estates in Pennsylvania, for the defense of the province from the French and Indians, had assumed such an acute stage in 1757 that the Assembly decided to petition the king upon the subject; and selected Franklin, then in the 41st year of his age, to visit London and present their petition. The next 41 years of his life were practically all spent in the diplomatic service. He was five years absent on this his first mission. Every interest in London was against him. He finally surmounted all obstacles by a compromise, which pledged the Assembly to pass an act exempting from taxation the unsurveyed lands of the Penn estate,— the surveyed waste lands, however, to be assessed at the usual rate. For his success the Penns and their partisans never forgave him, and his fellow colonists never forgot him.

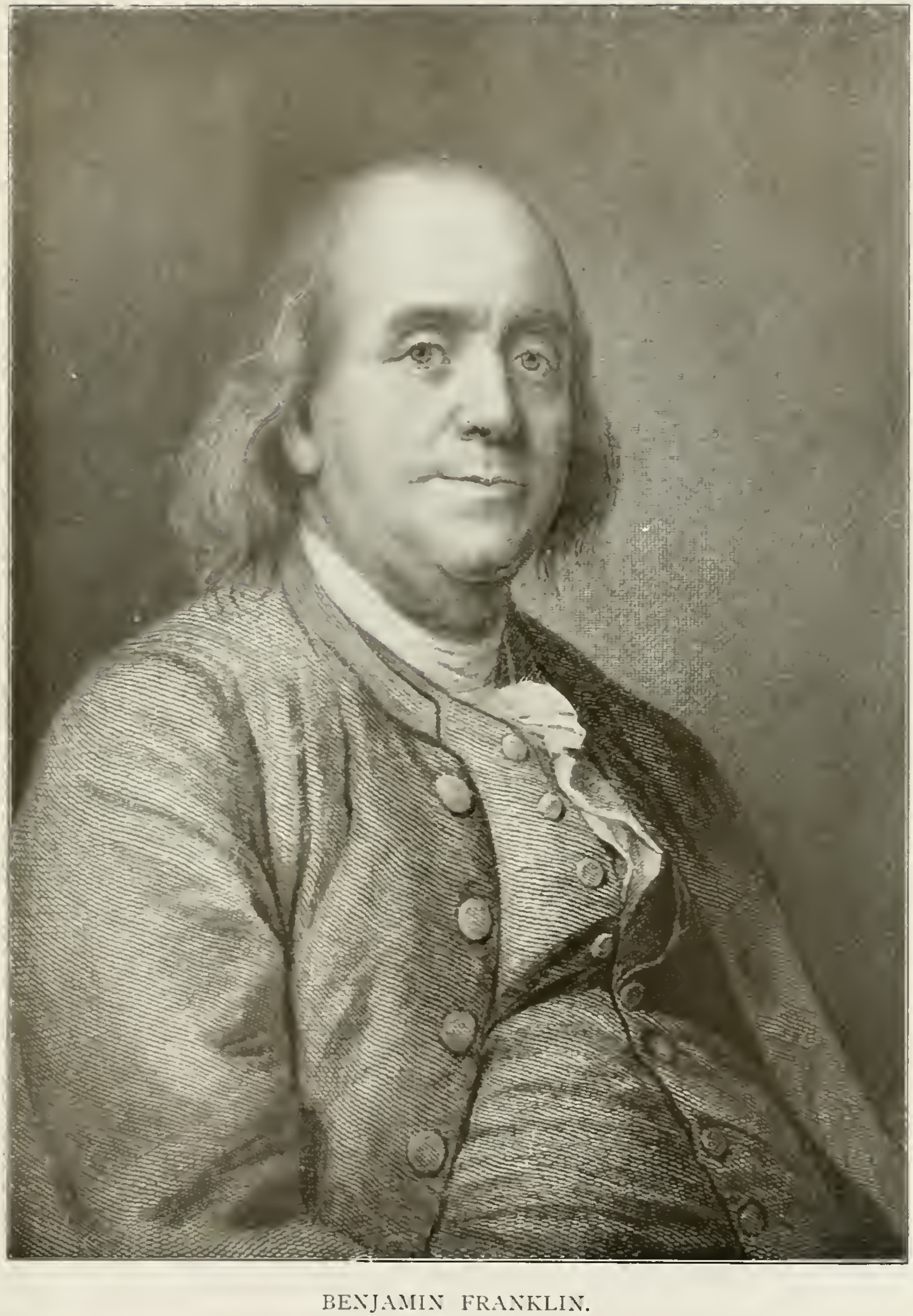
Franklin returned to Philadelphia in 1762, but not to remain. The question of taxing the colonies without representation was soon thrust upon them in the shape of a stamp duty, and Franklin was sent out again to urge its repeal. He reached London in November 1764, where he remained the next 11 years and until it became apparent that the surrender of the right to arbitrarily tax the colonies would never be made by England during the life of the reigning sovereign, George III. Satisfied that his usefulness in England was at an end, he sailed for Philadelphia 21 March 1775; and on the morning of his arrival was elected by the Assembly of Pennsylvania a delegate to the Continental Congress which consolidated the armies of the colonies, placed Gen. George Washington in command of them, issued the first Continental currency, and assumed the responsibility of resisting the imperial government; his last hope of maintaining the integrity of the empire having been dissipated by recent collisions between the people and the royalist troops at Concord and Lexington. Franklin served on 10 committees in this Congress. He was one of the five who drew up the Declaration of Independence in July 1776, and in September following was chosen unanimously as one of the three commissioners to be sent out to solicit for the infant republic the aid of France and the sympathies of continental Europe. In this mission, the importance of which to his country can hardly be exaggerated, he was greatly favored by the reputation which had preceded him as a man of science. While yet a journalist he had made some experiments in electricity, which established its identity with lightning. The publication by an English correspondent of the letters in which he gave an account of these experiments, secured his election as an honorary member of the Royal Society of London and undisputed rank among the most eminent natural philosophers of his time. When he arrived in Paris, therefore, he was already a member of every important learned society in Europe, one of the managers of the Royal Society of London, and one of the eight foreign members of the Royal Academy in Paris, where three editions of his scientific writings had already been printed. To these advantages must be added another of even greater weight: his errand there was to assist in dismembering the British empire, than which nothing of a political nature was at this time much nearer every Frenchman's heart.

The history of this mission, and how Franklin succeeded in procuring from the French king financial aid to the amount of 26,000,000 francs, at times when the very existence of the republic depended upon them, and finally a treaty of peace more favorable to his country than either England or France wished to concede, has been often told; and there is no chapter in the chronicles of this republic with which the world is more familiar.

Franklin's reputation grew with his success. "It was," wrote his colleague John Adams, "more universal than that of Leibnitz or Newton, Frederick the Great or Voltaire, and his character more beloved and esteemed than all of them. . . . If a collection could be made of all the gazettes of Europe for the latter half of the 18th century, a greater number of panegyrical paragraphs upon *le grand Franklin* would appear, it is believed, than upon any other man that ever lived."

A few weeks after signing the definitive treaty of peace in 1783, Franklin renewed an application which he had previously made just after signing the preliminary treaty, to be relieved of his mission, but it was not until 7 March 1785 that Congress adopted a resolution permitting "the Honorable Benjamin Franklin to return to America as soon as convenient." Three days later, Thomas Jefferson was appointed to succeed him. On 13 Sept. 1785, and after a sojourn of nearly nine years in the French capital, first in the capacity of commissioner and subsequently of minister plenipotentiary, Franklin once more landed in Philadelphia, on the same wharf on which, 62 years before, he had stepped, a friendless and practically penniless runaway apprentice of 17. Though now in his 79th year, and a prey to infirmities not the necessary incidents of old age, he had scarcely unpacked his trunks after his return when he was chosen a member of the municipal council of Philadelphia, and its chairman. Shortly after, he was elected president of Pennsylvania, his own vote only lacking to make the vote unanimous. "I have not firmness," he wrote to a friend, "to resist the unanimous desire of my country folks; and I find myself harnessed again into their service another year. They engrossed the prime of my life; they have eaten my flesh, and seem resolved now to pick my bones."

He was unanimously re-elected to this dignity for the two succeeding years, and while holding that office was chosen a member of the convention which met in May 1787 to frame the Constitution under which the people of the United States are still living. With the adoption of that instrument, to which he probably contributed as much as any other individual, he retired from official life; though not from the service of the public, to which for the remaining years of his stay on earth his genius and his talents were faithfully consecrated. Among the fruits of that unfamiliar leisure, always to be remembered among the noblest achievements of his illustrious career, was the part he had in



BENJAMIN FRANKLIN.

organizing the first anti-slavery society in the world; and as its president, writing and signing the first remonstrance against slavery ever addressed to the Congress of the United States.

In surveying the life of Dr. Franklin as a whole, the thing that most impresses one is his constant study and singleness of purpose to promote the welfare of human society. It was his daily theme as a journalist, and his yearly theme as an almanac-maker. It is that which first occurs to us when we recall his career as a member of the Colonial Assembly; as an agent of the provinces in England; as a diplomatist in France; and as a member of the conventions which crowned the consistent labors of his long life. Nor are there any now so bold as to affirm that there was any other person who could have been depended upon to accomplish for his country or the world what Franklin did in any of the several stages of his versatile career.

Though holding office for more than half of his life, the office always sought Franklin, not Franklin the office. When sent to England as the agent of the colony, he withdrew from business with a modest competence judiciously invested mostly in real estate. He never seems to have given a thought to its increase. Frugal in his habits, simple in his tastes, wise in his indulgences, he died with a fortune neither too large nor too small for his fame as a citizen or a patriot. For teaching frugality and economy to the colonists, when frugality and economy were indispensable to the conservation of their independence and manhood, he has been sneered at as the teacher of a "candle-end-saving philosophy," and his 'Poor Richard' as a "collection of receipts for laying up treasures on earth rather than in heaven." Franklin never taught, either by precept or example, to lay up treasures on earth. He taught the virtues of industry, thrift, and economy, as the virtues supremely important in his time, to keep people out of debt and to provide the means of educating and dignifying society. He never countenanced the accumulation of wealth for its own sake, but for its uses,— its prompt convertibility into social comforts and refinements. It would be difficult to name another man of any age to whom an ambition to accumulate wealth as an end could be imputed with less propriety. Though probably the most inventive genius of his age, and thus indirectly the founder of many fortunes, he never asked a patent for any of his inventions or discoveries. Though one of the best writers of the English language that his country has yet produced, he never wrote a line for money after he withdrew from the calling by which he made a modest provision for his family.

For the remaining half of his life both at home and abroad, though constantly operating upon public opinion by his pen, he never availed himself of a copyright or received a penny from any publisher or patron for any of these labors. In none of the public positions which he held, even when minister plenipotentiary, did his pay equal his expenditures. He was three years president of Pennsylvania after his return from France, and for his services declined to appropriate to his own use anything beyond his necessary expenditures for stationery, postage, and transportation. It is not by such methods that men justly incur the implied reproach of "laying up treasures on earth," or of teaching a candle-end-saving philosophy.

Franklin courted fame no more than fortune. The best of his writings, after his retirement from journalism, he never gave to the press at all; not even his incomparable autobiography, which is still republished more frequently than any of the writings of Dickens or of Thackeray. He always wrote for a larger purpose than mere personal gratification of any kind. Even his bagatelles and *jeux d'esprit* read in the salons of Paris, though apparently intended for the eyes of a small circle, were inspired by a desire to make friends and create respect for the struggling people and the great cause he represented. Few if any of them got into print until many years after his decease. Franklin was from his youth up a leader, a lion in whatever circle he entered, whether in the printing-house, the provincial assemblies, as agent in England, or as a courtier in France. There was no one too eminent in science or literature, on either side of the Atlantic, not to esteem his acquaintance a privilege. He was an honorary member of every important scientific association in the world, and in friendly correspondence with most of those who conferred upon those bodies any distinction; and all this by force of a personal, not to say planetary, attraction that no one brought within his sphere could long resist.

Pretty much all of importance that we know of Franklin we gather from his private correspondence. His contemporaries wrote or at least printed very little about him; scarcely one of the multitude whose names he embalmed in his 'Autobiography' ever printed a line about him. All that we know of the later half of his life not covered by his autobiography, we owe almost exclusively to his private and official correspondence. Though reckoning among his warm friends and correspondents such men as David Hume, Dr. Joseph Priestley, Dr. Price, Lord Kames, Lord Chatham, Dr. Fothergill, Peter Collinson, Edmund Burke, the bishop of St. Asaph and his gifted daughters, Voltaire, the habitués of the Helvétius salon, the Marquis de Ségus, the Count de Vergennes, his near neighbors De Chaumont and Le Veillard, the *maire* of Passy,— all that we learn of his achievements, of his conversation, of his daily life, from these or many other associates of only less prominence in the Old World, might be written on a single foolscap sheet. Nor are we under much greater obligations to his American friends. It is to his own letters (and except his 'Autobiography,' he can hardly be said to have written anything in any other than the epistolary form; and that was written in the form of a letter to his son William, and most of it only began to be published a quarter of a century after his death) that we must turn to learn how full of interest and importance to mankind was this last half-century of his life. Beyond keeping copies of his correspondence, which his official character made a duty as well as a necessity, he appears to have taken no precautions to insure the posthumous fame to which his correspondence during that period was destined to contribute so much. Hence, all the biographies — and they are numberless — owe almost their entire interest and value to his own pen. All, so far as they are biographies, are autobiographies; and for that reason it may be fairly said that all of them are interesting.

It is also quite remarkable that though Franklin's life was a continuous warfare, he had no personal enemies. His extraordinary and even intimate experience of every phase of human life, from the very lowest to the very highest, had made him so tolerant that he regarded differences of opinions and of habits much as he regarded the changes of the weather,— as good or bad for his purposes, but which, though he might sometimes deplore, he had no right to quarrel with or assume personal responsibility for. Hence he never said or did things personally offensive. The causes that he represented had enemies, for he was all his life a reformer. All men who are good for anything have such enemies. "I have, as you observe," wrote Franklin to John Jay the year that he retired from the French mission, "some enemies in England, but they are my enemies as an American; I have also two or three in America who are my enemies as a minister; but I thank God there are not in the whole world any who are my enemies as a man: for by his grace, through a long life, I have been enabled so to conduct myself that there does not exist a human being who can justly say, 'Ben Franklin has wronged me.' This, my friend, is in old age a comfortable reflection. You, too, have or may have your enemies; but let not that render you unhappy. If you make a right use of them, they will do you more good than harm. They point out to us our faults; they put us upon our guard and help us to live more correctly."

Franklin's place in literature as a writer has not been generally appreciated, probably because with him writing was only a means, never an end, and his ends always dwarfed his means, however effective. He wrote to persuade others, never to parade his literary skill. He never wrote a dull line, and was never *nimious*. The longest production of his pen was his autobiography, written during the closing years of his life. Nearly all that he wrote besides was in the form of letters, which would hardly average three octavo pages in length. And yet whatever the subject he touched upon, he never left the impression of incompleteness or of inconclusiveness. Of him may be said, perhaps with as much propriety as of any other man, that he never said a word too soon, nor a word too late, nor a word too much.

The Doric simplicity of his style; his incomparable facility of condensing a great principle into an apologue or an anecdote, many of which, as he applied them, have become the folk-lore of all nations; his habitual moderation of statement, his aversion to exaggeration, his inflexible logic, and his perfect truthfulness,— made him one of the most persuasive men of his time, and his writings a model which no one can study without profit. A judicious selection from Franklin's writings should constitute a part of the curriculum of every college and high school that aspires to cultivate in its pupils a pure style and correct literary taste.

There was one incident in Franklin's life, which, though more frequently referred to in terms of reproach than any other, will probably count for more in his favor in the Great Assize than any other of his whole life. While yet in his teens he became a father before he was a husband. He never did what men of the loftiest moral pretensions not unfrequently do,— shirk as far as possible any personal responsibility for his indiscretion. On the contrary, he took the fruit of it to his home; gave him the best education the schools of the country then afforded. When he went abroad, this son accompanied him, was presented as his son wherever he went, was presented in all the great houses in which he himself was received; he entered him at the Inns of Court, and in due time had him admitted to the English bar; made him his private secretary, and at an early age caused him to be appointed by the Crown governor of New Jersey. The father not only did everything to repair the wrong he had done his son, but at a time when he was at the zenith of his fame and official importance, publicly proclaimed it as one of the great errors of his life. The world has always abounded with bastards, but with the exception of crowned heads claiming to hold their sceptres by divine right, and therefore beyond the reach of popular criticism or reproach, it would be difficult to name another parent of his generation of anything like corresponding eminence with Franklin, who had the courage and the magnanimity to expiate such a wrong to his offspring so fully and effectively.

Franklin was not a member of the visible Church, nor did he ever become the adherent of any sect. With the Unitarian creed Dr. Franklin had more in common than with any other, though he was much too wise a man to suppose that there was but one gate of admission to the Holy City.

Franklin made a somewhat more definite statement of his views on the subject of religion, in reply to an inquiry from President Styles of Yale College, who expressed a desire to know his opinion of Jesus of Nazareth. Franklin's reply was written the last year of his life, and in the 84th of his age:

"You desire to know something of my religion. It is the first time I have been questioned upon it. But I cannot take your curiosity amiss, and shall endeavor in a few words to gratify it. Here is my creed. I believe in one God, the creator of the universe. That he governs it by his providence. That he ought to be worshipped. That the most acceptable service we render to him is doing good to his other children. That the soul of man is immortal, and will be treated with justice in another life respecting its conduct in this. These I take to be the fundamental points in all sound religion, and I regard them as you do in whatever sect I meet with them.

"As to Jesus of Nazareth, my opinion of whom you particularly desire, I think his system of morals and his religion, as he left them to us, the best the world ever saw or is like to see; but I apprehend it has received various corrupting changes, and I have, with most of the present Dissenters in England, some doubts as to his divinity; though it is a question I do not dogmatize upon, having never studied it, and think it needless to busy myself with it now, when I expect soon an opportunity of knowing the truth with less trouble. I see no harm, however, in its being believed, if that belief has the good consequence, as probably it has, of making his doctrines more respected and more observed; especially as I do not perceive that the Supreme takes it amiss, by distinguishing the unbelievers in his government of the world with any peculiar marks of his displeasure.

"I shall only add, respecting myself, that, having experienced the goodness of that Being in conducting me prosperously through a long life, I have no doubt of its continuance in the next, though without the smallest conceit of meriting such goodness. My sentiments on this head you will see in the copy of an old letter enclosed, which I wrote in answer to one from an old religionist whom I had relieved in a paralytic case by electricity, and who, being afraid I should grow proud upon it, sent me his serious though rather impertinent caution."

Bibliography.— 'Autobiography,' edited by Bigelow (1868); also 'Life of Benjamin Franklin, Written by Himself,' edited by Bigelow (1888); 'Complete Works,' 10 vols., edited by Bigelow (1887–8). Mignet, 'Vie de Franklin' (1854); Parton, 'Life and Times of Benjamin Franklin' (1867); McMaster, 'Benjamin Franklin' (1887); Hale, 'Franklin in France' (1887–8); Morse, 'Benjamin Franklin' (1889); Ford, 'Franklin Bibliography' (1889); Ford (edited), 'Sayings of Poor Richard' (1890); Ford, 'The Many Sided Franklin' (1899); Fisher, 'The True Benjamin Franklin' (1899).

John Bigelow.

Franklin, Fabian, American mathematician and editor: b. Eger, Hungary, 18 Jan. 1853. After his graduation from Columbian University, Washington, in 1869, he engaged in civil engineering and surveying. In 1877 he became a fellow at Johns Hopkins University, and his advance to the associate and then full professorship of mathematics quickly followed. During his connection with Johns Hopkins, which lasted until 1895, he was a frequent contributor to mathematical and other journals. In 1895 he became editor of the Baltimore 'News.'

Franklin, Sir John, English navigator: b. Spilsby, Lincolnshire, 16 April 1786; d. Lancaster Sound 11 June 1847. When only a boy he went to sea, and later entered the English navy. In 1806 he was present at the battle of Trafalgar, in 1814 at that of New Orleans, and in 1819 was appointed to head an overland expedition from Hudson Bay to the Arctic Ocean. After suffering many hardships and being frequently on the verge of death from hunger and fatigue, he reached home in 1822. In the following year he married a Miss Purden, the daughter of an architect, and the author of several poetical effusions. In 1825 he submitted to Lord Bathurst a plan "for an expedition overland to the mouth of the Mackenzie River, and thence by sea to the northwest extremity of America, with the combined object also of surveying the coast between the Mackenzie and Coppermine rivers." This proposition was accepted, and six days after he left Liverpool, in the same year, his wife died. In 1827 Capt. Franklin arrived at Liverpool, where he was married a second time, and in 1829 had the honor of knighthood conferred upon him. In 1845, Sir John set out on a third expedition with two ships, called the Erebus and Terror, and spent his first winter in a cove between Cape Riley and Beechey Island. After that period many expeditions were dispatched, both from England and America, in search of Sir John, of whom there were no tidings, and not till 1854 did the intelligence reach England that the navigator and his companions had, in all probability, perished in the winter of 1850-1. This intelligence, however, wanted confirmation, and Lady Franklin, who deserves all praise for the intelligent persistency of her efforts, resolved to have the mystery cleared up. Accordingly, a last expedition was fitted out, and the news was, in 1859, at length confirmed by the return of Capt. McClintock, in the yacht Fox, after a persevering search for the lost adventurers. This officer brought with him indisputable proofs of the death of Sir John and the loss of his crew. Several articles belonging to the unfortunate explorers were found at Ross Cairn and Point Victory. At the latter place a record was discovered, wherein it was stated that Sir John Franklin had died 11 June 1847. Other traces were found on the west coast of King William's Island, as the various survivors of the expedition had strayed from each other, perhaps in search of food, or the means of escaping from their dreary and desolate situations. C. F. Hall, the eminent Arctic explorer, returned in September 1869 from a five-years' search for the remains of Sir John Franklin's companions, and brought back about 150 relics of the expedition, purchased from the natives of King William's Land. It remained, however, for Lieut. Schwatka to find the bodies of the Franklin party in his expedition of 1879–80. Franklin was the author of 'Narrative of a Journey to the Shores of the Polar Sea in the Years 1819–22' (1823); 'Narrative of a Second Expedition to the Shores of the Polar Sea in 1825–27' (1828). Consult: McClintock, 'Narrative of the Fate of Sir John Franklin' (1860); Osborn, 'Career, Last Voyage and Fate of Sir John Franklin' (1860); Beesly, 'Sir John Franklin' (1881); Markham, 'Life of Sir John Franklin and the Northwest Passage' (1891); Traik, 'Life of Sir John Franklin' (1896).

Franklin, Samuel Rhoades, American naval officer: b. York, Pa., 25 Aug. 1825. In 1841 he entered the navy as acting midshipman, in 1862 became lieutenant-commander, served in the western gulf blockading squadron (1863), and as assistant to Palmer at New Orleans (1863–4), and was hydrographer to the Bureau of Navigation 1877–80. From 1884 to 1885, when he attained rear-admiral's rank, he was superintendent of the Naval Observatory, and from 1885 until his retirement in 1887 was in command of the European station. He was president of the Washington International Marine Conference (1889), and wrote 'Memoirs of a Rear-Admiral' (1898).

Franklin, William, American colonial governor: b. Philadelphia 1729; d. England 17 Nov. 1813. He was a natural son of Benjamin Franklin (q.v.). He served with the Pennsylvania forces on the Canada frontier, obtained a captain's commission before 1750, in 1754–6 was comptroller of the general post-office, and during a portion of that time clerk of the provincial assembly. He studied law in London and was admitted to the English bar in 1758. In 1762 he became governor of New Jersey. During the Revolution he was a Loyalist, and kept under guard by the patriots from January 1776. In June 1776 he called a meeting of the Colonial

Assembly, then abrogated, for which he was kept prisoner in Connecticut till 1778, when he was exchanged, and later went to England.

Franklin, William Buel, American military officer: b. York, Pa., 27 Feb. 1823; d. Hartford, Conn., 8 March 1903. He was graduated at the United States Military Academy in 1843. In the Mexican war he served on the staff of Gen. Taylor as a topographical engineer; and carried Taylor's orders at the battle of Buena Vista. At the outbreak of the Civil War he was assigned to the command of a brigade in Heintzelman's division. He took part in the battle of Bull Run, served with distinction in the Peninsular campaign and was promoted major-general in 1862. Subsequently he served under McClellan in Maryland and under Burnside at Fredericksburg, was assigned to the Department of the Gulf, under Banks, in 1863; and in 1865 was brevetted major-general in the regular army, but resigned a year later to engage in manufacturing. He was appointed United States commissioner-general to the Paris Exposition in 1899.

Franklin, William Suddards, American physicist and electrical engineer: b. Geary City, Kan., 27 Oct. 1863. He graduated from the University of Kansas in 1887, and the same year was appointed assistant professor of physics there. After studying at Harvard and Cornell and the University of Berlin, Germany, he was appointed in 1892 to the chair of physics and electrical engineering in Iowa State College, remaining there till 1897, when he received his appointment to the same chair in Lehigh University. In 1901 he was a member of the jury of awards of the Pan-American Exposition. He has written 'Elements of Physics' and 'The Elements of Alternating Currents.'

Franklin, a title bestowed upon the English landholders previous to the Norman conquest, who held their lands of the crown free from any feudal servitude. They were bound together by the Frank-pledge, by which the members of each decennary or tithing, which was comprised of 10 families, were held responsible for each other and forced to make reparation if any member committed an offense. In later years they lost their power and dignity, which was usurped by the Normans and became simply wealthy yeomen.

Franklin, Ind., city, county-seat of Johnson County; on the Pittsburg, C. C. & St. L., and the C., C., C. & St. L. R.R.'s; about 75 miles east of Terra Haute, and 16 miles south of Indianapolis. It is in an agricultural section and its chief manufactures are agricultural implements, flour and lumber. Its trade is principally in grain, flour, and boards. It is the seat of Franklin College, founded in 1834 by the Baptist Church. Pop. (1900) 4,005.

Franklin, Ky., city, county-seat of Simpson County; on the Louisville & N. R.R.; about 145 miles southwest of Lexington, and 5 miles from the boundary line between Kentucky and Tennessee. The manufactures are woolen goods, flour, bricks, and lumber. The trade is in the agricultural products of the surrounding country, and the manufactures of the town. It is the seat of the Franklin Military Institute and the Franklin Female College. Pop. (1900) 2,166.

Franklin, La., a town and parish-seat of Saint Mary Parish, 100 miles southwest of New Orleans and 30 miles west of Morgan City, on Teche Bayou, and on the Southern Pacific R.R. It is in the centre of a very fertile district, and as the bayou is navigable for steamers, the town deals in a considerable quantity of cotton, sugar, fruits, etc. There are also several saw-mills located in the town. Pop. (1900) 2,166.

Franklin, Mass., town in Norfolk County, 27 miles southwest of Boston, on the New England R.R. The town also includes the village of Unionville. Dean Academy, an endowed coeducational school, is located here, and the town also has an almshouse, a public library, and six churches. There are manufactories of pianos, straw, woolen, felt and cotton goods, an iron foundry and a canning factory. It was originally a part of the town of Wrentham, but in 1778 was separated and incorporated. The affairs of the community are administered by town meetings. Pop. (1900) 5,017.

Franklin, N. H., a city in Merrimac County, situated at the junction of the Pemigewasset and Winnepesauke rivers, which here unite to form the Merrimac, and on the Boston & M. R.R., 95 miles northwest of Boston. Owing to the abundant water power, numerous mills have located here, among which are paper and pulp mills, machine shops, wood-working shops, hosiery and knitting machine mills, woolen mills and one of the largest needle factories in the world. It is famous as the birthplace of Daniel Webster, and on the farm once owned by him now stands the New Hampshire Orphans' Home. The city owns and operates its waterworks. It was incorporated as a town in 1828 and as a city in 1895. A mayor and council administer public affairs. Pop. (1900) 5,846.

Franklin, Ohio, village in Warren County, on the Great Miami River, and the Miami and Erie Canal, 40 miles northeast of Cincinnati. There are six churches, one high and one primary schools, five paper mills, two wood pulp mills, and three large tobacco warehouses. It was founded by Gen. William Schenck in 1796. Pop. (1900) 2,724.

Franklin, Pa., a city and county-seat of Venango County, 123 miles north of Pittsburg, on the Allegheny River, at the mouth of French Creek, and on the Allegheny V., the Erie, the W. N. Y. & P, and Lake S. & M. S. R.R.'s. The chief business is in oil, as the city is in the heart of the great oil region, but there are also flour mills, planing mills, machine shops, carriage factories, brick works. The city has two beautiful parks and a public library; the streets are provided with sewers and paved with brick. Franklin was first settled in 1753, and was incorporated in 1795. The government is vested in a mayor and council elected annually. Pop. (1900) 7,317.

Franklin, Tenn., town and county-seat of Williamson County, 20 miles south of Nashville, on the Harpeth River, and on the Louisville & N. R.R. The Tennessee Female College, which was established in 1856, and the Harpeth Male Academy are located here, and there are also several public schools and a Masonic Temple. It has flour mills, a furniture factory and a planing mill, several steam cotton gins, and carriage manufactories. It was the scene of two battles during the Civil War, the first on 10 April 1863, between the Federal forces under Gen. Granger and the Confederate forces under Gen. Van Dorn, the latter being defeated; the second on 30 Nov. 1864, between the forces of Gen. Hood and those of Gen. Schofield, and which is famous as the Battle of Franklin (q.v.). Pop. (1900) 2,180.

Franklin, State of, now Tennessee (q.v.). Fifteen years after the Watauga Association was formed (1769), and when four counties west of the present North Carolina had been organized, with some 10,000 people, that State on request of Congress ceded the district to the United States, giving it two years to accept. The inhabitants, already aggrieved at having no supreme court or militia protection, and being left to fight the Indians and keep public order without help, and now, feeling abandoned to at least two years' anarchy, decided to revolt, set up a State, and ask Congress for admission. On 23 Aug. 1784 deputies from three counties met at Jonesboro, resolved on measures, and issued an address to the people. Each county chose five representatives, which met in convention at Jonesboro in November, but were unable to agree, and adjourned to 14 December. Meantime the alarmed North Carolina legislature established a supreme court and proper officers, and formed the Watauga militia into a brigade, commanded by the leader of the revolt, John Sevier. He advised the convention to accept this redress of their grievances; they refused and made him president, drew up a constitution to be ratified by another convention the following November, and named the new State perhaps at first Frankland: if so, they soon changed it to Franklin, after the philosopher. A governor — Sevier — and a legislature were elected; courts established, sheriffs and justices appointed, etc. For the next three years there were two conflicting governments, each levying taxes, disallowing each other's official acts, and making war on each other. The North Carolina militia invaded the Franklin court-house at Jonesboro, seized the papers, and turned the judge and counsel outdoors; a Franklin mob did the same service to a North Carolina court; the North Carolina commander took the papers by force from Sevier's house, and Sevier gathered a force and recaptured them from his opponent's house. At last, in 1788, the North Carolina party prevailed and put an end to Franklin; Sevier was carried off and tried for high treason; a great Watauga militia gathering attacked the town, rescued him from jail, and carried him back home. Finally the North Carolina legislature sensibly passed an act of oblivion and made Sevier a senator, and in 1790 the lands were ceded to the United States. See U. S.— WESTWARD MOVEMENT.

Franklin and Marshall College, located at Lancaster, Pa., was formed in 1852 by the consolidation of Franklin College, founded at Lancaster in 1787, and Marshall College, founded at Mercersburg, Pa., in 1836. Franklin College was organized with a view to meet the needs of higher education in the interior of the State, especially among the Germans, who formed so large a part of the population. Dr. Benjamin Franklin, after whom the college was named, took a deep interest in its welfare, contributed liberally to its endowment, and in his old age made the journey from Philadelphia to Lancaster to be present at its formal opening. Although the college had in its faculty men like Henry E. Muhlenberg, the distinguished botanist, and Frederick V. Melsheimer, the entomologist, and on its board of trustees some of the most prominent men of the commonwealth, its work was that of a first class high school.

Marshall College was founded by the Reformed Church in the United States, when its theological seminary was removed from New York to Mercersburg, to meet the educational requirements of her own communion, and with limited resources accomplished a wonderful work. Among the eminent men in its faculty were its first presidents, Drs. Frederick Augustus Rauch and John Williamson Nevin, and later on Dr. Philip Schaff, all of whom took high rank as philosophers and theologians. The college had a brilliant career, but declined for lack of endowment and pecuniary resources.

When the two colleges were united, James Buchanan became president of the new board of trustees, and the institution entered upon a prosperous career, although it had to make its way in the face of many obstacles and limitations. Its growth was checked by the Civil War, from the effects of which it but slowly recovered. During the last fifteen or twenty years, however, its growth has been rapid, and it now compares favorably in point of equipment, grade of scholarship, and number of students with its sister colleges in the State of Pennsylvania.

Franklin and Marshall College makes no pretense to be a university. It lays stress upon the college course as a means of liberal education, with sufficient elasticity in the way of electives to make first class preparation for technical or professional study. It confers the degrees of A.B. and Ph.B. for undergraduate work, and A.M. for graduate work, after the completion of the prescribed courses and satisfactory examinations.

The site of the college is exceptionally fine. The principal buildings are: the main building, the halls of the literary societies, the Daniel Scholl Observatory, the gymnasium, the Academy building, the De Peyster Library, and the new Science building, with admirable equipment for physics, chemistry, and biology. The libraries contain altogether about 42,000 volumes. The students in the college proper and the academy number 357, and the faculty 21. This account does not include the Theological Seminary of the Reformed Church, which, although in close proximity to the college, is a separate institution.

JOHN S. STAHR,
President.

Franklin, Battle of. On 12 Nov. 1864 Gen. Sherman turned back from his pursuit of Hood to begin his march from Atlanta to the sea, leaving Gen. Thomas to act on the defensive in Tennessee or to take the offensive in Alabama. Hood was at Florence and Tuscumbia, on the Tennessee River, threatening Nashville, with an army of 44,000 men. Thomas' command, much smaller, was widely distributed from Chattanooga to Nashville. Gen. Schofield was at Pulaski, Tenn., 80 miles south of Nashville. With the Fourth corps under Gen. Stanley, a part of the Twenty-third corps, under Gen. Cox, and a division of cavalry. Thomas instructed Schofield to delay Hood, should he advance, until the army could be concentrated and Nashville reinforced. On the 21st Hood moved on Schofield's right. Schofield withdrew from Pulaski on the 22d, reached Columbia on the 24th, and remained there until the 27th, when Hood forced him to withdraw to the north bank of the river. On the 28th Schofield learned that Forrest's Confederate cavalry threatened his line of withdrawal through Spring Hill, 11 miles in his rear, and early on the morning of the 29th all his trains and three divisions of infantry were put in motion for Spring Hill. Stanley led, and arrived at Spring Hill just as Forrest reached it. Stanley checked Forrest and took defensive positions. Hood followed Forrest, and during the night Schofield's entire army passed through Spring Hill, in sight of Hood's bivouac fires, for Franklin, 12 miles distant, which the advance reached before daylight of the 30th. Being unable at once to cross to the north bank of the Harpeth River, Schofield, who was closely followed by Hood, had to fight to save his trains, with a river at his back. He threw up a line of entrenchments, and a division of the Fourth corps under Stanley crossed to the north bank of the river, all those remaining in the works south of it being under command of Gen. Cox. By noon the trains were in, and most of them crossed to the north bank. Not anticipating a general attack, Schofield gave orders for the withdrawal of the troops at sunset. He was mistaken as to the intention of Hood, who had closely followed his rear with Forrest's cavalry, and when Wagner's division, acting as Schofield's rear-guard, had halted and thrown up barricades about 280 yards beyond the main line, Hood rapidly advanced his infantry and ordered a desperate assault to drive the Union forces into the river. Two of Wagner's brigades were on either side of the Columbia road; Opdycke's brigade had come into the main line and was massed 200 yards in rear of the entrenchments. Wagner's orders were "to develop the enemy, but not to attempt to fight if threatened by too strong a force." Hood formed his lines with celerity on either side of the Columbia pike, Cleburne's and Brown's divisions of Cheatham's corps on the east and west sides of the road respectively, in two lines of battle. When within 400 yards of Wagner's line, at 3.30 P.M., the charge was ordered and, with a wild shout, they rushed forward. Wagner was enveloped on both flanks and fiercely attacked in front, the Confederates rushed over his barricades, and his men gave way in the greatest disorder, closely pursued by the exultant enemy. When within 100 yards of the main line the Union artillery and infantry opened fire. Cleburne, who was leading his division, was shot dead, great gaps were made in the ranks, but the line pressed on, carried the centre of the Twenty-third corps' line for the length of a brigade, went over the works, captured two batteries and many prisoners, reached an inner line of intrenchments, 68 yards in rear of the main line, and here they were checked. Col. Opdycke, who had massed his brigade in rear, when he saw Wagner's men falling back in disorder, and that the works in front had been captured, ordered his men forward. Deploying as they advanced, they rushed upon the Confederates, and a desperate hand-to-hand encounter took place, resulting in the retreat of the enemy to the outer line of works, the capture by Opdycke of nearly 400 prisoners and 9 battle-flags, and the recovery of the captured batteries. Gen. Thomas says Opdycke's prompt action "saved the day." Meanwhile the battle had extended to the right and left, involving all of the Twenty-third corps and the left brigade of Kimball's division. The Confederates reached the works in many places, but were unable to carry them. On both sides the fighting was most gallant. At midnight the Union army crossed to the north bank of the river and marched to Nashville.

The Union army engaged at Franklin, not including cavalry, numbered about 23,000 men, of whom 189 were killed, 1,033 wounded, and 1,104 missing. Of this loss 1,241 were in Wagner's division. The Confederates engaged numbered about 22,000. There are no official reports of Hood's losses, but Schofield reports that 1,750 were buried on the field, 3,800 were disabled and placed in hospital, and 702 captured, an aggregate of 6,252, to which must be added the slightly wounded, probably 2,000. Consult: 'Official Records,' Vol. XLV.; Cox, 'Battle of Franklin' 'The March to the Sea, Franklin and Nashville'; The Century Company's 'Battles and Leaders of the Civil War,' Vol IV.

E. A. Carman.

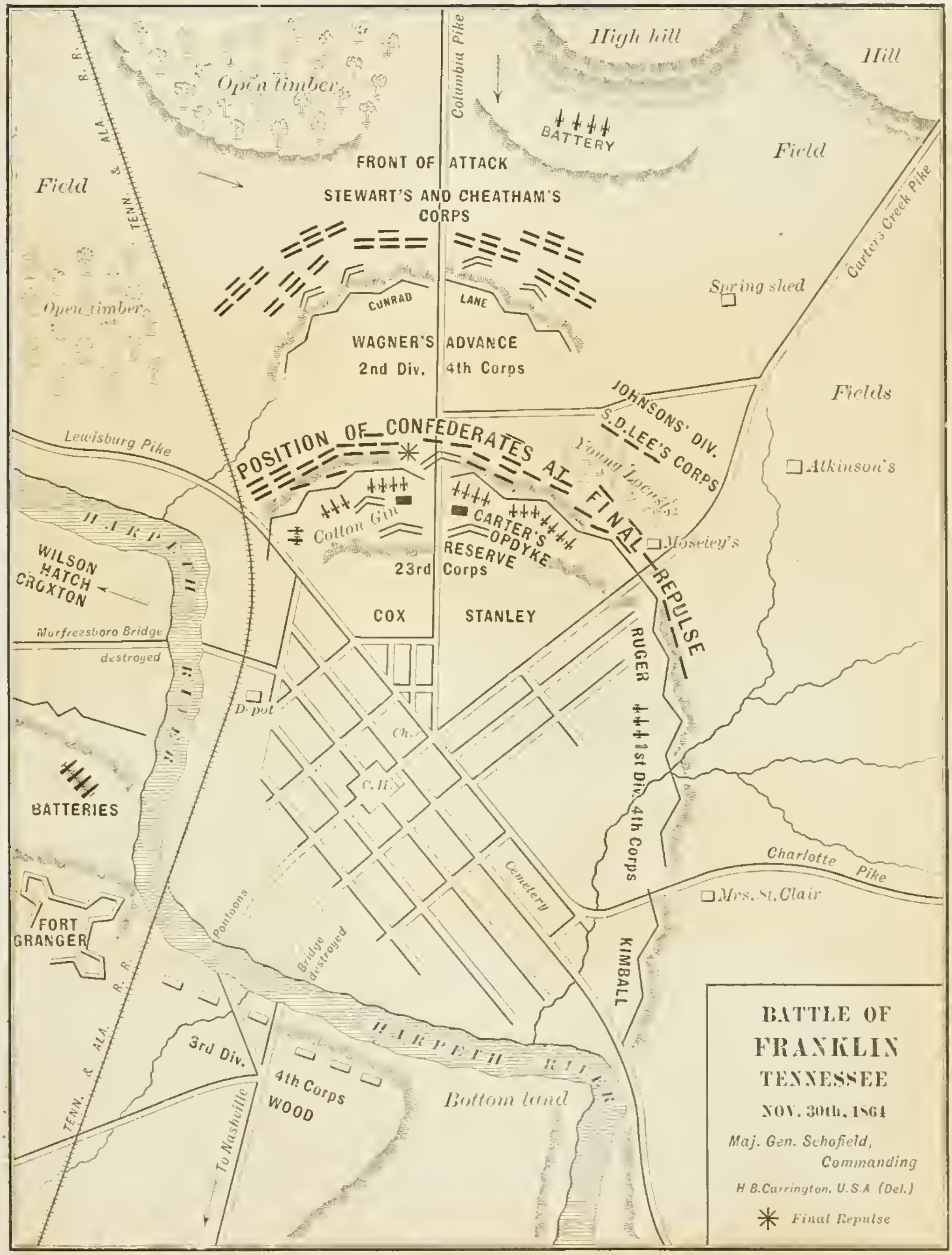
Franklin College, a coeducational institution in Franklin, Ind.; founded in 1834 under the auspices of the Baptist Church; reported in 1905: Professors and instructors, 17; students, 200; volumes in the library, 12,300; productive funds, $300,000; grounds and buildings valued at $75,000; income, $33,000; number of graduates, 394.

Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts. A famous school in Philadelphia, established in 1824, which now embraces schools in mechanical and architectural drawing, machine design, naval architecture, etc. The objects of the institute are obtained by means of a journal (begun in 1826), lectures, libraries, reports, exhibitions and school instruction. The library now contains 55,000 volumes and 38,500 pamphlets. The institute grants medals, premiums and certificates for mechanical inventions. The Institute building is located at 15 South 7th Street, Philadelphia.

Franklinism. See Electricity.

Frank'linite, a native oxide of zinc, manganese and iron, containing these metals in rather widely varying proportions. It crystallizes in the isometric system with octahedral habit, and also occurs in massive and granular forms. It is opaque, slightly magnetic, and iron-black in color, commonly with a metallic lustre. Its hardness varies from 5.5 to 6.5, and its specific gravity from 5.1 to 5.25. In the United States it occurs in considerable quantity in the neighborhood of Franklin Furnace, N. J., taking its name from the locality, where it is mined as an ore of zinc, its manganese and iron being melted into "spiegeleisen," an alloy used in the manufacture of Bessemer steel.

Franks, Sir **Augustus Wollaston,** English archæologist: b. Geneva, Switzerland, 1826; d. London 22 May 1897. He was graduated at Cambridge University in 1849; became an as-



High hill
Hill
Open timber
Columbia Pike
BATTERY
Field
FRONT OF ATTACK
STEWART'S AND CHEATHAM'S CORPS
Field
TENN. & ALA. R. R.
Carters Creek Pike
Spring shed
Open timber
CONRAD
LANE
WAGNER'S ADVANCE
2nd Div. 4th Corps
JOHNSONS' DIV.
S.D.LEE'S CORPS
Fields
Lewisburg Pike
POSITION OF CONFEDERATES AT FINAL REPULSE
Young Locusts
Atkinson's
HARPETH
Cotton Gin
CARTER'S
OPDYKE
RESERVE
Mosley's
WILSON
HATCH
CROXTON
23rd Corps
COX
STANLEY
Murfreesboro Bridge
destroyed
RUGER
Depot
Ch.
1st Div. 4th Corps
C.H.
BATTERIES
Cemetery
Charlotte Pike
Mrs. St. Clair
FORT GRANGER
Pontoons
Bridge destroyed
KIMBALL
HARPETH RIVER
3rd Div.
4th Corps
WOOD
To Nashville
Bottom land
TENN. & ALA. R. R.
BATTLE OF
FRANKLIN
TENNESSEE
NOV. 30th, 1864
Maj. Gen. Schofield,
Commanding
H B.Carrington, U.S.A (Del.)
Final Repulse

sistant in the British Museum in 1851; and served as keeper of the Department of British and Mediæval Antiquities for many years. He was knighted in 1888; and was president of the Society of Antiquities from 1892 till his death. His publications include 'Recent Excavations and Discoveries on the Site of Ancient Carthage' (1860); 'Guide to the Christy Collection of Prehistoric Antiquities and Ethnography' (1868); 'Catalogue of a Collection of Oriental Porcelain and Pottery' (1876); etc.

Franks ("Spearmen"), **The.** In the 3d century A.D. (the name first appears in 240, under the Emperor Gordian), the scattered Teutonic tribes north and east of the middle and lower Rhine, in the present Westphalia, Hesse, Gelderland, etc., united in a loose confederacy; very probably compacted by the ancestor of the Meroving family, to whom the Franks clung so loyally and even stupidly for centuries. The tribes themselves were known from the early empire: Ampsivarii, Attuarii, Batavi, Bructeri, Chamavii or Gambrivii, Chatti, Cherusci, Sali, Sigambri, Usipetes, etc. In 253 under Valerian they raided Belgic Gaul, and half a century later had permanently settled south of the lower Meuse in Brabant. They are early distinguished as Salian and Ripuarian Franks: the former (from their chief tribe, perhaps originally on the Isala or Yssel) on the lower Rhine; the latter (*ripa*, bank) on both banks of the middle Rhine. The Salians, after heavy defeats by the Romans, became their allies and wardens of the marches; but when the pretender Constantine withdrew the Roman garrisons in 406 for his attempt on Italy, they flooded central Belgium, and Colonia Agrippina (Cologne) shortly fell into their hands. By 450 they had reached the Moselle and the Somme, or Luxemburg and northwest France; but still acknowledged Roman sovereignty. They sent forces to help the Romans against Attila at Châlons; but when the Huns had retreated from the fortresses whence they had expelled the Romans,— Trier, Mainz, Metz, etc.,— the Franks occupied them and the lands on the Rhine and Moselle instead of the Romans. The Salians now held the territory from the Scheldt to the Somme and Meuse, or most of Belgium and a little of France; the Ripuarians from the Meuse to the Rhine, and the lands along that river from the Lippe to the Lahn. They were still pagans; backward in the arts of war; had no political union or common head, though their chiefs all claimed Meroving descent; and were credited with being treacherous and perfidious even beyond barbarian wont, which their history makes probable.

When the Western Empire fell, the Rhone and Saône valleys were occupied by a Burgundian kingdom; central and northern France by a Roman province with no one to obey; below which was the great Visigothic kingdom of Euric, taking in south France and nearly all the Spanish peninsula. Five years later (481) a Salian prince of the upper Scheldt named Chlodovech (Latinized Clovis) acceded, and in 485 fell on the Roman province in alliance with other princelings. In three years he had conquered it, making Gaul to the Loire and Brittany a Frankish possession; refusing to share the spoil with his allies, he attacked and subjugated all the Ripuarians, slaying every Merovingian prince he could seize, to exterminate all rivals. In 492 he married Clotilda, the Catholic niece of the Burgundian king. In 496 he subdued the Alemanni, and Frankish settlers founded Franconia. On returning from this campaign he was baptized a Christian, in the Athanasian creed; and in a single generation the entire Frankish body, now consolidated into one, renounced paganism. He then conquered nearly all Visigothic Gaul. But Burgundy was too strong for him. He died in 511. The chance of Chlodovech becoming an Athanasian instead of an Arian had the most important consequences: alone of all the barbarian conquerers of Rome, his subjects were in religious sympathy with him, and his work endured, while the Arian kingdoms crumbled to pieces. This also began the career of the Frankish monarchy, for centuries, as the champion of the Church, helping it and helped by it.

Chlodovech began the practice of dividing the kingdom among his sons, which his successors followed; again and again death or the strong hand united the realms, again a legacy would divide them; and the records of the ferocious, half decrepit, perfidious Merovingians are the blackest in all European history for unredeemed wickedness and unprogressive anarchy. Scarce one of them for a century lived to be 40, and scarce one showed any gleam of statesmanship to justify his atrocities or his even worse weakness. At last in 613 the dominions — which had generally followed the fourfold divisions of Austrasia, Neustria, Burgundy, and Aquitaine — were united for a seeming finality, but the Merovingian kings ceased to have any but a nominal sovereignty. The great provincial governors, in the anarchy, had made their offices hereditary; the officers of state likewise — chamberlain, keeper of the seal, etc. Of these the mayors of the palace became the *de facto* rulers; keeping the kings as puppets, but making them live as country gentlemen, only attending court functions annually, in a farm-cart and with long hair. This mayoralty in Austrasia fell into the hands of one of the most wonderful families of the world, the Karlings or Carlovingians, who mostly held possession of it for a century, till one of them became king; and later the mightiest of them, Charlemagne, became emperor of the Romans in a revived empire. Pepin, or Pippin of Landen, "the Elder," was the first, dying 639; then his son Grimwald, murdered 656; the latter's sister married the son of Arnulf Bishop of Metz; and their son was Pepin the Younger or Pepin of Heristal, who, after 30 years of anarchy and partition and reunion following Grimwald's death, finally and forever reunited the Frankish realms by a crushing defeat of the allied forces of Neustria and Burgundy at the battle of Testry, 687. His son, Charles Martel (Hammer), who held power 717–41, carried civilization at the sword's point among the Germans, and in 732 routed a great Saracen army at Poitiers, saving France from the Mussulman. His son Pepin the Short, after 10 years of mayoralty, deposed the last driveling Meroving and ascended the throne. Pepin's son Charles (Carolus Magnus, Charlemagne, perhaps with a confusion of the title with the name Carloman), acceded in 768. As warrior, statesman, and lawgiver, he stands among the foremost of all time. The Frankish realm as such attained by far its greatest extension under him — though it is incorrect to say, as is usual, that his work perished with him, for the pieces of his realm never went back to their old anarchy. He ruled a vast congeries of races, from north Spain to north Germany, and from the Hungarian plains to the English Channel; and he brought them all under the reign of law and Christianity, inheritors of the memories and civilization of Rome. In 800 he crowned the career of the Franks begun by Clovis, becoming secular head of a Holy Roman Empire, of which the Pope was the spiritual head. Whether it was well judged or beneficial to the world, historians are still divided. The history of Charlemagne's successors is not the history of the Franks: after this they have become merged in a wider aggregation.

The Frankish dominion was the conduit through which the treasures of Rome, political, social, and ecclesiastical, were given to the world. Roman law, Roman literature, and the Christian religion were forced on the barbarians through the Franks: that Europe is what it is, we have to thank them first of all. The best modern compendium is Oman's 'History of the Dark Ages' (1901).

Franz, fränts, **Robert**, German composer: b. Halle 28 June 1815; d. Berlin 24 Oct. 1892. He studied under Schneider at Dessau 1835–7, and in 1843 published his first set of 12 songs, which won the warm praises of Schumann, Mendelssohn, Liszt, and other masters. From then till 1868 he held various appointments at Halle. He published over 250 songs with pianoforte accompaniments, a Kyrie, and several chorales and four-part songs, besides arrangements of the vocal masterpieces of Bach and Handel. Franz's best songs rank with those of Schubert and Schumann.

Franz-Josef Land, fränts'-yō'zĕf-länt, an Arctic archipelago, north of Nova Zembla, extending, so far as it has yet been explored, between lat. 80° and 83° N. It consists of two large masses of land, Wilczek Land to the east, and Zichy Land to the west, separated by Austria Sound, and Rawlinson Sound. Between these two sounds lies Crown Prince Rudolf Land, while to the north of this again comes Petermann Land, and to the northwest King Oscar Land. The southern shores are deeply indented with fjords; and the whole archipelago, which rises into isolated flat-topped or dome-shaped mountains of basalt, 5,000 feet high, is sheeted with ice. Owing to the open water round its shores in summer, and the comparative abundance of its animal life — bears, walruses, foxes, and numerous birds occurring — Franz-Josef Land is regarded by many experienced Arctic explorers as the most favorable base whence to make an attempt to reach the North Pole. The archipelago was discovered and partly explored by Payer and Weyprecht in 1873–4; its southern shores were explored by Leigh Smith in 1880–2, and much of it by the Jackson-Harmsworth expedition in 1895–6. See POLAR EXPLORATION.

Franzensbad, fränt'sĕns-bät, **Egerbrunnen**, ā'gĕrbroon-nĕn, or **Kaiser-franzensbad**, Bohemia, a celebrated Austrian watering-place, about three miles north of Eger, with which it is connected by a fine avenue. It is situated amid low bare hills, and consists of four rectangular streets lined with trees. The mineral springs here were known in the 16th century, and even at that time the waters were made up in bottles to be sent to a distance. It was selected as a watering-place in 1793 by the Emperor Francis II., from whom it received its present name. The bathing establishment consists of an irregular building erected over the springs with a long colonnade extending to the Kurhaus, where the visitors assemble, and the balls and concerts are given. The springs, 12 in number, are alkaline, taline, chalybeate, and are very efficacious in cases of anæmia, dyspepsia, catarrh of the bowels, uterine disorders, etc. The mud baths of Franzensbad are much used by those suffering from gout, rheumatism, skin diseases, etc. Pop. (1890) 2,330.

Fra'ser, Agnes, («FRANCES MAC NAB»), English traveler and writer: b. Halstead, Essex, 7 Dec. 1859. She studied art in London 1882–4, and has since traveled extensively in Algiers, Norway, British Columbia, Morocco, and South Africa. She has published: 'No Reply' (1888); 'Relics: Fragments of a Life' (1893); 'On Veldt and Farm in Bechuanaland, Cape Colony, the Transvaal, and Natal' (1897); 'British Columbia for Settlers' (1898); 'A Ride in Morocco among Believers and Traders' (1902).

Fraser, Alexander Campbell, Scottish philosophical writer: b. Ardchattan, Argyleshire, 3 Sept. 1819. He was a lecturer on mental philosophy in the New College, Edinburgh, 1846; editor of the 'North British Review' (1850–7); professor of logic in Edinburgh University 1856–91. His principal productions are: 'Essays in Philosophy' (1856); 'Rational Philosophy' (1858); a memoir of Bishop Berkeley, with a collected edition of his works (1871–90); an annoted edition of Locke's 'Essay on Human Understanding' (1894); 'Philosophy of Theism' (1898), etc.

Fraser, Augusta Zelia Webb («ALICE SPINNER»), Scottish novelist. She was married to Affleck Fraser 1889. She has published over the pseudonym «ALICE SPINNER,» 'A Study in Color'; 'Lucilla'; 'A Reluctant Evangelist.'

Fraser, Charles, American painter; b. Charleston, S. C., 20 Aug. 1872; d. there 5 Oct. 1860. He studied law, was admitted to the bar in 1807, but withdrew from practice in 1818, and acquired, particularly in the South, a considerable reputation as a miniature-painter. His sitters included Lafayette (1825) and most prominent South Carolinians for 50 years. He also painted interiors, landscapes, genre, and still-life scenes, and historic subjects. An exhibition of his works at Charleston in 1857 comprised 313 miniatures and 139 other canvases in oils. Publication: 'Reminiscences of Charleston' (1854).

Fraser, MRS. Hugh. See FRASER, MARY CRAWFORD.

Fraser, James, English prelate: b. Prestbury, Gloucestershire, 18 Aug. 1818; d. Manchester 22 Oct. 1885. He was educated at Lincoln College, Oxford, took orders in the English Church and was rector at Cholderton, Wiltshire, 1847–60; and of Ufton Newet, Berkshire, 1860–70. In the year last named he became bishop of Manchester, in which position he gained the approbation of churchmen and nonconformists alike. Under his administration the diocese made a most remarkable advance.

Bishop Fraser was greatly interested in educational matters and visited the United States and Canada in 1865 as a commissioner of education, subsequently publishing a ‘Report on the Common School System of the United States and of Upper and Lower Canada’ (1866). A bronze statue of Bishop Fraser stands in the square before the Town Hall of Manchester, and in the Fraser Chapel of the Cathedral of Manchester is a recumbent statue in marble of the much beloved prelate. See Hughes, ‘Memoir of Bishop Fraser’ (1887).

Fraser, Mary Crawford (MRS. HUGH FRASER), English novelist: b. Rome. She is a sister of F. M. Crawford (q.v.), the novelist, and was married to Hugh Fraser, English minister to Japan, who died in 1894. She is the author of ‘The Brown Ambassador’ (1895); ‘Palladia’ (1896); ‘A Chapter of Accidents’ (1897); ‘The Looms of Time’ (1898); ‘A Diplomatist's Wife in Japan’ (1899); ‘The Customs of the Country: or Tales of New Japan’ (1899); ‘The Splendid Porsenna’ (1899), etc.

Fraser, Simon. See LOVAT, TWELFTH LORD.

Fraser, William Alexander. Canadian author: b. Picton County, N. S., 24 March 1859. He traveled widely and became a mining engineer, but subsequently turned his attention to writing. He has contributed much to English and American magazines; published an interesting collection of animal stories, ‘Mooswa and Others of the Boundaries’ (1900), and also ‘The American Animal Book,’ and ‘The Outcast’ (1901).

Fraser River, the principal river in British Columbia, rising in the Rocky Mountains, in lat. 53° 42′.; lon. 119° W. It flows northwest for about 270 miles, then turns south, and after a total course of over 700 miles falls into the Gulf of Georgia, in lat. 49° N. Gold is found both on the Fraser and its affluents. Its principal affluents are the Thomson, Quesnelle, and Stuart rivers.

Fraserville, or Reviere du Loup, rē-vē-ār dü loo, Canada, a town and county-seat of Temiscouata County, Quebec, on the south shore of the St. Lawrence at the confluence of the Reviére du Loup, 116 miles below Quebec. It is on the Intercolonial Railway and is the terminus of the Temiscouata Railway. Its permanent population is almost entirely French Canadian. It has a good trade and manufactories of pulp, leather, lumber, furniture, iron products and woollens. There are three churches (2 Angelican and 1 Catholic), a convent, hospital, and collegiate institute. It has a creamery, banks, and newspapers (French), and is a popular summer resort. Pop. (1901) 4,569.

Fraternal Insurance. See INSURANCE, FRATERNAL.

Fraternal Societies in America. A fraternal society is defined as a corporation or voluntary association organized and carried on for the sole benefit of its members and their beneficiaries. It has no capital stock and is not operated for profit. Every such society must have a representative form of government, and is supposed to operate on the lodge system, with a ritualistic form of work for the meetings of the lodges or other designated subordinate bodies. It has power to adopt its own constitution, by-laws, rules and regulations for the orderly conduct of its affairs, and in general terms may manage its internal interests as it may deem best. Although the American fraternities have the same basis as the friendly societies (q.v.) of England and Scotland, they are a purely American institution, organized without reference to, and at the outset of their career, in entire ignorance of the fact that the same system was in successful operation elsewhere. At the present time the laws governing the fraternal system are in a state of transition, and as the fraternal societies are the creatures of, and governed by the laws of the different States, any change in those laws will necessarily change or modify the system as at present operated.

There are two representative bodies, claiming to act for, and represent a large constituency among the fraternal associations. The National Fraternal Congress, organized in 1886, represents the larger number of leading societies. From its official reports it appears to aim at eventually securing the adoption of a uniform law throughout the United States and Canada, defining as fraternal society, as above expressed, with the addition, that every society shall pay a death benefit on the death of a member, and may pay disability payments, resulting from accident, disease, or old age. During the years 1900 and 1901 the Congress made a vigorous effort to secure the passage of a uniform bill in the legislatures of all the leading States, restricting the benefits, coupled with a provision requiring all the newer organizations to charge adequate rates, but allowing the older societies to continue their low rate assessment system. This action was bitterly opposed by the minority of the Congress and by a still larger number of other associations, that were not affiliated with the Congress. The result of this opposition was the defeat of the proposed law in every State where a contest was made.

The outside societies that participated in this contest, feeling the need of a union, for mutual protection thereafter, immediately after the contest was ended met together and in March 1901, organized the Associated Fraternities of America, with the avowed object of opposing any further changes in the laws of the different States until public sentiment was ripe for the adoption of a uniform law on the basis of the largest liberty to each society in the matter of benefits, provided adequate rates are charged therefor. This dissension among the fraternal societies induced the convention of the insurance commissioners of the different States to formulate a proposed law for the government of fraternal societies, containing many new and startling features.

All the early fraternal associations collected their contributions from their members by means of assessments, the rate of which, except in two instances, was graded according to age at entry, and each member was required to pay such a number of assessments each month as might be needed to meet the death losses. As these older organizations advanced in years, their death losses necessarily increased in number, and with increased death losses the number of assessments each month also increased. During this period many new societies were organized on the same system and while young, naturally had a low death rate, and a low mortality cost per member. Being much cheaper they naturally attracted members from their predecessors until they were displaced in popular favor by other new creations on the same plan. Whatever differences of opinion may now exist among fraternalists as to the need of the systems at the present time, they all agree that the old assessment system has been a failure, and should be superseded by rates based on the recognized mortality tables. The newer organizations profited by the experience of the older societies, and generally started with higher rates, and this fact has made it much easier for them to provide for their deficiencies. A large number of the younger organizations are, and for some years have been, charging adequate rates, and the protection they furnish is as safe as the insurance supplied by any insurance company.

The real basis of the fraternal system in America is the fraternal bond of union, uniting the members together in a common cause for mutual beneficial and protective purposes. The lodge system requires meetings of the members at least once a month, and therefore directly tends to draw the members closer together. Every member thus participates in the work of the organization and the emulations aroused among the different lodges naturally produces the best results at the least outlay. Bread cast upon the waters will return, and it is the act of casting that produces that wonderful change in the human heart, which constitutes the return. A mother is fonder of her offspring than the father, and both parents love a crippled child more than the sturdy members of the flock, and the reason is the same. The mother suffers more and bears more than the father, and both do more for the cripple than for the healthy child. No one ever did a good deed, or thought to do a good act without feeling the better for it, and thus no person ever did or can participate in the good work that the various lodges of the fraternities are engaged in without growing to love the work and the organization which does the work. This ennobling influence upon the membership is not by any means the least of the many blessings conferred upon the American people by the fraternal system. This same influence naturally impels the members to labor without compensation for the growth and prosperity of the organization and thus at a low cost produce results beyond the dreams of avarice to the insurance companies.

Every society is required to have a representative form of government and is governed by its constitution and laws, as enacted, or from time to time amended, by the constituted authorities. Its constitution and laws therefore constitute the contract between the members in their relations to the society. The protection furnished by such societies is not insurance in the ordinary sense, in which that word is understood and used. No society can issue a certificate in favor of a creditor of the member and the benefits furnished under the certificate cannot be attached for the debt of the member. The beneficiaries are limited to husband or wife, affianced husband, or affianced wife, or, some heir, blood relative, or dependent of the member. In insurance anyone having an insurable interest in the life of the policy holder may be named as beneficiary while under a fraternal certificate the beneficiary is limited by the bonds of affection and duty. In the one case a beneficiary has a vested interest in the policy and it cannot be changed without her consent, while in the other the beneficiary has no vested rights whatever until the claim matures; and the member may have his certificate changed in favor of another beneficiary without her knowledge or consent.

Among the prominent large fraternal societies in the United States are the Odd Fellows, founded in 1810; Knights of Honor 1873; Knights of Pythias 1877; and Royal Arcanum 1877. The insurance paid by these varies from $500 to $3,000. There are numerous other societies conducted on the same principle. According to the reports of the supreme bodies of these organizations for 1904, the membership of the principal fraternal organizations in the United States and Canada was as follows:

Odd Fellows	1,341,375
Freemasons	1,011,655
Modern Woodmen of America	700,359
Knights of Pythias	594,883
Ancient Order of United Workmen	423,015
Knights of the Maccabees	375,000
Improved Order of Red Men	355,662
Royal Arcanum	303,597
Foresters of America	299,081
Independent Order of Foresters	224,000
Woodmen of the World	217,128
Ancient Order of Hibernians	193,832
Benevolent and Protective Order of Elks	190,000
Order of Eagles	165,000
Junior Order of United American Mechanics	130,977
Ladies of the Maccabees	140,000
Knights of the Modern Maccabees	127,000
Knights of Columbus	122,645
Ladies Catholic Benevolent Association	87,400
Tribe of Ben Hur	85,267
Knights and Ladies of Honor	76,761
Court of Honor	70,426
Knights of the Golden Eagle	69,385
National Union	69,000
Improved Order of Heptasophs	62,860
Catholic Mutual Benefit Association	58,035
Protected Home Circle	56,000
Knights of Honor	52,600
Brotherhood of American Yeomen	47,025
Order of B'rith Abraham	46,234
Order of Gleaners	46,000
United Order of American Mechanics	42,691
New England Order of Protection	39,098
Ancient Order of Foresters	38,898
Sons of Temperance	34,789
Independent Order of B'nai B'rith	31,500
Catholic Benevolent Legion	28,000
Knights of Malta	28,000
Smaller organizations	284,541
Total	8,278,779

All the older associations operate on what is known as grand jurisdictions, consisting of representatives elected by the subordinate lodges within the limits of the grand jurisdiction. It in turn sends delegates to the supreme body, which is the highest authority in the organization. As a general rule the supreme body assumes all liability for death or disability payments that are permanent in their nature, and the subordinate lodges assume and pay the sick or other temporary disability benefits. Each member pays his share of all benefits through the local lodge, of which he is a member, the dues going to the supreme office, being remitted direct, and not through the grand jurisdiction. As a rule the grand jurisdiction covers a State, and has supervision over the growth and general management of all the lodges within its territory. Of late years the tendency has been to do away with the plan of grand jurisdictions and have the supreme body composed of delegates elected either directly by the lodges or by districts composed of a number of lodges. The officers are usually elected by the supreme body, but in some cases are elected by a direct vote of the members.

To sum up in a word: a fraternal society is a brotherhood of members, bound together by its fraternal bond of union. It is organized and carried on for the sole benefit of its members and their beneficiaries. It operates on the lodge system, and uses a ritual in the meetings of its lodges and the initiation of its new members. It has a representative form of government, in which the management is responsible to the members for the faithful performance of their duties. It is governed by a constitution and laws enacted by the representatives of its members, and it furnishes its members, in all the States, with protection in case of death, and in many of the States with protection in case of disability resulting from illness, accident and old age, after the expectancy of life, and in some of the States with still more liberal benefits. See INSURANCE, FRATERNAL, and the articles on the different fraternal organizations.

FREDERICK GASTON,
President the Grand Fraternity.

Frater'nities, religious societies for pious practices and benevolent objects. They were often formed during the Middle Ages, from a desire of imitating the holy orders. From the 12th to the 15th century nothing was considered more meritorious than to form and belong to such orders. The laity, who did not wish to pronounce the monastic vows, entered into associations in order to gain some of the advantages of the religious even in their worldly life. These societies were at first formed without any ecclesiastical interference, and on this account many of them, which did not obtain or did not seek the acknowledgment of the Church, had the appearance of separatists, which subjected them to the charge of heresy. The pious fraternities which were formed under the direction of the Church, or were acknowledged by it, were either required by their rules to afford assistance to travelers, to the unfortunate, the distressed, the sick, and the deserted, on account of the inefficiency of the police, and the want of institutions for the poor, or to perform certain acts of penitence and devotion. Of this description were the Fratres Pontifices, a brotherhood that originated in Tuscany in the 12th century, where they maintained establishments on the banks of the Arno, to enable travelers to cross the river, and to succor them in case of distress. A similar society was afterward formed in France, where they built bridges and hospitals, maintained ferries, kept the roads in repair, and provided for the security of the highways. A bridge of 18 arches over the Rhône at Avignon, built by St. Bénézet in 1177, and another of 22 arches over the same river at Pont St. Esprit, built between 1265 and 1309, were among their greatest achievements in bridge-building. They gradually amassed great wealth by alms and gifts. In 1519 they were secularized on account of the abuses that had crept into the order.

Similar to these were the Knights and Companions of the Santa Hermandad in Spain; the Familiars and Cross-bearers in the service of the Spanish Inquisition; the Calender Brothers in Germany; the Alexians in Germany, Poland, and the Netherlands, etc. The professed object of the Alexians was to visit the sick and imprisoned; to collect alms for distribution; to console criminals, and accompany them to the place of execution; to bury the dead, and to cause masses to be said for those who had been executed, or for persons found dead. They derived their name from Alexius, their patron saint, and were at first principally composed of persons from the lower classes of the people in the Netherlands. They were afterward increased by the addition of the female branch, the Black Sisters. Although lay brothers they had houses, and formed their order into two provinces under an ecclesiastical government. They still exist, in the societies for burying dead bodies, in Antwerp, Utrecht, and Cologne. The Brothers of Death, of the order of St. Paul, were dressed in black, like the Alexians, and were distinguished by a death's head on their scapulary. They were suppressed by Pope Urban VIII.

There were also Gray Penitents (an old fraternity of an order existing as early as 1264 in Rome, and introduced into France under Henry III.), the black fraternities of Mercy and of Death; the Red, the Blue, the Green, and the Violet Penitents, so called from the color of their cowl; the divisions of each were known by the colors of the girdle or mantle. The fraternity of the Holy Trinity was founded at Rome in 1548 by Philip de' Neri for the relief of pilgrims and the cured dismissed from the hospitals. The Brothers of the Christian Schools are a fraternity founded near the end of the 17th century, the statutes of which were approved by Benedict XIII. Their labors have been of great service in the cause of elementary and secondary education in France, though their work is not confined to France but extends over a large part of the world, including Belgium, North and South America, and England. They take religious vows, wear a suit of clerical dress, and always work in pairs. In Ireland there is a body of Christian Brothers modeled on the French one, the first of its schools having been opened at Waterford in 1804. Their schools have spread over Ireland, and their system of education has received the approval of various Royal Commissions.

The Brothers of Common Life, founded at Deventer in Holland by the celebrated theologian, Gerald Groot, toward the end of the 14th century, and formally approved by Gregory XI. in 1376, were a fraternity which performed great services to learning, especially theological learning. From Holland they spread rapidly over Germany, and increased so greatly in numbers that 500 houses belonged to the order in 1460. The Roman Catholic Church is indebted to it for a text of the Latin version of the Bible by St. Jerome, most carefully prepared by a collation of the most ancient manuscripts. This text was consulted as an authority by the editors of the Bible prepared at the command of Sixtus V. The same order prepared some texts of the Christian fathers.

The Brothers of Charity are another fraternity whose hospitals are found in the principal cities. It was founded by St. John de Dieu in Spain in 1540. Much better known in Great Britain are the Sisters of Charity (called also Gray Sisters, Daughters of Charity, Sisters of St. Vincent de Paul), a Roman Catholic order founded in 1634 at Paris by St. Vincent de Paul for the purpose of nursing the sick in hospitals. The sisters take vows of poverty, chastity, and obedience, besides a vow binding themselves to serve the sick. Besides conducting hospitals and nursing, they sometimes undertake the manage ment of poor schools. They attend the sick of every nation and religion. There is also a body of Irish Sisters of Charity, separate from the one just mentioned. See ORDERS, RELIGIOUS.

Fraternities, College. See GREEK-LETTER SOCIETIES.

Fraticelli, frăt-ĭ-sĕl'ī, a name applied to several heretic sects in the Middle Ages. They were generally opposed to existing ecclesiastical and social order and were similar to the Brethren of the Free Spirit, Beghards and other sects. They had no fixed place of residence. In 1260 to 1300 the Fraticelli made considerable progress and attracted more or less attention in northern Italy. They declared the existing Church as in a state of apostasy and looked upon poverty as an absolutely essential condition.

Fratricellians. See FRATICELLI.

Fraud, in law, all deceitful practices in defrauding or endeavoring to defraud, another of his known right, by means of some artful device, contrary to the plain rules of common honesty. It is condemned by the common law, and punishable according to the offense. All frauds and deceits for which there is no remedy by the ordinary course of law are properly cognizable in equity. Where a fraud can be clearly established, courts of law exercise a concurrent jurisdiction with courts of equity. Wherever fraud or surprise can be imputed to, or collected from, the circumstances, equity will interpose and grant relief against it. Where a person is party to a fraud, all that followed by reason of that fraud shall be said to be done by him. A party prejudiced by a fraud may file a bill in equity for a discovery of all its circumstances. Mere inadequacy of price alone is not a ground for a court to annul an agreement; but if there be such inadequacy as to show that the person did not understand the bargain he made, or was so oppressed that he was glad to make it, knowing its inadequacy, it will show a command over him which may amount to a fraud. If a person be fraudulently prevented from doing an act, equity will consider the act as done; and equity also relieves against bargains made under misconception of rights. In treaties, concealment of a material fact by one of the parties, in order to keep the other in ignorance, whereby to profit, is a gross fraud, and the contract will be set aside in equity. Constructive or legal fraud is applied to such acts or contracts as, though not originating in any actual evil design or contrivance to perpetrate a positive fraud or injury upon other persons, yet by their tendency to deceive or mislead other persons, or to violate public or private confidence, or to impair or injure the public interest, are deemed equally reprehensible with actual fraud, and are prohibited by law, as within the same reason and mischief as acts and contracts done *malo animo*. Gross criminal frauds are punishable by way of indictment or information. Frauds are not indictable at common law unless they be such as affect the public — as vending unwholesome provisions, or using false weights or measures; or by way of conspiracy; or unless they affect the crown or the administration of justice. See FRAUD, STATUTE OF; FRAUDULENT CONVEYANCES.

Consult: Browne, 'Construction of the Statute of Frauds' (1895).

Frauds, Statute of. Perhaps one of the most important statutes ever enacted in England or the United States was the Statute of Frauds (29 Charles II. ch. 3). It was passed in the year 1673. Its object is stated to be the "prevention of frauds and perjuries," and its effect is to make writing essential to the validity of many contracts or transactions. The most important sections are those relating to contracts; namely, the 4th and the 17th, almost every word of which has been the subject of numerous decisions. It is provided by the 4th section that no action shall be brought on the contracts therein mentioned unless the agreement or some note or memorandum thereof, shall be in writing and signed by the party to be charged therewith, or some other person thereunto by him lawfully authorized. The contracts referred to are the following: (1) Any special promise by an executor or administrator to answer damages out of his own estate; (2) any special promise to answer for the debt, default, or miscarriage of another person; (3) any agreement made upon consideration of marriage; (4) any contract or sale of lands, tenements, and hereditaments, or any interest in or concerning them; and (5) any agreement that is not to be performed within the space of one year from the making thereof. This section, however, does not make the contract null and void, but only unactionable. The 17th section has reference to sales of goods for the price (or value) of £10 and upward, which are "not allowed to be good" unless some memorandum of the bargain has been made in writing, or unless the buyer shall accept part of the goods so sold, and actually receive the same, or give something in earnest to bind the bargain, or in part payment. In the statutes of the American States the principal alteration made in these terms is by the specification of a different sum of money. The sum usually established is $50, but in some of the States it is $30, or $40. The importance of this statute has been so fully recognized in this country that it has been substantially re-enacted in every State in the Union, and in some of them its provisions have been made still more comprehensive and stringent. See FRAUD.

Fraudulent Conveyances, in law, a fraudulent conveyance is a conveyance the object, tendency, or effect of which is to defraud another not a party to such a conveyance, or the intent of which is to avoid some debt or duty due by or incumbent on the party making it. Conveyances of this character are declared invalid by two celebrated English statutes which have been substantially re-enacted throughout the United States with the same provisions. The first of these statutes was passed in the 13th year of the reign of Queen Elizabeth (1571), and commonly referred to as the statute 13 Eliz. ch. 5, and by it all fraudulent conveyances, gifts, or alienations of lands or goods whereby creditors might be in anywise disturbed, hindered, delayed, or defrauded of their just rights, are rendered utterly void; but the statute does not extend to any estate or interest in lands on good consideration, and *bona fide* conveyed to any person not having notice of such fraud. The second statute against fraudulent conveyances is the statute 27 Eliz. ch. 4, which was passed in 1585. It provides that the conveyance of any interest in lands for the intent and purpose to defraud and deceive subsequent *bona fide* purchasers of the lands for a good and sufficient consideration shall be utterly void. This statute differs from the one first mentioned in applying solely to lands, and in protecting the interests of purchasers instead of creditors; but it contains similar provisions declaring the validity of any previous conveyance if it be upon valuable consideration and to a *bona fide* purchaser. It has been held in England, in the interpretation of this statute, that if the previous conveyance be voluntary it is void as to a subsequent purchaser, even if he had notice before he received his deed that such a conveyance had been made. This doctrine has been generally rejected by the courts throughout the United States as unjust, and the principle adopted that the receipt of notice gives a person intending to purchase sufficient opportunity to protect his own interests, and if he is guilty of imprudence in accepting the conveyance he should receive no assistance from the courts. This appears to be the more unobjectionable doctrine. Voluntary conveyances are never set aside under either statute, as between the immediate parties, but only in favor of purchasers or creditors. See FRAUD.

Fraunhofer, Joseph von, yō'sĕf fōn frown'-hō-fĕr, German mathematician: b. Straubing, Bavaria, 6 March 1787; d. Munich 7 June 1826. In 1799 he was placed with a looking-glass maker and glass-grinder at Munich. After various vicissitudes he received an appointment as optician in the mathematical and mechanical institute of Reichenbach at Benedictbeurn, and in 1809 the mechanical part of the optical institute was chiefly under his direction. Ultimately he became one of the members of the firm under which the business was conducted. One of the most difficult operations of practical optics was to polish the spherical surfaces of large object-glasses accurately. Fraunhofer invented a machine which obviated this difficulty, and rendered the surface more accurate than it was left by the grinding. He invented also other grinding and polishing machines, and introduced many improvements into the manufacture of the different kinds of glass used for optical instruments, and which he found to be always injured by flaws and irregularities of various sorts. In 1811 he constructed a new kind of furnace, and on the second occasion when he melted a large quantity found that he could produce flint-glass, which, taken from the bottom of a vessel containing two hundredweight of glass, had the same refractive power as glass taken from the surface. He found that the English crown-glass and the German table-glass both contained defects occasioning irregular refraction. In the thicker and larger glasses there would be more of such defects, so that in larger telescopes this kind of glass would not be fit for object-glasses. Fraunhofer therefore made his own crown-glass. The cause which had hitherto prevented the accurate determination of the power of a given medium to refract the rays of light and separate the different colors which they contain was chiefly the circumstance that the colors of the spectrum have no precise limits, and that the transition from one to another is gradual and not immediate; hence, the angle of refraction cannot in the case of large spectra be measured within 10′ or 15′. To obviate this, Fraunhofer made a series of experiments for the purpose of producing homogeneous light artificially, and unable to effect his object in a direct way, he did so by means of lamps and prisms. In the course of these experiments he discovered that bright fixed line which appears in the orange color of the spectrum when it is produced by the light of fire. This line enabled him afterward to determine the absolute power of refraction in different substances. Experiments to ascertain whether the solar spectrum contains the same bright line in the orange as that produced by the light of fire led him to the discovery of the innumerable dark fixed lines in the solar spectrum, consisting of perfectly homogeneous colors. The importance of this discovery can scarcely be overestimated. It led to the invention and use of the spectroscope, to the science of spectroscopy, and to all our present knowledge of solar and stellar chemistry. Fraunhofer also made a variety of other important discoveries and inventions.

Fraunhofer Lines. See SPECTROSCOPE.

Fraxinus, frăk'sĭ-nŭs. See ASH.

Frazee, Lawrence Fisher, American inventor: b. New Brunswick, N. J., 22 May 1813; d. Jersey City, N. J., 10 Oct. 1896. He became connected with the New Brunswick Steamboat and Transportation Company about 1835; and continued with its successors, the Camden and Amboy, and the Pennsylvania railroad companies till his death. During the Civil War he had command of the transport Massachusetts. He was the inventor of numerous useful appliances.

Frazer, John Fries, American scientist: b. Philadelphia, 8 July 1812; d. there 12 Oct. 1872. Grandson Gen. Persifor Frazer of Revolution. Was graduated with highest honors at the University of Pennsylvania in 1829, and afterward completed courses in both law and medicine. With Professor A. D. Bache he made the first researches on magnetics in the United States. In 1836 he became one of the two assistants on the First Geological Survey of Pennsylvania. After filling for some time a professorship in the Philadelphia High School, in 1844 he succeeded Professor Bache, as professor of natural philosophy and chemistry in the University of Pennsylvania, serving until his death; and from 1855–68 also as vice provost. In 1857 he received the degree of LL.D. from Harvard. He was an active member of the American Philosophical Society (its vice-president in 1855), the Academy of Natural Sciences, and the Franklin Institute (the editor of its journal from 1850 to 1866), and one of the charter members of the National Academy of Sciences.

Frazer, Persifor, American geologist, son of preceding: b. Philadelphia, 24 July 1844. After graduation (1862) from the University of Pennsylvania, served during Civil War in the South Atlantic squadron (1862–63) as aide, United States coast survey; in the cavalry during Gettysburg campaign, and as ensign in the navy to the end. Was mineralogist and metallurgist to the United States geological survey (1869–70), professor of chemistry in the University of Pennsylvania (1870–74), assistant geologist second geological survey of Pennsylvania, 1874–82. He was the first foreigner to receive the degree of Docteur ès-Sciences Naturelles from France, which also gave him the decoration of the golden palms of the Academy. He served as vice-president, representing the

United States in the International Geological Congress of 1888 (London), and of 1897 (St. Petersburg). He has written extensively for scientific periodicals, published five volumes of Reports of the Geological Survey of Pennsylvania; 'Tables for the Determination of Minerals' (1874); and 'Bibliotics, or the Study of Documents' (1894).

Fraziers Farm, Battle of. See GLENDALE, BATTLE OF.

Frear, Walter Francis, American jurist: b. Grass Valley, Cal., 29 Oct. 1863. He was graduated at Yale University in 1885, and at the Yale Law School in 1890; was made second judge of the first circuit court of Hawaii, in January 1893, first associate justice in the supreme court of the Republic of Hawaii in January 1896. He was a member of the commission to recommend to Congress legislation for Hawaii, in August, 1898, became chief-justice of the Supreme Court of Hawaii in July 1900 and governor in 1907. He is the author of 'Evolution of the Hawaiian Judiciary'; etc.

Frechette, Louis Honoré, loo-ē ō-nō-rā frā-shĕt, French Canadian poet: b. Levis, Quebec, 16 Nov. 1839. He has edited several French Canadian journals and in 1889 became clerk of the Legislative Council of Quebec. His lyrics have been much admired both for their form, and sincerity of passion. His published books include: 'Mes Loisirs' (1863); 'La Voix d'un Exilé' (1869); 'Pêle Mele' (1877); 'Les Fleurs Boreales,' crowned by the French Academy (1880); 'Les Oiseaux de Niège' (1880); 'La Legende d'un Peuple' (1887); 'Les Feuilles Volonte' (1891); 'Veronica,' a drama; and in prose 'Lettres à Bastile' (1872); 'Histoire Critique des Rois de France' (1881); 'Originaux et Detraques' (1893); 'Lettres sur l'Education' (1893); 'La Noël au Canada' (1900).

Freckles, brownish-yellow spots of a circular form on the human skin. They are due to excess of pigmentary matter in the cells of the cuticle, immediately above the true skin, and only appear on those exposed surfaces, as the neck, face, hands, and arms. They are sometimes congregated in thick clusters which give to the features an unsightly appearance. Sometimes freckles are hereditary, appearing soon after birth, and continuing through life, or subsiding or vanishing altogether. This affection is most common as well as most persistent in persons of fair complexion and hair, and especially so in those with red hair. There can be no doubt that exposure to the sun increases the disfigurement.

Frederic, Harold, American journalist and novelist: b. Utica, N. Y., 19 Aug. 1856; d. London, England, 19 Oct. 1898. He was for many years London correspondent of the New York *Times*. His writings include: 'Seth's Brother's Wife' (1887); 'The Lawton Girl' (1890); 'In the Valley' (1890); 'The Return of the O'Mahoney' (1892); 'The New Exodus' (1892); 'The Copperhead,' a tale of the Civil War (1895); 'Marsena' (1895); 'The Damnation of Theron Ware' (1896); 'March Hares,' a study of contemporary social life (1896); 'Gloria Mundi' (1898); 'In the Market Place' (1899).

Fredericia, frĕd-ĕ-rĭsh'ē-ă, Denmark, seaport, on the coast of Jutland. It was at one time well fortified, but the forts have not been kept in repair. The chief exports are eggs, meat, fish, cheese, and butter; the chief imports are cotton and woolen goods, fruit, salt, and petroleum. Pop. (1900) 12,700.

Frederick I., king of Denmark and Norway: b. 3 Sept. 1471; d. 10 April 1533. He succeeded his nephew Christiern (or Christian) II., on the deposition of the latter, in 1523, and entered into an alliance with Gustavus I., king of Sweden. After taking Copenhagen, he gained over all the nobility, and introduced Lutheranism into his dominions.

Frederick II., king of Denmark, the son and successor of Christian III.: b. 1534; d. 1588. He ascended the throne in 1559. He was a great friend of learning, and was a patron of Tycho Brahe and other men of science. He waged a long war with Sweden, which ended in 1570.

Frederick III., king of Denmark: b. Hadersleben, Schleswig, 18 March 1609; d. Copenhagen 9 Feb. 1670. He succeeded his father Christian IV., in 1648. The most remarkable event of his reign was his changing of the constitution from an elective to an hereditary monarchy.

Frederick IV., king of Denmark: b. Copenhagen 11 Oct. 1671; d. there 12 Oct. 1730. He ascended the throne on the death of Christian V. in 1699. He leagued against Charles XII. of Sweden, who forced him to make peace; but when Charles fled to Turkey, Frederick drove the Swedes out of Norway, and concluded a favorable peace; retaining possession of the duchy of Schleswig.

Frederick V., king of Denmark: b. Copenhagen 31 March 1723; d. 14 Jan. 1766. He came to the throne in 1746. The character of his reign may be inferred from the following remark, which, on his deathbed, he made to his successor, Christian VII.: "It is a great consolation to me, my son, that I have not injured any person, and that my hands are not stained with one drop of blood."

Frederick VI., king of Denmark: b. Copenhagen 28 Jan. 1768; d. there 3 Dec. 1839. He ascended the throne in 1808, though, from 1784, he was associated in the government with his father, who had lost his reason. On his accession he had to repair the damages done by the English in their bombardment of Copenhagen in 1807, and to wage a war with the Swedes, who attempted to possess themselves of Norway. He succeeded in defeating them, and peace was signed at Jon Kœping, in 1899. Allying himself with Napoleon, Norway was, in 1814, given to Sweden, under Bernadotte; Pomerania and the isle of Rügen falling to Denmark. More tranquil times now arriving, Frederick devoted himself to the extension of the internal resources of his kingdom.

Frederick VII., king of Denmark: b. Copenhagen 6 Oct. 1808; d. Glücksburg 15 Nov. 1863. He ascended the throne in 1848. He was well known as an archæologist, publishing numerous works on the subject. On his death, the elder line of the house of Oldenburg became extinct.

Frederick I., surnamed **Barbarossa,** emperor of the Holy Roman Empire, son of Frederick, Duke of Suabia: b. 1121; d. June 1190. He was chosen to succeed his uncle Conrad III. in 1152. He was crowned at Aix-la-Chapelle a few days after his election. His great ambition was to secure the independence of the empire, and, above all, to be master of Italy. His first expedition to Italy was made in 1154, when, after subduing several towns in Lombardy, he went to Rome, and, after some delays, had himself crowned emperor by Adrian IV. He marched again into Italy in 1158, took Brescia and Milan, and at the celebrated Diet at Roncaglia assumed the sovereignty of the towns and received the homage of the lords. On his return to Germany he triumphed over Bohemia, and made Poland tributary to the empire. After the death of Pope Adrian, Frederick had three anti-popes in succession elected in opposition to Alexander III., who excommunicated him and his pope, Victor. The same year, 1160, he besieged and took Crema, after a most courageous defense. In 1162 he conquered Milan, and had many of the public buildings destroyed, as well as parts of the fortifications; after which the other towns of Lombardy submitted to him. In 1166, he traversed the Romagna, levied contributions on the towns, besieged Ancona, and had himself crowned a second time at Rome by the anti-pope, Pascal. A fresh league being formed against him, he put its members under the ban of the empire and returned to Germany. In 1174 he besieged unsuccessfully the newly founded town of Alessandria, and in the following year was totally defeated by the Milanese at Como. Soon after he made peace with the Pope and the towns of Lombardy. In 1188 he assumed the cross, set out in the following year on the third crusade, was opposed on the march by the Greek emperor and the sultan, arrived in Asia, and was drowned while crossing a river. Frederick was great, not only as a soldier, but as a ruler. His administration was marked by justice, his subordinate officers were chosen for their capacity and probity, he was himself an educated man and promoted education and literature. His memory is still cherished among the peasants of Germany, who dream of the return of Fritz Redbeard, as the Welsh did of King Arthur. Consult: Prutz, ‘Kaiser Friedrich I.’ (1871–3); Fischer, ‘Kreuzzug Friedrichs I.’ (1870).

Frederick I., first king of Prussia (Frederick III. as elector of Brandenburg): b. Königsberg 22 July 1657; d. Berlin 25 Feb. 1713. He succeeded his father in 1688, entered into the alliance against France, and seized Bonn and other towns, sent auxiliaries to the emperor against the Turks, and, after a dispute of some years, sold to the emperor the circle Schwiebus, which the Great Elector had acquired in exchange for the principalities of Liegnitz, Brieg, and Wohlau. He supported the emperor in the war of the Spanish Succession, and in 1701 obtained from him the title of king, which he had long coveted. Frederick gratified his love of pomp in the ceremony of his coronation at Königsberg, the cost of which exhausted his treasury for a time. He placed the crown on his head with his own hands. In 1694 he founded the University of Halle; two years later the Berlin Academy of Painting; and, in 1707, he established the Academy of Sciences, Berlin, and made Leibnitz first president.

Frederick I., William Charles, duke (1797–1803), elector (1803–6), and king (1806–16) of Würtemberg: b. Treptow, Pomerania, 6 Nov. 1754; d. 30 Oct. 1816. He was a son of Sophia Dorothea, niece of Frederick the Great. In 1797 he became duke. His title of king, with a large accession of territory, he gained through an alliance with Napoleon. In 1806 he joined the Confederation of the Rhine; in 1809, 1812, and 1813 fought for Napoleon, but in 1813 took side with the allies.

Frederick I., William Louis, grand-duke of Baden: b. Karlsruhe 9 Sept. 1826; d. Mainau. He was the second son of Grand-duke Leopold. In 1856 he assumed grand-ducal powers. He restored the constitution 28 Sept. 1907; and devoted himself to the promotion of art and science and the spiritual and material interests of his realm. Though he took side with Austria in 1866, he later worked for the admission of Baden to the North German Confederation.

Frederick II., emperor of the Holy Roman Empire: b. Jesi 26 Dec. 1194; d. Viorenzuoli 13 Dec. 1250. He was elected king of the Romans in 1196, again after the death of his father, Henry VI., and a third time on the excommunication of Otho IV., in 1211. He was already king of Sicily and duke of Suabia, under the joint regency of his mother and Pope Innocent II. He made a league with Philip Augustus, king of France, and after the defeat of Otho by the latter at the battle of Bouvines, was crowned at Aix-la-Chapelle in 1215. He received the imperial crown at Rome in 1220, on which occasion he had to renew a vow previously extorted from him to take the cross. In 1225 he married Yolande, daughter of John of Brienne, king of Jerusalem, and in 1227 embarked for the Holy Land. Illness compelled him in a few days to land again, and for this he was excommunicated by Pope Gregory IX. He set out again in 1228, and the Pope exciting opposition to him, and invading his hereditary states, he at once concluded a truce with Kameel, the sultan of Egypt, by which he became master of Jerusalem. He entered the city, crowned himself (no priest daring to do it), and returned to Europe. He recovered his states, made peace with the Pope, and suppressed the revolt of his son Henry, who was then imprisoned for life. In 1235 Frederick began the war with the cities of Lombardy, having for his ally Eccelino, tyrant of Verona. After his victory of Cortenuova, he took Ravenna, Faenza, and Benevento; and, in 1241, his fleet defeated that of the Genoese, and captured the cardinals and bishops who were on their way to attend a council against him. Frederick promoted the election of Innocent IV., who had been his friend, and made a treaty with him; but soon found Innocent a most determined enemy. A new anathema and sentence of deposition, and release of his subjects from their allegiance to him, was published in 1245. The mediation of St. Louis utterly failed to bend the Pope to reconciliation. Rival emperors were set up, the war in Italy continued, Parma was lost in 1248, his son Enzio was defeated and made prisoner in the following year. Frederick was the most accomplished sovereign of the Middle Ages; but his strong sympathies with his Italian motherland, and his unremitting endeavors to establish a compact and all supreme empire in Italy, were the causes not only of his own misfortunes but of the miseries which he brought on the German empire by embroiling him in costly wars abroad, and leading him to neglect the welfare and sacrifice the interests of his German subjects.

Frederick II., landgrave of Hesse-Homburg, called "Prince of Homburg": b. 9 June 1633; d. 24 Jan. 1708. He fought bravely at Copenhagen (January 1659), where his leg was shot away and its silver substitute gained him the sobriquet "mit dem silbernen Bein." In 1670–8 he was a general of cavalry in the army of Frederick William, the great elector of Brandenburg, to whose victory over the Swedes at Fehrbellin (1675) he contributed the chief part. Having succeeded to power in 1681, he renovated the saline springs of Homburg, beautified the city, and made it prominent as a watering-place.

Frederick II., best known as **Frederick the Great**, king of Prussia: b. 21 Jan. 1712; d. Sans Souci 17 Aug. 1786. He was the son of Frederick William I., and the Princess Sophia Dorothea of Hanover. Though, by the direction of his father, he was instructed only in the details of military exercises and service, his taste for poetry and music was early developed by the influence of his first instructress, Madame de Roconles, and his early teacher, Duhan, who, countenanced by the queen, formed a secret opposition to his father's system of education. The prince's inclination led him to adopt entirely the views of his mother. This gave rise to a coolness between him and his father. Indignant at the oppression and hatred which he experienced from his father, Frederick determined to flee to the court of George II., king of England, his mother's brother. His sister Frederica and his friends, Lieuts. Katt and Keith, were the only persons entrusted with the secret of his flight. He was, however, overtaken, was barbarously treated by his father, and obliged to be an eye-witness of the execution of his friend Katt.

While the prince remained in the closest confinement in Küstrin, the king sent a proposal to him to renounce the succession in favor of his younger brother Augustus William, on condition that he should have the liberty of pursuing his own inclinations in regard to his studies, traveling, etc. "I accept the proposal," said the prince, "if my father declares that I am not really his son." On this answer the king, who looked on conjugal fidelity with religious respect, relinquished his plan. That the king was inclined to sentence his son to death is certain. But the provosts Reinbeck and Seckendorf, who had before intrigued against the prince, now saved his life; the latter, in particular, by availing himself of the interference of the emperor.

The prince was not admitted to court till on the occasion of the nuptials of his sister Frederica, and was obliged by his father in 1733 to marry the Princess Elizabeth Christina, daughter of Ferdinand Albert, duke of Brunswick-Bevern. Frederick William gave the castle of Schönhausen to her, and to the prince the county of Ruppin, and in 1734 the town of Rheinsberg, where he lived devoted to study till he ascended the throne. Among his daily visitors were literati, musicians, and painters. He corresponded with foreign scholars, particularly with Voltaire, whom he greatly admired. Several of his writings, in particular his 'Antimacchiavel,' had their origin in the rural tranquillity of Rheinsberg.

The death of his father raised him to the throne 31 May 1740. Frederick on his accession found in his states a population of only 2,240,000. At his decease he left 6,000,000. He raised Prussia to this pitch of greatness by his talents as a legislator and general, assisted in the field and in the cabinet during a reign of 46 years by many distinguished men. Frederick II., who had already excited great expectations, retained for the most part the institutions and laws of his father, but gave to the latter more extent and vigor. The death of the Emperor Charles VI. was a favorable moment, of which Frederick II. took advantage, to revive the claims of the house of Brandenburg with regard to the Silesian principalities, so far as to ask from the queen, Maria Theresa, the duchies of Glogau and Sagan, in return for which he promised her assistance against all her enemies, his vote for the election of her husband as emperor, and 2,000,000 Prussian dollars. These proposals being rejected, he occupied Lower Silesia in December 1740, and defeated the Austrians 10 April 1741, near Molwitz. This victory which was almost decisive of the fate of Silesia, raised new enemies against Austria. France and Bavaria united with Prussia, and the war of the Austrian Succession commenced. The only ally of the queen of Hungary and Bohemia, George II. of England, advised her to make peace with Prussia, because Frederick II. was her most active and formidable enemy. After the victory of Czaslau (Chotusitz), gained by Frederick 17 May 1742, the first Silesian war was terminated by the preliminaries signed at Breslau under British mediation (11 June), and by the peace signed at Berlin 28 July 1742. Frederick obtained Lower and Upper Silesia, and the larger part of the county of Glatz, with full sovereignty. On the other hand he renounced all claims to the other Austrian territories, assumed a debt of 1,700,000 Prussian dollars charged on Silesia, and promised to respect the rights of the Catholics in Silesia. Saxony acceded to this peace, of which England and Russia were the guarantees.

Frederick II. seized the opportunity of a peace to introduce useful institutions into the conquered territories, and to render his army more formidable. In 1743 on the death of the last Count of East Friesland, he took possession of that country, the reversion of which had been granted to his family in 1644 by the emperor. The war of the Austrian Succession continued; the Emperor Charles VII. was driven from his hereditary estates of Bavaria, and the Austrians were everywhere victorious. Frederick, apprehensive that an attempt would be made to recover Silesia, entered into a secret alliance with France (April 1744), and with the emperor, the palatinate, and Hesse-Cassel, in Frankfort (22 May 1744). He promised to support the cause of the emperor by the invasion of Bohemia, on condition that he should receive the circle of Königgrätz. He entered Bohemia suddenly, 10 Aug. 1744, and captured Prague; but the Austrians and Saxons compelled him to evacuate Bohemia before the close of the year. The death of the emperor (18 Jan. 1745), and the defeat of the Bavarians at Pfaffenhofen, obliged Maximilian Joseph, the young elector

FREDERICK THE GREAT,

ONE OF THE STATUES PRESENTED TO HARVARD UNIVERSITY BY EMPEROR WILLIAM II.

of Bavaria, to conclude the Peace of Fuessen with Maria Theresa, and occasioned the dissolution of the Alliance of Frankfort, after Hesse-Cassel had already declared itself neutral. The victory of the Prussians over the Saxons at Kesselsdorf, 15 Dec. 1745, led to the Peace of Dresden (25 December). Frederick retained Silesia, acknowledged the husband of Maria Theresa, Francis I., as emperor, and Saxony promised to pay 1,000,000 Saxon dollars to Prussia.

During the 11 following years of peace Frederick devoted himself with the greatest activity to the domestic administration, to the improvement of the army, and at the same time to the Muses. It was at this time that he wrote his 'Mémoires pour servir à l'Histoire de Brandenbourg,' his poem, 'L'Art de la Guerre,' and other works in prose and verse. He encouraged agriculture, the arts, manufactures, and commerce, reformed the laws, increased the revenues of the state, perfected the organization of his army which was increased to 160,000 men, and thus improved the condition of the state.

Secret information of an alliance between Austria, Russia, and Saxony gave him reason to fear an attack and the loss of Silesia. He hastened to anticipate his enemies by the invasion of Saxony, with which the Seven Years' War, or third Silesian war, commenced. The Peace of Hubertsburg (15 Feb. 1763), terminated this war, without any foreign interference, on the principle that the contracting parties should remain in *statu quo*. Frederick came out of the Seven Years' War with a reputation which promised him in the future a decisive influence in the affairs of Germany and Europe. His next care was the relief of his kingdom, drained and exhausted by the contest. He opened his magazines to furnish his subjects corn for food and for sowing. To the peasants he distributed horses for plowing, rebuilt at his own expense the houses destroyed by fire, established new settlements, built manufactories, and laid out canals. In 1764 Frederick founded the Bank of Berlin, with a capital of 8,000,000 Prussian dollars.

A treaty was concluded with Russia (31 March 1764), in consequence of which Frederick supported the election of the new king of Poland, Stanislaus Poniatowski, and the cause of the oppressed Dissidents in Poland. For the purpose of connecting Prussia with Pomerania and the Mark, and of enlarging and consolidating his territories, Frederick consented to the first partition of Poland proposed at St. Petersburg and concluded 5 Aug. 1772. Frederick received the whole of Polish Prussia (which had been ceded to Poland by the Teutonic Order in 1466) with the part of Great Poland to the river Netz, excepting Dantzic and Thorn. From this time the kingdom of Prussia was divided into East and West Prussia. He declared against the possession of a large part of Bavaria by Austria in 1778, after the death of Maximilian Joseph, elector of Bavaria, without issue, but Austria was not to be diverted from her designs by negotiations. Saxony, therefore, formed an alliance with Prussia and Frederick invaded Bohemia with two armies (July 1778). The Emperor Joseph, in a strongly fortified camp behind the Elbe, could not be induced to give battle. The aged Empress Maria Theresa wished for peace. But Catharine II. having declared her intention of assisting Prussia with 60,000 men, this war of the Bavarian Succession was terminated without a battle by the Peace of Teschen (13 May 1779). Austria consented to the union of the principalities of Franconia with Prussia, and renounced the feudal claims of Bohemia to those countries. In the evening of his active life Frederick concluded, in connection with Saxony and Hanover, the confederation of the German princes, 23 July 1785.

Frederick left to his nephew, Frederick William II., a kingdom increased by 29,000 square miles, more than 70,000,000 Prussian dollars in the treasury, an army of 200,000 men, great credit with all the European powers, and a state distinguished for population, industry, wealth, and science. Improved by severe experience before he ascended the throne, and possessed of rare talents, Frederick shook the political system of Europe when he conceived and established, in accordance with the wants of his time, the confederation of princes, the master-work of his policy. One of his great merits is that in the most difficult circumstances he contracted no public debts, but on the contrary, though he distributed a considerable part of his revenues in different ways among his subjects, he had a richer treasury than any monarch in Europe ever possessed. His contempt for ecclesiastical establishments, which was considered by his contemporaries as a contempt of religion, has been censured, and his writings show that his heart was a stranger to the highest sentiments of piety. Entirely unacquainted with the literature and mental cultivation of Germany, he underrated it, and contributed nothing to its improvement.

Some of Frederick's writings were published during his lifetime, but most of them appeared first in the 'Œuvres Posthumes' (1788–9). In 1846–57 the Berlin Academy published a critical edition of the whole, together with his literary and private correspondence, under the title 'Œuvres de Frédéric le Grand' (31 vols.).

Consult Loryman, 'Frederick the Great and the Seven Years' War' (1881); Carlyle, 'History of Frederick II.' (1858–65); Tuttle, 'History of Prussia under Frederick the Great' (1888); Lavisse, 'La jeunesse du grand Frédéric' (1891); Lavisse, 'Le grand Frédéric avant l'événement' (1893); Koser, 'Friederich der Grosse als Kronprinz' (1901).

Frederick II., landgrave of Hesse-Cassel: b. 14 Aug. 1720; d. Castle Weissenstein, Wilhelmshöhe, 31 Oct. 1785. He ascended the throne in 1760. By the aid of his architect, Du Ruy, he greatly beautified his capital, in which he founded the Collegium Carolinum, the museum, the library, and an academy of painting and sculpture. He sold a corps of 12,000 troops to England for service in America during the Revolution; whence, in the patriot mind, a stigma attached to the name "Hessian."

Frederick III., emperor of the Holy Roman Empire: b. Innsbruck 21 Dec. 1415; d. Linz 19 Aug. 1493. He was elected emperor in 1440 and ruled for 53 years, the longest German reign. His sobriquet was "the Pacific," owing to his plans for the pacification of the empire.

He left it to his son Maximilian to carry out the device inscribed upon his palaces and books, A, E, I, O, U; which characters are generally supposed to represent the motto, *Austriæ est Imperare Orbi Universo* ("Austria is to rule the world").

Frederick III. (the Wise), elector of Saxony: b. Torgau 17 Jan. 1463; d. 5 May 1525. He succeeded his father, Ernest, and is known chiefly as founder of the University of Wittenberg, and as the friend and very cautious protector of Luther, one of the first professors of the new university. It was by his arrangement that Luther, after the Diet of Worms, was seized and carried off to Wartburg. He did not, however, establish the reformed faith in his dominions. He became administrator of the empire in 1519, and was offered the imperial crown, but declined it.

Frederick III., king of Prussia, second emperor of modern Germany: b. Potsdam 8 Oct. 1831; d. 15 June 1888. He married in 1858 the Princess Royal of England, the eldest daughter of Queen Victoria. He early entered the army of Prussia, and when the latter declared war against Austria in 1866 the crown prince, as he was called, became commander of the army of the Oder. By a series of rapid marches from Silesia through the Sudetic mountain passes into Bohemia his army arrived just in time to aid Prince Frederick Charles and snatch the decisive victory of Sadowa. At the outbreak of the Franco-German war he commanded the third German army, which numbered 200,000 men, and with these he advanced to attack the French under MacMahon. The first assault was made at Weissenburg (4 August), and two days later he successfully turned the French defense at Woerth, causing the disorderly retreat of MacMahon's army. He pressed northward closely after MacMahon, and the passage of the Meuse by the Germans under his command greatly contributed to the successful turning of the French advance, and the final surrender at Sedan. This accomplished, he pushed on to Paris, and after surrounding the city established his headquarters at Versailles, where he remained until the capitulation in January 1871. In 1887 he was attacked by a throat disease, and while undergoing treatment for this his father died, and he became emperor in March 1888. The announcement of his own death three months later was received with wide regret, for his renown as a military commander, his liberal views, his large-heartedness, and his resignation under suffering, had touched his personality with the rarest heroic qualities.

Frederick III., elector of Brandenburg. See FREDERICK I. OF PRUSSIA.

Frederick V., elector-palatine and king of Bohemia: b. Amberg 1596; d. Mentz, Germany, 19 Nov. 1632. He succeeded his father, Frederick IV., in 1610. In 1618 he married the Princess Elizabeth, daughter of James I. of England, and in the following year accepted the crown of Bohemia. He made a triumphal entry into Prague, followed in 1620 by his total defeat by the Imperial forces at the battle of Prague, and the loss of his kingdom and hereditary states. He then took refuge in Holland.

Frederick Augustus II., elector of Saxony and king of Poland. See AUGUSTUS II.

Frederick Augustus III., elector of Saxony and king of Poland. See AUGUSTUS III.

Frederick Charles, Prince of Prussia: b. Berlin 20 March 1828; d. Castle of Klein-Ghericke, near Potsdam, 15 June 1885. He was a son of Frederick Charles Alexander and nephew of William I. He was in command of the first Prussian army which made so vigorous a resistance, and, aided by the second army, which arrived opportunely, finally defeated the Austrians at the battle of Sadowa (Königgrätz). In the Franco-German war he commanded the second army, directed the siege-operations against Metz, and 28 Nov. 1870 defeated the army of the Loire.

Frederick, Christian August, duke of Schleswig - Holstein - Sonderburg - Augustenburg: b. Castle Augustenburg, island of Alsen, 6 July 1829; d. Wiesbaden 14 Jan. 1880. He was banished by Denmark in 1851, after having taken part in the insurrection as an officer of the general staff. Upon the conclusion, however, of the war between Denmark and Germany, he was proclaimed duke by a popular assembly at Elmshorn in 1864, and received allegiance at Kiel. But he was not destined to rule. The duchy, by the terms of the Treaty of Vienna, fell to Austria and Prussia for disposal, and Prussia, through Bismarck, imposed upon Frederick conditions which he rejected. After the war with Austria, his domains were incorporated with Prussia. He took part in the Franco-German war as a Bavarian general on the general staff of the Prussian crown prince. His daughter, Augusta Victoria, was married to Prince William of Prussia, later William II., emperor of Germany.

Frederick Louis, Prince of Wales: b. Hanover, Germany, 6 Jan. 1707; d. Leicester House, London, 20 March 1751. He was the eldest son of George II. He became the leader of the Opposition, which was strongly against Walpole and styled itself the Patriot party. In the contest between Handel and Buononcini he was a partisan of the latter. At the outbreak of the rebellion of 1745 he sought, but did not obtain, the command of the royal army. His eldest son became King George III.

Frederick William I., king of Prussia: b. Berlin 15 Aug. 1688; d. Potsdam 31 May 1740. He commenced his reign in 1713, after having married the daughter of the elector of Hanover, afterward George I. of England. In 1715 he declared war against Charles XII. of Sweden, and in conjunction with Denmark took Stralsund; but on the death of Charles, in 1718, he made peace. The habits of this sovereign were entirely military, and he labored unweariedly to promote the discipline of his troops. One of his strongest peculiarities was an extraordinary love for tall soldiers; and in order to procure them had agents employed in all parts of Europe. He held science and literature in profound contempt; but money he worshipped, and men of a military character after his own ideal he respected and encouraged. The consequence was that he left an abundant treasury and a well-appointed army of 66,000 men. He was succeeded by his son Frederick the Great.

Frederick William I., last elector of Hesse: b. Philippsruhe 20 Aug. 1802; d. Prague 6 Jan. 1875. He succeeded to the throne in 1847. His reign was disturbed by conflicts with his people due to his efforts to disregard the constitution of 1831 and to limit popular representation. In 1866 he took sides with Austria in the war with Prussia, was deposed, and for a time imprisoned. In the same year Hesse was annexed to Prussia, in which the larger portion of it is now incorporated with the province of Hesse-Nassau.

Frederick William II., king of Prussia: b. 25 Sept. 1744; d. 16 Nov. 1797. He was the eldest son of Prince August William, brother of Frederick the Great, and ruled from 1786 to 1797. As the result of an interview at Pilnitz in 1791, he arranged with the emperor of Austria to interfere in aid of Louis XVI. of France. The ensuing campaign was an inglorious one, concluded by a retreat to the Rhine in the autumn of 1792. The war was ended in 1795, and Frederick William ceded to France Prussian territory west of the Rhine. From the second (1793) and third (1795) partitions of Poland he acquired large territory.

Frederick William III., king of Prussia: b. 3 Aug. 1770; d. 7 June 1840. He commenced his reign in 1797 by maintaining a strict neutrality in the various alliances with and against France, which resulted from the ambitious designs of Napoleon I. In 1805, however, he yielded to the solicitations of Russia, allying himself with the czar against the French emperor. The rapid campaign of 1806, and the defeat of the Prussians at Jena, opened the gates of Berlin to the enemy, in whose hands it remained till 1809. In 1807 the battle of Friedland led to the humiliating peace of Tilsit. Restored to his capital, the king diligently endeavored to repair the evils of war; but new disasters overtook him, and his kingdom suffered greatly during the struggle from 1812 to 1814. He subsequently joined his troops with those of Russia. The allies having triumphed over the French at Leipsic, Frederick William in 1814, entered Paris with Czar Alexander. On the return of Napoleon from Elba, he once more joined the allies. After the victory of Waterloo, in which the Prussians, under Blücher (q.v.) played an important part, Prussia, once more at peace, gradually recovered the losses she had sustained, under the wise and paternal sway of Frederick, whose constant efforts and moderation contributed greatly to the maintenance of peace. Throughout his life, he was a warm defender of the Protestant religion, and a patron of education. He never redeemed his promise, however, to bestow a representative constitution on his people. The establishment of the provincial estates only affected very slightly the absolute power, which, it is true, he wielded with ability, and with a kind of paternal affection for his people. It may finally be said of him, that, a waverer between the Absolutist party and the Liberal party, he secured, as is the lot of most undecided men, the respect and adherence of neither.

Frederick William IV., king of Prussia: b. 15 Oct. 1795; d. near Potsdam 2 Jan. 1861. On the death of his father Frederick William III. succeeded to the throne in 1840. He evinced, at an early period of his life, a very great love for the arts, which he preserved throughout his career. During the first years of his reign his subjects anxiously demanded the reform of the government, requiring the liberal constitution which had been promised them in 1815, in return for the great sacrifices they had made during the continental war. In 1847, at a general diet of the Prussian states, many of these reforms were granted, and it was thought that the kingdom might escape the troubles of the next year's revolution. In March 1848, however, the king was obliged to change the ministry, to issue a general amnesty, and commence a war in favor of Schleswig against Denmark. In the war between the western powers and Russia, the king preserved a strict neutrality, though earnestly solicited by each party to espouse its side in the conflict. In 1856, in consequence of an attack on Neufchâtel by some Prussian partisans, war was in danger of breaking out between Switzerland and Prussia; but this was avoided, and a treaty concluded, in May 1857, in reference to the king's claims on that place. In the complication relative to the Danubian principalities, Prussia followed the lead of France and Russia as opposed to England and Austria. Toward the end of 1857, a severe illness, resulting in the loss of some of his faculties, caused his brother William to be nominated regent, who succeeded him as king.

Frederick William, duke of Brunswick: b. Brunswick 9 Oct. 1771; d. at Quatre-Bras 16 June 1815. He entered the Prussian military service in 1788, and in 1800 was commissioned major-general. With a Bohemian volunteer corps he invaded Saxony, and with Austrian reinforcements took Dresden and Leipsic. After the armistice of Znaim, he defeated Reubel's corps, 6,000 strong, at Oelger, near Brunswick, finally arrived at Elsfleth and Brake, seized all available shipping, and embarked for England, where he was received with demonstrations of enthusiasm. He participated in the Peninsular war, and returned only after the battle of Leipsic (1813). He was shot while leading an attack at Quatre-Bras.

Frederick William, elector of Brandenburg, called the Great Elector: b. 16 Feb. 1620; d. Potsdam 29 April 1688. He succeeded his father when the unhappy Thirty Years' war was still raging in Germany, and his conduct toward both parties was prudent. In 1641 he concluded a treaty of neutrality with Sweden, notwithstanding the earnest remonstrances of Austria. In 1644 he concluded an armistice with Hesse-Cassel, by which Cleves and the county of Mark were restored to him, and by the Peace of Westphalia in 1648 received Madgeburg, Halberstadt, and Kammin. In the war between Poland and Sweden (in 1655) he was obliged to take part, on account of the duchy of Prussia. He supported both parties in turn, and obtained an acknowledgment of the independence of the duchy of Prussia from Poland, upon whom it was formerly dependent. In 1672 he concluded a treaty with the Dutch Republic, when this state was threatened by Louis XIV. On June 6, 1673, he concluded a treaty with France at Vossem, by which France promised to evacuate Westphalia, and to pay 800,000 livres to the elector, who, in return, broke off his treaty with Holland, and promised not to render any aid to the enemies of France. In 1674 the German empire declared war against France. In the following December a Swedish army, at the instigation of France, entered Pomerania and the Mark. The elector defeated them, 18 June 1675, at Fehrbellin. In 1678 he concluded a separate peace with France, at Nimwegen, as did also Holland and

Spain. France demanded the restoration of all the conquered territories to Sweden. The elector, having refused compliance, formed an alliance with Denmark, and waged a new war against Sweden, but was obliged to submit, by the Peace of St. Germain, 29 June 1679. Louis XIV. having occupied several circles of Alsace by his famous *chambres de réunion,* Frederick William effected an armistice of 20 years between France and Germany (in 1684). But when he renewed (1685) his treaty with Holland, and received into his dominions about 14,000 Protestant refugees from France, new difficulties arose between him and France, which brought him into a closer connection with Austria. He received the circle of Schwiebus in 1686, and in the same year sent 8,000 men to assist the Austrians against Turkey.

The elector paid great attention to the promotion of agriculture and horticulture, and, by affording protection to the French refugees, gained 20,000 industrious manufacturers. A colossal statue of Frederick William in bronze, at Berlin, was cast by Jacobi, in 1700, and is still one of the greatest ornaments of that city. Consult: Hitl, 'Der grosse Kurfürst und seine Zeit' (1893); Philippson, 'Der grosse Kurfürst' (1897–1902).

Frederick, Md., city, county-seat of Frederick County; on Carroll's Creek, and on the Pennsylvania, and the Baltimore & O. R.R.'s; 62 miles northwest of Baltimore. Here are Frederick College, Woman's College of Frederick, and the State institution for the deaf and dumb. The city has manufactories of coaches, leather, shoes, knit goods, shirt-waists, palmetto, fibre brushes, tobacco, etc., and an assessed property valuation of nearly $4,000,000. During the Civil War it was twice occupied by the Confederates, the second time, in 1864, by Gen. Early, who forced the citizens to pay a ransom of $200,000. In 1862 Federal troops under Gen. McClellan occupied the place. Pop. (1900) 9,296.

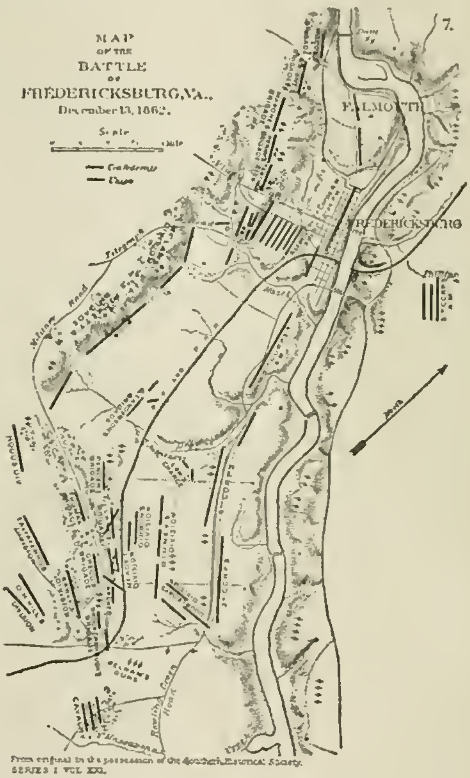
Fredericksburg, Tex., town, county-seat of Gillespie County; on the San Antonio & A. P. R.R.; 80 miles west of Austin. It was founded by a German colony in 1846. Pop. (1900) 1,532.

Fredericksburg, Va., city in Spottsylvania County; on the Rappahannock River, and the Richmond, F. & P., and the Potomac, F. & P. R.R.'s; 61 miles north of Richmond. It has tanneries, iron works, cigars, ice, and shoe factories, and an assessed property valuation of nearly $2,000,000. It was the scene of several battles during the Civil War and 15,300 graves of Confederate dead are in the National cemetery here. Pop. (1900) 5,068.

Fredericksburg, Battle of. At the beginning of December 1862 the Army of the Potomac, under command of Gen. Burnside, held the north bank of the Rappahannock River at Falmouth, Va., while the Confederate army, under Gen. Lee, held the south bank at and below Fredericksburg. The Army of the Potomac "present and equipped for duty" numbered 120,281 men, with 312 guns. Gen. Lee's army, strongly entrenched on a broken range of hills back of Fredericksburg, numbered (10 December) "present for duty" 78,513 men, with 270 guns.

The Army of the Potomac was organized into three grand divisions: The right, under Gen. Sumner, consisted of the Second corps, Gen Couch, the Ninth corps, Gen. Willcox, and Pleasonton's cavalry division; the centre, under Gen. Hooker, of the Third corps, Gen. Stoneman, Fifth corps, Gen. Butterfield, and Gen. Averell's cavalry division; the left, under Gen. Franklin, of the First corps, Gen. Reynolds, Sixth corps, Gen. Smith, and Gen. Bayard's cavalry brigade. Gen. Lee's army was divided into two wings, Gen. Longstreet commanding the left, and Gen. Jackson the right.

Burnside concluded to cross the river at and below Fredericksburg by pontoon-bridges. Under great difficulties, with annoyance from the enemy, the bridges were completed 11 December, troops



rushed over, and by night of the 12th Sumner and Franklin had crossed and taken position. Franklin, who was to open the battle by an attack upon the Confederate right, reinforced by Birney's and Sickles' divisions of the Third corps, and Burns' of the Ninth, had about 60,000 men. At 7.30 A.M. on the 13th, Burnside gave him orders to seize the heights at Hamilton's crossing. One of Franklin's smallest divisions, Meade's, led the attack, moving out at 9 o'clock; but owing to flank attacks and lack of immediate support, it was 1.15 P.M. before Meade drove the Confederates from the Richmond Railroad and, crossing it, charged up a ridge and into the woods, piercing the centre of A. P. Hill's first line; but when he had crossed the road that ran in rear of the crest he was attacked, front and flank, by Hill's second line and the reserves, and was driven back with a loss of over 40 per cent in killed, wounded, and captured. Gibbon, who had been thrown forward to support Meade's right, shared the same fate, being forced back, with a loss of 1,267 men. The Confederates then advanced beyond the railroad but were checked. Franklin made no further attempt to carry the ridge, but directed his attention to protecting his left, which he thought was seriously threatened. At 2.30 P.M., when Sumner was heavily engaged in front of Marye's Heights, Franklin received Burnside's order to attack with his whole force, but the order was not carried out. Franklin put but a small part of his command into the fight.

Sumner was held in position until after 11 A.M. in the expectation that Franklin would make such an impression upon Lee's right as would enable him to carry the line near the Telegraph and Plank roads. Feeling the importance of haste, Burnside now directed Sumner to begin his movement. In rear of the town, and between it and the heights that Sumner was to carry, was a broken plain, traversed about midway by a canal or ditch, running from right to left. Two roads cut the plain nearly at right angles with the canal; the Plank road on the right, the Telegraph road on the left, leading to Richmond. The advance was to be made on and between these two roads, over ground completely covered by artillery on the heights. McLaws' division held the heights to be assaulted, Cobb's and Kershaw's brigades being placed in the sunken Telegraph road, that ran at the base of the hill. On the side of the road next to the town was a stone wall, shoulder high, behind which Cobb's and Kershaw's men were well protected. The Second corps led in the attack. French's division moved out of the town by parallel streets, and at noon, under a severe artillery and musketry fire, had driven in the Confederate skirmishers and gained a rise of ground, within about 120 yards of the stone wall, from which and the top of the hill it received a most deadly fire. Hancock's division followed in support. At 1 P.M. Couch ordered French and Hancock to carry Marye's Heights. French sent in his three brigades in succession, but they were bloodily repulsed by the deadly fire from behind the stone wall. Hancock now ordered in Zook's brigade. It sprang forward, was joined by some shattered regiments of French's division, and when within 25 paces of the stone wall was repulsed with great loss. The Irish brigade and Caldwell's followed in succession, but failed to carry the position and, after losing one-half, fell back, and both French and Hancock continued, with parts of their commands, to hold the rise of ground near the stone wall. While Hancock's men were falling by hundreds, Howard was ordered to move his division to the right of the Telegraph road and turn the Confederate left, but as French and Hancock needed help, Howard was recalled and ordered in on the Telegraph road, and two divisions of the Ninth corps went in on Couch's left. All fought gallantly, but made no impression upon the Confederate line. French's loss was 1,160; Hancock's 2,032; Howard's 900; Sturgis' division of the Ninth corps lost 1,000, and Getty's division 290.

It was 2 P.M. when Hooker, riding in advance of the Fifth corps, came on the ground. After an examination of the position and conference with Couch and other general officers, he concluded that it would be a useless waste of life to make a further attempt and sent an aide to Burnside, giving his opinion. Burnside ordered him to attack. Hooker then rode to Burnside, across the river, and sought to impress upon him the hopelessness of the attempt, but Burnside reiterated the order to attack. Every available battery opened fire upon the Confederate position, and near sunset Humphreys led his division of the Fifth corps against Marye's Heights, Sykes' division moving on his right. Twice Humphreys led his men forward; some of them were killed within 20 yards of the stone wall; but he was repulsed with a loss of 1,000 men. Sykes, on his right, lost over 200, while Griffin's division, on the left, supporting the Ninth corps, lost over 800 men. Night came with the Union army everywhere repulsed. Burnside directed preparations for a renewal of the battle on the morning of the 14th, when he proposed to lead the Ninth corps, his old command, in an assault where the 2d and 5th Corps had failed, but he was dissuaded from the attempt. From the night of the 13th until the night of the 15th the two armies confronted each other, engaged in artillery-firing and angry skirmishing. On the night of the 15th the Army of the Potomac recrossed the river, after one of its most bloody and humiliating defeats. Its loss was 1,284 killed, 9,600 wounded, and 1,769 missing, an aggregate of 12,653. The Confederate loss was 595 killed, 4,061 wounded, and 653 missing. The loss of the Confederate troops defending Marye's Heights was less than 1,000; that of the attacking and supporting Union troops was over 7,300. Consult: 'Official Records,' Vol. XXI.; Allan, 'Army of Northern Virginia'; Swinton, 'History of the Army of the Potomac'; Walker, 'History of the Second Army Corps'; Powell, 'History of the Fifth Army Corps'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. III.

E. A. CARMAN.

Fredericton, Canada, county-seat of York County and capital of New Brunswick, is beautifully situated on the west side of the river St. John, 60 miles north-northwest of St. John. It is on the Canadian P. and Canadian East. Rys., and is the terminus of the Fredericton Ry. It is a port of entry and the seat of a United States consular agent. It has handsome public buildings, and is the seat of New Brunswick University and of the provincial normal school. Fredericton has manufactories of iron castings, machinery, leather, boots and shoes, woolen ware, etc., but its chief trade is in lumber and timber products. The city was founded in 1740, first called Saint Anne, and given its present name by Governor-General Sir Guy Carleton in 1785, two years later becoming the capital of the province. Pop. (1901) 7,117.

Fredonia, N. Y., village, in Chautauqua County; on the Dunkirk, A. V. & P. R.R.: about four miles south of Dunkirk, and about 50 miles southwest of Buffalo. It was settled in 1803 and incorporated as a village in 1829. It was early noted for its good schools, including its free academy. It is a residential village with not a large amount of manufactories. It is situated in an agricultural region, in the Lake Erie grape section, and its chief manufactures are canned and dried fruits, grape baskets, and boxes, and patent medicines. Natural gas was discovered here in the early part of the 19th century and was in use for lighting the village in 1821. The trade is chiefly in fruits, wine, and patent medicines. It has the D. R. Barker free library and one of the State Normal schools. It was for some years the home of William Barker Cushing (q.v.), a United States naval officer. The village owns and operates the waterworks and electric light plant. Pop. (1900) 4,127.

Fredro, frā'drō, Count **Alexander**, Polish dramatist, called "the Molière of Poland": b. Suchorow, Galicia, 1793; d. Lemberg 15 July 1876. He was the founder of Polish comedy, those who preceded him having worked over French plays. 'Mr. Moneybags' (his first piece, 1821); 'Ladies and Hussars'; 'Man and Wife'; and 'Revenge,' are his titles. The scenes are taken from real life.

Free Banking System, the predecessor of and essentially the same as our present national banking system, and on the same principles as the general railroad and corporation laws. Up to 1838 all banks required special charters, with the attendant evils of collusive "blanket" powers, corruption, and an insecurity which was not only a private evil, but seriously affected the state credit and finance. In that year New York State passed a "free" or open banking law, under which anyone could start a bank by depositing with the State an amount of securities equal to its circulating notes. The other States soon followed the precedent.

Free Church, the term applied by British non-conformists to the Christian denominations throughout the British empire, free from state patronage and control. The Free Church of England, a distinct evangelical Protestant denomination founded on the basis of recognizing only two orders, presbyters and deacons, although the first order also comprises bishops, maintains the ecclesiastical parity of presbyters, whether episcopally or otherwise ordained. The governing body is the convocation consisting of all the clergy and laity in the several churches. The denomination originated in the creation of "free churches" in the west of England, as a protest against the Tractarian (q.v.) movement of 1832. The Shore controversy (1843–9), and the Gorham case (1849–50), promoted its development. It was enrolled in chancery by a deed poll in 1863. The bishops are in the Canterbury line of episcopal succession. See Reformed Episcopal Church.

The Free Church of Scotland was the name assumed by the large body of ministers and their adherents who separated from the Established Church of Scotland at the Disruption (q.v.) of 18 May 1843. They seceded in vindication of what they called the "Headship of Christ," that is, to gain liberty to obey what they deemed the will of their Divine Lord in all church arrangements, without the control of the civil power. No new article of faith was adopted, all the forms and rights of the national Church being retained in their integrity. The Church prospered in the face of formidable financial difficulties which were largely overcome by the institution of a sustenation fund, and by the excellent arrangements made for its distribution and employment. After 1867 there was a movement in favor of the union of the Free and United Presbyterian Churches of Scotland, and on 31 Oct. 1900 the union was formally completed by the constitution at Edinburgh of the first assembly of the United Free Church of Scotland. See Presbyterian Church.

The Free Church Association founded in 1866, in English ecclesiology, is a society which has for its main object the abolishment in the Established Church of pew rents and pew ownership, maintaining the equal right of all parishioners to the free use of seats in churches. It has a long list of distinguished patrons, and aids churches with pecuniary grants if "free" and in need. See Institutional Church.

Free Cities, the name applied to various cities of Germany which in the 12th century assisted the emperors in repressing the arrogance of the nobles, and, in return for their services or contributions, received various privileges and immunities and became imperial cities. Free cities existed in Germany from the time of the Romans; they had little in common with the free cities of later times, and in the beginning of the 16th century lost their most essential privileges, and even the name of free cities, through the ignorance and carelessness of their magistrates. The most important of those privileges, as shown in the case of Ratisbon, were, that they should enjoy an independent government; should never swear allegiance to any emperor or king, nor be obliged either to engage in any expedition against the Romans, or to pay for the privilege of exemption; nor to pay any contributions whatsoever to the empire; nor be in any way reckoned among the cities of the empire. Virtually they were independent republics. Commerce and manufactures gradually increased the importance of the imperial cities and they often ventured to resist their masters, the emperors, and could not be reduced to obedience without great difficulty. In the middle of the 13th century two important confederacies were established for common objects — the Hanseatic League (1241), comprising the cities of Frankfort-on-the-Main, Hamburg, Bremen, and Lübeck, and the league of the Rhenish cities (1246), comprising Cologne, Worms, Mainz, Strasburg, Basel and Spires, which are now incorporated in their respective political divisions. The powerful Hanseatic League lasted nearly four centuries, until its dissolution was effected by several causes in 1630. The remnant of this league and of the former *collegium* of cities, which had its representatives in the German Diet, namely the free cities of Hamburg, Bremen, and Lübeck, was incorporated with the French empire in 1810. As these cities co-operated vigorously in the recovery of German independence, they were acknowledged, together with Frankfort-on-the-Main, as free cities by the Congress of Vienna (1814–15). They joined the German Confederacy, and obtained the right of a vote each in the Diet, and one among the four in the narrower council. In conformity with the 12th article of the Constitution of the German Confederacy, they established a common supreme court of appeal in 1830. Frankfort in 1866 was annexed to Prussia. The only free cities now existing are Hamburg, Lübeck, and Bremen, each sending a member to the Bundesrath, and Hamburg three deputies to the Reichstag, the others one each.

Free Congregations (Ger. *Freie Gemeinden*), sometimes called "Protestant Friends," a sect of German Rationalists, who at first professed to be Christians, but now reject the doctrines of miraculous revelation and a personal deity. There are upwards of 120 congregations of them in Germany, and a few in the United States.

Free Negroes, in the United States. At the formation of the Union these numbered about 60,000, nearly half of them in the South; but while there were few slaves in New England, and those dwindling, and less than 50 per cent more than the free colored population north of Maryland, the South had more than 20 times as many slaves as freedmen, and the system was extending. Hence this section began early to dread the free negroes, as an element always making their slaves discontented, and possibly stirring them to revolt; a sentiment deepened into terror after the Santo Domingo massacres. State laws and constitutions were framed or amended to drive them from the States or re-enslave them; one method being to forbid emancipation by will, and provide that free negroes must choose masters or leave the State: and another to punish all penitentiary offenses of negroes with reduction to slavery. The Colonization Society (q.v.) derived its first impetus from this feeling, till it was seen to be a mere reinforcement of slavery. The laws for refusing to allow negro merchant sailors to land, or even imprisoning them if they did, also caused much bad blood with the North. The "Black Laws" reached their acme just before the War, as did the personal-liberty laws in the free States. By the Dred Scott decision, free negroes were not citizens of the United States; which became law and remained so until repealed by the Fourteenth Amendment, though the Thirteenth had abolished slavery.

Free Port, a harbor where ships of all nations may enter and load or unload on payment of harbor dues or charges for accommodation. Goods may be stored at free ports, and may then be either re-shipped for export, or they may be admitted for home consumption on payment of the usual full customs of the country. The bonded warehouse system effects the same end as free ports. See TREATY PORT.

Free Ships, Free Goods. That is, that in time of war, belligerents shall have no right to inquire into anything regarding a vessel and her cargo but whether the former belongs to a neutral, and if so, her cargo must be as free as herself; unless the cargo is agreed contraband of war. This is the doctrine of international law which the countries of predominantly industrial interests have always struggled to have accepted; while those by nature constantly or frequently at war have refused to admit it. In the great wars of France with England, in the Revolutionary and Napoleonic era, the United States was the great champion of this doctrine, while England refused to admit it, claiming the right to confiscate her enemy's goods wherever she found them, and search every neutral for them. The War of 1812 arose partly from this, and did nothing toward settling it; but the close of the war period left it of little practical importance for many years. The Declaration of Paris (q.v.) went farther than this, and proclaimed neutral goods safe even in an enemy's vessels.

Free-soil Party (1848-55). This was the old Liberty party (q.v.) of direct abolition (Birney, Chase, etc.), plus the "Conscience Whigs" of Massachusetts (Sumner, C. F. Adams, etc.), who supported the Wilmot Proviso (q.v.), and the "Barnburners," or Van Buren section of the New York Democrats. The latter as a body adopted their principle of restricting the extension of slavery into the Territories, to punish the Polk administration, ultra-southern, for attempting to build up its own "machine" in New York at the expense of the Albany Regency (q.v.); but a small element of it was really in sympathy with their less extreme purposes. Van Buren had lost the nomination in 1844 by refusing to approve the annexation of Texas; and his co-operation was more than a mere party move. The Liberty party in 1847 nominated John P. Hale of New Hampshire and Leicester King of Ohio for President and Vice-President; but seeing a chance of larger success through the promising split in the Democracy, dropped them and waited. The Barnburners, offered only an even share of the State vote with their rivals the Hunkers in the Baltimore Democratic convention of 1848, withdrew, and after nominating Van Buren at a bolting convention to keep the party together, agreed to join in a fusion "Free-Soil" party. A convention of this at Buffalo in August nominated Van Buren and Adams. The platform declared for "Free Soil, Free Speech, Free Labor, and Free Men"; and that slavery in the States was beyond the control of Congress, but that as Congress could not make slaves it was bound to refuse it admission to the Territories (see WILMOT PROVISO). The party cast 291,263 votes, turned Maine and six western States over to the Democrats (Cass), and would have defeated the Whigs (Taylor) but that the New York defection (120,510) was mainly from the Democrats and gave that State to the Whigs. The New York Democratic delegation to Congress was annihilated all but one; and the two factions at once struck a bargain, which left Van Buren permanently out of public life. The Free-Soilers in the 31st Congress (1849-51) had 2 United States senators (Chase and Hale), and 14 representatives, including J. R. Giddings, George W. Julian, and Horace Mann. Sumner in the Senate and 3 more representatives reinforced them in 1851, and in the 33d Congress (1853-5) they had 5 senators and 17 representatives. Having been abandoned by their casual allies, in 1852 they nominated Hale and Julian; with a platform denouncing the Compromise of 1850 (q.v.), both the great parties for accepting it, and slavery as "a sin against God and a crime against man," and demanding the repeal of the fugitive-slave law. They polled 156,149 votes, of which 25,329 were in New York. They maintained their organization in Congress till the Kansas-Nebraska Bill (q.v.) had created the Republican party, into which they were at once fused.

Free Sons of Israel, Independent Order of, a Jewish fraternal and benevolent society founded 10 Jan. 1849. It has 3 grand lodges and 103 subordinate lodges in the United States. In 1902 it had a total membership of 11,000, and a reserve fund of $860,000.

Free Spirit, Brethren of the, a sect of heretics which originated in Alsace in the 13th century, and quickly became disseminated over Italy, France, and Germany. They claimed "freedom of spirit," and based their claims on Rom. viii. 2–14. Thence they deduced that they could not sin.

Free Stone. See BUILDING STONE; SANDSTONE.

Free Trade, in current use restricted to mean the interchange of commodities between countries politically independent, without obstacles specifically intended to restrict the trade. All taxes on imports, which form a large part of the revenue of most civilized governments to that extent impede the freedom of trade; but the essence of the free-trade system is, that they shall not be arranged to "protect" the correspondent home production, or, as free-traders would put it, to divert capital into otherwise unprofitable channels at the expense of the consumer. This is accomplished by selecting articles not possible to produce at home (as tropical products in a temperate country); by forbidding their production at home (as tobacco in England), foregoing certain new home industries for the sake of sparing existent ones; or by laying corresponding internal taxes.

That free trade was never even formulated as a theory till a few generations ago, nor adopted as a policy till within two generations, that it is even now practised in its fulness by only one country, and nearly so by only two more, and that the former, its chief exponent, is at this moment rent by a fierce struggle to resume its old protective system, indicates something more back of this question than the mere state of economic enlightenment. The truth is, free trade is a matter of business, and all states have prior interests which business only subserves, and to which it is sometimes partially antagonistic. National existence always comes first, national prestige usually, national rivalry and jealousy frequently. In the Middle Ages war was the normal condition of most countries and the constant liability of the rest; hence everything had to be subordinated to diversified resources in war, whence a nation's supplies might be suddenly shut off. As the age of neutrality and the localization of wars has supervened, this danger has practically passed; but masses of capital and of labor in each country, which its rulers cannot politically disregard, can still be injured by the hostile tariffs which are the modern substitutes for fleets and armies of conquest. The problem at issue is, whether these injure the target as much as the marksman: free-traders have one answer, protectionists another. But the protectionist interest is always much more concentrated and effective than the free-trade: it is that of masses of capital embarked in certain enterprises and fighting for life, with all the masses of people behind it whom it maintains, and who would be temporarily injured by a readjustment. Protection is led by those who are interested in terms of millions, free trade mostly by those who are interested relatively in terms of pennies. The contest is so unequal that it is only wonderful that any circumstances have ever given the latter even a temporary victory.

In Europe till the 17th century, and in most parts of that till the 18th, the only way the bounds of free trade were extended was by conquest; and even that did not always effect it, old provinces and feudalities retaining their rights to separate custom-houses — primarily an octroi, but used for "protection." Most countries were cut up by dozens of these vexatious boundary lines, crippling all internal trade, and making each little district a special and self-subsistent world. Under Louis XIV. Colbert (1665–83) swept away many of these old provincial barriers, to the enormous development of French industry and trade, and consequently revenue; but he could not touch the chief portion. Already in 1623 De la Croix had propounded the theory of free trade; and in England it was urged in 1690 by Nicholas Barbon, one of the founders of the life-insurance system. But about the middle of the 18th century it sprung into life at once in two quarters, the lesser influence at the time having been vastly more potent in the end: with the French "Physiocrats" and Adam Smith. The theory of the former — whose founder was Cantillon and the chief heads Quesnay and De Gournay — was enthusiastically taken up by a group of able thinkers and men of affairs, and in 1774 put partially in practice by Turgot, in free trade for grain throughout France. Their method of approach was curious: they held that as commerce does nothing but transfer from hand to hand wealth already existing, without creating new, the gains of the trading class are at the expense of the only real wealth, the products of the earth; it is therefore to the community's interest that they should be as small as possible, and to this end commerce should take the shortest and most natural channels, as this leaves the "net product" of society the highest. Meantime in 1752–63, Adam Smith, a professor of moral philosophy at the University of Glasgow, had been working out a theory of the social progress of nations; and, as one branch of it, he investigated the causes of their material well-being. He was anything but a man of business, but he had a Scotch intellect which reasoned truly, and his society included many keen and able merchants and importers of the day. From them and his own mind he produced and fortified the theory that dams in a stream could never create water, but only force it into other channels. He visited France and met the Physiocrat leaders, and received doubtless new arguments and fresh facts. In 1775 he published his 'Wealth of Nations,' perhaps the most epoch-making single book of all time; for it created political economy as a science and free trade as a practical system. He took separately each kind of protective duty in use or advocated, and proved that each did harm in the very line it was supposed to do good. But he saw no hope of free trade ever coming about in England, so dominating was the influence of invested capital and of "furious and disappointed monopolists." But a curious change in industrial affairs inverted the position of his friends and enemies. His views had been favored by the landed interest and disfavored by the manufacturers; but the course of business made the agriculturists eager to keep up the duties on grain, which gave them immense profits; while the manufacturers began to be irked by the duties on raw material, which checked their coming dominance of the textile market under the splendid English inventions. The ablest statesmen were on the same side: Shelburne and the younger Pitt were convinced free-traders, and the latter tried to put Irish free trade into the act of Union in 1800. Two decades later the adherents were numerous: Ricardo's 'Political Economy' had reinforced Smith's, with greater weight because he was a successful Jewish banker; and London merchants were petitioning to have the shackles taken off trade. The first great success was making William Huskisson president of the board of trade in 1823: he was ignominiously driven from the Cabinet by the Duke of Wellington, but had induced Parliament to free some articles and lighten the duty on others. Thrust aside by more pressing politics, the reform stood still till 1836, when a failure of crops made it once more a burning question. Never was an issue so sharply marked out: the people were sacking the towns for bread while grain was taxed to enrich the landlords. Meantime manufacturers, increasingly the chief reliance of the national revenues, were kept out of foreign markets by having to pay higher for raw materials and more for wages. Local Anti-Corn-Law Associations from 1837 on were fused into the National Anti-Corn-Law League in 1839; at its head were Richard Cobden and John Bright, both partners in Manchester calico-printing works; whence the term "Manchester School" for supposed believers in various doctrines mistakenly attributed to Cobden. The struggle convulsed England, and almost broke the bonds of social order; but the final blow to the old system was the Irish potato famine in 1845. This shortage made food still higher; and Sir Robert Peel, who had taken office expressly to resist the repeal of the Corn Laws, remained in it to repeal them himself, 26 June 1846 — most of the duty at once, the rest by a sliding scale within three years.

The full free-trade policy was not introduced for many years, however: it was Mr. Gladstone in 1869 who framed the present system of absolute freedom from protection, though as Palmerston's chancellor of the exchequer in 1861 he had taken a long step toward it. In 1841 more than 1,000 articles were on the customs list, over half of them large staples; in 1849 they were reduced to 515, and in 1855 to 414, but still 153 main articles of consumption; while in 1861 they were reduced at a blow to 142, of which only 19 were of great importance, and in 1876 to 42, of which 10 were important. They have since been reduced to 12 altogether, in as few classes as possible — seven kinds of drinks, three of sweets, one narcotic and one food; namely, spirits, wine, and beer; tea, coffee, chicory, and cocoa; sugar, molasses, and glucose; tobacco; and dried fruits.

The progress of Great Britain under this system is the very point now in fierce issue, and soon to be passed upon by a fresh election. It may be said here that in the last 30 years of protection, the total increase of British imports and exports was $340,000,000; in the first 30 of free trade it was $2,400,000,000, between seven and eight times as much. In 1816–40 the total increase in British shipping was 80,000 tons; from 1848 to 1858 it was 1,257,000, and thence to 1880 1,917,000 more. The experience of Belgium was even more striking. Under Napoleon prohibitory duties were imposed, and the country became largely depopulated; with the return of the Dutch and low duties, great manufactures at once sprang up; with their expulsion in 1830 high protective duties were again imposed, and in 1851 the prime minister declared that if they were not removed all domestic industry would be ruined; the whole system was swept away in 1855, and Belgium rapidly became, size for size, the foremost industrial and commercial state of the world, the richest per capita, and the manufactory of Europe. Only a few per cent of its revenue is from imports, the rest being from internal duties.

The arguments for free trade cannot be stated without those against protection, being the same. They are not alone industrial, but political and social. Broadly, it is asserted that protection cannot increase the total industrial product to be divided up, and can only enable one class of the community to force the remainder to buy one costly article instead of two cheap ones, thus lessening the volume of trade and production; that its claim, to redistribute the amount in wages is false, as but for the system the same capital would have been employed in other industries and paid as much wages, with lower prices to the consumers; that its claim to ultimately reduce prices is false, because as soon as that object has been achieved, it applies to the government on that very ground to save it from ruin by increasing the duty; that its claim to found industries is false by demonstration; and that it narrows instead of diversifying them; that it extorts high prices from home consumers by squeezing the market of which it is given a monopoly, and then sells its surplus to foreigners at a low price — which Adam Smith sets down as inevitable with a protective system; that it produces trusts, to prevent competition through which the public might secure its alleged benefits; that it produces alternate "feast or famine," inflation and panic, instead of equable business; that it makes orderly public finance impossible, by creating huge random revenues to be spent at random, in place of a calculable budget; that it corrupts politics deeply and hopelessly, by making masses of capital dependent on legislation for its profit, and consequently influencing that legislation for its own ends, stripping the treasury to prevent repeal of duties, inventing extravagant schemes to spend an unnecessary revenue, and buying votes in its favor by enormous permanent burdens on the people, through pensions and the like; that the low tone of American public life, wherein men can remain and be honored after exposures which would drive them into permanent obscurity in any European country, is mainly due to this money power created by legislation. For the opposite side, see PROTECTION.

Free Will. This question is properly divided into two sections, that of the metaphysical basis and the doctrinal application; but the latter has so deeply affected the reasonings on the former, that it is almost impossible to separate them.

The metaphysical problem is unique, from its presenting at the outset an irreconcilable contradiction between the phenomena of consciousness and the operations of reason. In this respect it is different from the insoluble problems of time and space, where the conflict is between opposing conclusions of the reason with regard to the materials furnished by consciousness;

here there is a denial, by reason, of the validity of those materials. Consciousness appears to show us at every moment that we can dictate our actions mostly and our thoughts very largely; reason tells us that each follows on other phenomena, from whose invariable relation of precedence we characterize them as cause and the former as effect. Consciousness tells us that our will is the active agent in producing the phenomena which immediately succeed it; reason tells us that this fancied agency is an illusion and itself a part of the chain of sequences, and that the apparent relation is because, as Hobbes says, the so-called will is the last wish of the mind before determining. But what causes the determination? This involves the problem of the nature of the will as before, as well as of the "coupling-pin" by which, if a reality, it acts on matter; if not a reality, the reason why a mental resolve is invariably followed by a physical movement or mental conception. Of the coupling-pin no acceptable theory has ever been framed; the best explanation of the association of will and act, supposing the former an illusion, is still Spinoza's, that they are twin phases of the same ultimate reality, and of necessity change coincidently. But this leaves it still unexplained why our consciousness makes the will not coincident with the act, but invariably its predecessor: we do not will and act simultaneously, but in succession. The overwhelming weight of reason, however, for 2,500 years, from the Greek predecessors of Aristotle to Jonathan Edwards, has won reluctant acceptance to the doctrine of universal determinism, or in theological phrase, of necessitarianism: a chain of causation extending to all things and back to infinity, since no uncaused first act or idea can be fancied except as part of the First Cause of the universe. It is of course never claimed that all acts are volitional or all volitions deliberate, but only that the mind at will can interject uncaused determinations among the caused. It is evident, however, that to assume the possibility of uncaused acts is to consign the universe to chaos and abolish the reign of law; that only on the theory of strict and unbroken causation (or "invariable sequence") can we reason at all concerning phenomena: that the mind must follow the same law as other entities, and has no power, nor could even be endowed with such by omnipotence, of willing without motive — that is, without a cause itself the resultant of an endless series of other causes. Indeed, as Prof. Huxley puts it, for the mind to cause itself implies that it has anteceded itself, which is absurd: the first mental action must have been part of the chain of causation, which surrenders the whole case, as there is no spot where it can be imagined that it was able to throw down the ladder by which it had climbed, and cut loose from causes into a region of caprice.

To avoid this conclusion, a curious dilemma — usually known as "Buridan's Ass," though Buridan did not devise it — was invented by the mediæval schoolmen. Suppose an ass between two bundles of hay, exactly alike, and with no motive for choosing which to bite first: it is absurd to suppose he would starve in the midst of food, and he must therefore act from free will. To this, however, it was answered that if motiveless he would so starve; and the question remained as before.

Involved with this is the question of God's foreknowledge. It is obvious that this involves his pre-determination of events, as otherwise he would foreknow what was never to happen, or was to happen outside his will; and there can be no change in the predestined order, since any change in a sequence must itself be part of the predestination and foreknowledge.

Alone of all metaphysical questions not incident to the claims of religious founders, this has always been a fierce battle-ground, the dividing line of great religious sects. The reason is that the possibility of sanctions for moral law, and consequently of a decent basis for human society, is believed to depend upon it. Determinism seems to cut the roots of moral obligation, by removing the possibility of obedience to it. If we are without will except as a consciousness of preference resulting from causes outside our control, we are automata; and preaching obligation of any sort to us seems as irrational as preaching it to a doll, for our action will not be influenced by it, nor are we responsible for disobedience. In this extreme form, the fallacy is easily apparent. The will, as Edwards has put it, always follows the greatest seeming good; but its estimate of good is not an unvarying thing, but constantly changing with experience and reason. Now moral rules, apprehended and accepted by the mind, form a part of this good, and therefore become new causes which determine the will; and whatever may have been the causation which has determined the evolving and enforcing of the moral law, it is nevertheless a portion of the environment which acts on the mind. As to responsibility, the question is irrelevant. An automaton which runs into a fire or the sea perishes none the less than if the act were a conscious volition. Punishment waits not on responsibility, but on violation of the laws of its being, and blame as excuse are alike impertinent to the result. We do not blame a child who burns its fingers, but the fingers are in the same condition as if we did.

Back of this, however, lies a contradiction of fact. So far from determinism making moral law impossible, free will makes it impossible. If volition can perpetually nullify the action of motive, there is a fatal breach in the continuity of cause and effect; there can be no calculable sequence of action and therefore no law. The most perverse defiance of natural order is no more independent of cause than the steadiest obedience, for that perversity is itself due to causes precedent. Whence then come the invariable consciousness of freedom to act, its universal recognition, its embodiment into the framework of society, the obvious fact that there can be no society except on this basis? Why, here again, do consciousness and practice oppose themselves unalterably to invincible argument? Edwards explains that though we have not liberty of willing, we have liberty of action; which taken literally would imply that the will has no necessary connection with the act, and that we may voluntarily do a thing we have involuntarily willed not to do. Of course Edwards does not in fact maintain this, but only that God has given a choice of action by furnishing experience and reason and illumination by which to frame correct determinations. Waiving discussion of the difference between these determinations and will, the real explanation probably lies in the confusion between the abstract and concrete will, between its dependence on causes and, as above said, our own power to determine or change those causes. Instruction, example, appeals to self-interest or fear, or vanity, or affection, or honor, etc., produce an evironment and modify the view taken by each of the supreme immediate good, calculably enough to base coherent society upon; where their effect is grossly miscalculated the society goes to pieces. Metaphysics and the general consciousness are both right, each in its own sphere: the will must have motives, but those motives are furnished in great measure externally. Furthermore, subject to the inexorable limitation, it can furnish by its own action motives to change itself; and constantly does so, attributing to its independent action what is really due to the influence of the new causes it has made to operate in altering its estimate of relative good. For the purposes of human life, volition is absolute and there is no injustice in enforcing responsibility.

Freedman. See FREEMAN.

Freedmen's Bank, a savings bank chartered by Congress in the District of Columbia in 1865, at the special instance of Charles Sumner and Charles R. Buckalew, as a means of encouraging thrift among the newly emancipated negroes. It was in fact intended as part of the Freedmen's Bureau work, and had among its corporators Gen. Howard, the chief commissioner, and a host of the most eminent and upright public men and philanthropists; and its investments were restricted to government securities. It started branches in some 30 Southern cities, with doubtful legality, but covered by the elastic ægis of the bureau's power and every one's good will, the South's most of all: and did a large business. But the corporators appointed successors much less disinterested; the restriction on investments was removed in 1870, ostensibly to benefit depositors by a higher rate of interest, against the protest of Simon Cameron in the Senate: the securities were rapidly replaced by "wildcat" stocks, all speculative and mostly worthless, and by mortgages on valueless property; and in 1874 the bank was pronounced insolvent, with practically no assets. The blow to incipient negro thrift was very great; and the scandal discredited the entire system of which the bank was an outcome, and was one cause of the political overturn in 1874.

Freedmen's Bureau, 1865-9. The supervision, temporary maintenance, and employment of the mass of homeless, penniless, and untaught freedmen created by emancipation, was an obvious duty of the government, urged upon it at once after the proclamation of 1 Jan. 1863; and in 1863-4 officials were appointed to lease abandoned lands to them for not exceeding a year. The military officers left much of the care and provision for freedmen in their hands; but a more comprehensive plan was needed, and after various abortive efforts at an acceptable measure, a "Bureau of Refugees, Freedmen, and Abandoned Lands" was established in the War Department 3 March 1865, to continue for a year after the war. It was to be headed by a commissioner, with assistant commissioners in all the seceded States; to issue supplies to destitute freedmen, have charge of abandoned lands to lease and ultimately sell in 40-acre plots, and have "control of all subjects relating to refugees and freedmen"— an elastic provision construed in the most elastic way. Its commissioners — the head being Gen. O. O. Howard (q.v.), a noble-minded and laborious philanthropist — acted as courts of law where there were none, or where negroes were not recognized as free; established the institution of marriage, and kept records; assured the freedmen the right to choose employers, and made fair contracts for them. The "abandoned lands" disappeared under the amnesty acts; but the bureau did excellent work by inaugurating free schools on a large scale. On 6 Feb. 1866 Congress passed a bill to enlarge its powers and make it permanent; Johnson successfully vetoed it, but on 16 July another was passed over his veto, extending the bureau to July 1868, later extended a year in unreconstructed States. Under this its sweeping powers made it largely the government of the South under Reconstruction, especially as the department military commanders were usually made assistant commissioners; and the demoralizing and disastrous struggle of the North to secure negro independence, and of the South to reassert white mastery, is a history of part of the bureau's action — through executive and legislative powers scarcely pretended to be constitutional, and to transfer which to the regular courts the Fifteenth Amendment was passed. Better features of its work were the foundation of the free public schools in the South, and of Fisk, Howard, and Atlanta universities, and Hampton Institute; of the system of negro peasant proprietorship; and the winning of equal rights for all men in the courts. That it failed in its larger hopes, and that its harmful results were so great that many hold them far in excess of its benefits, are facts attributed by the fairest judges to the inevitable conditions of the problem. (See a very lucid and singularly just summary by W. E. B. DuBois — colored — in the 'Atlantic Monthly,' Vol. LXXXVII., p. 354.) The bureau ended its main work in 1869; its educational work continued till 1872, and bounty payments some years longer. It had about 900 agents in 1868; and expended in all some $20,000,000, over $10,000,000 on objects unconnected with soldiers' bounties. Gen. Howard published a report of its work in the House Executive Documents, 41st Congress, 2d session.

Freedom, or Freedom of the City, an English custom occasionally revived in America. The freedom of a city or borough is the right of enjoying the privileges and immunities that belong to the burgesses or freemen, such as electing the council or the parliamentary representative. In certain boroughs there were at one time freemen by birth or marriage not on quite the same footing as burgesses.

Freehold, N. J., town, county-seat of Monmouth County; on the Central R.R. of New Jersey, and the Pennsylvania R.R.; about 32 miles southwest of Jersey City. It was settled in 1734, and for some time it was called Monmouth Court House, because of the county court being held in the village. In 1869 it was incorporated. It is the trade centre for a large agricultural section. Its chief manufactures are bicycles, foundry, and machine-shop products, underwear, and shirts. One of the attractions of the town is the granite monument in memory of the battle of Monmouth (q.v.) which took place here 28 June 1778. Pop. (1900) 2,934.

Freehold, in English and American law, an estate or real property held in fee simple in America, or in England either in fee simple or fee tail; the tenure by which such an estate is held. (See FEE.) Anciently it was one of the two chief tenures known as tenure in free socage, and was the only free method for laymen to hold property. A freehold estate must possess immobility, in other words, must consist either of land or of some interest arising out of land annexed to it. Secondly, it must be of indeterminate duration.

Freeland, Pa., borough in Luzerne County; on the Lehigh Valley R.R.; about 30 miles southwest of Scranton. It is situated in the anthracite coal region, but it is surrounded by a large section of good farming land. The chief manufactures are lumber, mining and farm implements, and foundry products. During the last decade the place has increased rapidly in population and manufacturing. Pop. (1890) 1,730; (1900) 5,254.

Freeman, Alice Elvira. See PALMER, ALICE FREEMAN.

Freeman, Edward Augustus, English historian: b. Harborne, near Birmingham, 1823; d. Alicante, Spain, 16 March 1892. He was educated at Trinity College, Oxford, where he obtained a scholarship in 1841, and after his marriage in 1847 he retired to a small estate at Somerleaze, in Somerset, where he devoted himself to literature. His first publication (1849) was a 'History of Architecture,' a subject in which he maintained interest throughout his life. This work was more especially devoted to Gothic architecture. His architectural researches helped to turn his attention to history, but his earliest historical works were the product of his interest in contemporary burning questions. His 'History and Conquests of the Saracens' (1856) was partly due to the Crimean war; and the American Civil War brought forth his 'History of Federal Government' (1863), which, however, remained a fragment in one volume. Between 1867 and 1879 appeared his *magnum opus*, the 'History of the Norman Conquest of England,' in six volumes, followed in 1882 by two supplementary volumes dealing with 'The Reign of William Rufus and the Accession of Henry I.' In 1884 he was appointed regius professor of modern history at Oxford, and this post he occupied till his death. His last great work was a 'History of Sicily,' which he left unfinished, though three volumes of the work were published. He died in Spain, where he was traveling for the purposes of recreation and research. Other works of his beside those mentioned were: 'Church Restoration' (1849); 'Essay on Window Tracery'; 'The Architecture of Landaff Cathedral'; 'History of Wells Cathedral' (1870); 'Old English History' (1869); 'Growth of the English Constitution' (1872); 'Historical Essays' (three series, 1872–79); 'The Ottoman Power in Europe' (1877); 'Historical Geography of Europe' (1881); 'Sketches from the Subject and Neighbor Lands of Venice' (1881); 'Lectures to American Audiences' (1882); 'English Towns and Districts' (1883); 'Some Impressions of the United States' (1883); 'Exeter' (1887); 'Methods of Historical Study' (1886); 'The Chief Periods of European History' (1887); 'William the Conqueror' (1888). He was a man of strong partisan feeling, with a firm belief in the superiority of the Teuton which sometimes interfered with a judicial weighing of evidence. But he took great pains to verify his facts, indeed was devoted to truth, and had a wide and deep knowledge of history. In spite of his pugnacity and the obstinacy with which he maintained his side in a controversy he was a man of generous and kindly nature. Consult 'Life and Letters,' by Stephen (1895).

Freeman, James, American Unitarian clergyman: the first in the United States to assume the name Unitarian: b. Charlestown, Mass., 22 April 1759; d. Newton, Mass., 14 Nov. 1835. He was graduated from Harvard in 1777, in 1782 became lay-reader in King's Chapel, Boston, later proclaimed himself an Unitarian, and, supported by his congregation secured corresponding changes in the Prayer-book. In 1787, his bishop having refused him ordination, he was ordained by his wardens and congregation. Until his death he was rector of the chapel. He published: 'Sermons and Charges' (1832).

Freeman, James Edward, American artist: b. Nova Scotia 1808; d. Rome, Italy, 21 Nov. 1884. He was a pupil of the National Academy of Design, and was elected national academician in 1833. From 1836 his studio was in Rome. His works, largely portraits and genre subjects, are skilful in color and display attention to technical detail. They include: 'Young Italy'; 'Peasants on the Sands of the Sezchio'; 'The Beggars.'

Freeman, James Midwinter, American Methodist clergyman: b. New York 29 Jan. 1827; d. 1900. He was educated at Wesleyan University, and ordained to the ministry of the Methodist Episcopal Church, of whose Sunday-school Union and Tract Society he became secretary and editor in 1872. He was the author of 'Use of Illustration in Sunday-school Teaching' (1867); 'Hand-book of Bible Manners and Customs' (1874); 'Short History of the English Bible' (1879).

Freeman, Mary Eleanor Wilkins, American novelist: b. Randolph, Mass., 1862. She was educated at Mount Holyoke Seminary and after some years spent in Brattleboro, Vt., returned in 1883 to Randolph, which remained her home till her marriage to Charles Freeman in January 1902, when she removed to his home in Metuchen, N. J. She came first into notice about 1886 by her extremely faithful delineations of certain phases of New England life in her short stories contributed to the magazines. After some years she attempted more sustained work, and within the last ten years has published several novels, displaying the same characteristics as her short stories, as well as skill in the handling of plot, and dramatic vigor. Her work has steadily gained in popularity and has been greatly admired by English as well as American critics. A fondness for very short sentences gives her work almost a staccato character at times, and it must be said that while the accuracy of her studies of New England village existence cannot be called into question, her insistence upon the bareness of the life to the exclusion, or almost entire subordination of its happier phases, conveys a not wholly correct impression of the life in its entirety. Her published works include: 'The Adventures of Ann' (1886); 'A Humble Romance and Other Stories' (1887); 'A New England Nun, and Other Stories' (1891); 'Young Lucretia' (1892); 'Giles Corey, Yeoman,' a drama (1893); 'Jane Field,' her first novel (1893); 'Pembroke' (1894); 'The Long Arm,' with J. E. Chamberlin (1895); 'Jerome, a Poor Man'; 'Silence and Other Stories'; 'The People of Our Neighborhood'; 'Understudies'; 'Madelon'; 'The Love of Parson Lord'; 'Evelina's Garden'; 'The Wind in the Rose-Bush'; a series of ghost stories (1903); etc.

Freeman, Nathaniel, American jurist: b. Dennis, Mass., 1741; d. 1827. In 1763 he became resident at Sandwich. He fought in the Revolution, and was brigadier-general of militia forces in 1781–91. In 1795–99 he was a member of the United States Congress, and he also sat in the Massachusetts legislature, and was for many years judge of the court of common pleas. He was also a medical practitioner, and an orator of some distinction.

Freeman, or **Freedman,** is one who has inherited the full privileges and immunities of citizenship; one who has been delivered from the restraints of bondage, but who, usually, is not placed in a position of full social or even political equality with him who was born free. In old Rome, the equivalent for freeman comprehended all classes of those who were not slaves. As the organization of Roman society survived the convulsions of the Middle Ages to a far greater extent in the towns than in the landward districts, where the institutions of feudalism (q.v.) almost entirely superseded it, it is in the borough and other municipal corporations of Europe that we still find freemen, or persons inheriting or acquiring by adoption, purchase, or apprenticeship the rights of citizenship. In the United States the term freemen was used of the colored people emancipated by the Civil War. The duty of caring for those people, finding them work, and preparing them for the privileges of freedom was thrown on the War Department; and in 1865 an act of Congress created in that department the bureau commonly known as the "Freedmen's Bureau" (q.v.), whose duties practically ceased in 1870. The founding of several institutions for colored persons, such as Howard University and Fisk University (q.v.), was a permanent result of its work, out of which have grown other educational achievements of great importance in the advancement of the colored people.

Freemasonry. See MASONIC FRATERNITY.

Freemasons. See MASONIC FRATERNITY.

Freeport, Ill., city, county-seat of Stephenson County, on the Pecatonica River, the Illinois C., the C. & N., and the C., M. & St. P. R.R.'s; about 105 miles northwest of Chicago, and 55 miles southeast of Dubuque. It was settled in 1835 and received its charter in 1855. The "Freeport heresy," a political doctrine much discussed before the Civil War, was that regardless of the Dred Scott case (q.v.) any Territory had the right to reject the slave system by the means of police laws which would be "unfriendly," and would in time stamp out the existence of slavery. This "doctrine" or "heresy" was advanced by Douglas in the famous debate with Lincoln which took place in Freeport in 1858. The chief manufactures are wind-mills, bicycles, organs, wagons, and toys. It has coffee-mills and railroad shops. It contains a free library, St. Francis Hospital, a good system of public and parish schools, and several fine public buildings. Pop. (1900) 13,258.

Freer, Paul Caspar, American chemist: b. Chicago, Ill., 27 March 1862. He was graduated in 1882 at the Rush Medical College of Chicago; at the University of Munich, Germany, in 1887; was assistant in Owens College, Manchester, England, in 1887; and an assistant and instructor in Tufts College in 1887–9. In 1889 he became professor of general chemistry in the University of Michigan. He has published: 'A General Inorganic Descriptive Chemistry' (1895); 'The Elements of Chemistry' (1896); and numerous pamphlets.

Freethinker, a name assumed by those who, disbelieving in revelation, feel themselves free to adopt any opinion in religious or other matters which may result from their own independent thinking. The name was specially claimed by those who in the 17th century took part on the anti-Christian side in the deistic controversy. Voltaire (q.v.) was a well-known French freethinker.

Freetown, Africa, a seaport of West Africa, capital of the British colony of Sierra Leone, on the south side of the river of Sierra Leone. Its principal streets are broad and straight, and have, more especially in the part occupied by Europeans, a very attractive appearance, the houses being generally detached and surrounded by trees. Freetown is a strongly fortified imperial coaling-station. A railway runs from Freetown some distance into the interior. Pop. (1901) 34,463.

Freezing, Congelation, or **Solidification,** the transformation of a liquid into a solid under the influence of cold. Each liquid always solidifies at the same temperature, which is called its freezing point, and the solid also melts again at the same temperature. Thus the freezing point and the melting point, or point of fusion, are the same, and the point is always the same for the same substance. The freezing point of water, or the melting point of ice (32° F.), is taken for one of the fixed points in thermometry. The freezing point of mercury is 39° below zero, of sulphuric ether 46° below zero, of alcohol 203° below zero F. It has been shown that the increase of pressure on water, and on all substances which expand in freezing, will lower the freezing point; and that such substances as wax, spermaceti, sulphur, and paraffin, which contract in freezing, have the freezing point raised by pressure. See MELTING-POINT.

Freezing-mixture, a mixture for the production of artificial cold. For this purpose two substances are mixed, of which one is usually solid, and which tend to form a liquid mixture. In liquefying any solid a certain amount of heat is made latent, and owing to this the temperature of the mixture at the end of the liquefaction is often very low indeed.

Thus on mixing snow and salt together the salt converts the snow into water, or rather tends to form brine; but snow cannot melt without making latent a considerable quantity of heat. Hence the temperature of the brine which is the result of the mixture is very much below that of either the salt or snow. The fact is that salt and water mixed cannot be in the solid condition, except at a temperature very much below that of ordinary snow. The following is a list of freezing-mixtures, and of the lowering temperature obtained by means of them. The substances, with the exception of the ice, mentioned in the second, are supposed to be mixed together at 10° C. (50° F.). Such mixtures are often employed in the making of ice-cream or water-ices, for cooling wine, etc. See ICE, ARTIFICIAL; REFRIGERATING MACHINES.

Substances	Parts by Weight	Reduction of Temperature
Sulphate of sodium..	8	+ 10° C. (+ 50° Fah.) to − 17° C. (+1° Fah.)
Hydrochloric acid....	5	
Powdered ice or snow	2	+ 10° C. to − 18° C. (0° Fah.)
Common salt........	1	
Sulphate of sodium..	3	+ 10° C. to − 19° C. (− 2° Fah.)
Dilute nitric acid....	2	
Sulphate of sodium..	6	+ 10° C. to − 26° C. (− 15° Fah.)
Nitrate of ammonium	5	
Dilute nitric acid....	4	
Phosphate of sodium.	9	+ 10° C. to − 29° C. (− 20° Fah.)
Dilute nitric acid....	4	

Freezing Point, that temperature at which the solid and fluid states of a substance can co-exist in a state of permanent equilibrium. For water, this temperature is 32° F., or 0° C. For the freezing points of other substances, consult the articles in which their general properties are described. See also HEAT; MELTING POINT; SOLUTIONS; THERMODYNAMICS; THERMOMETRY.

Freiberg, frī'bĕrg, Saxony, a mining town 19 miles from Dresden. It is the capital of the mining district of Saxony, and contains a mining academy founded in 1765, with 13 professors, fine scientific collections, among which is the celebrated collection of precious stones amassed by Werner, and a large library. There is a fine relic called the Golden Portal belonging to the ancient Church, which stood on the site of the Gothic cathedral. It is an ancient imperial city, and is still surrounded by the old walls and ditch. The town owes its origin to the discovery of silver mines in the 12th century. Here, on 29 Oct. 1762, Prince Henry of Prussia defeated the allied Austrian and Saxon army. Pop. (1900) 30,175.

Freiburg, frī'boorg, or **Freyburg**, or **Freiburg im Breisgau**, Baden, a town in the circle of the upper Rhine, on the Dreisam, and on the railway from Carlsruhe, in one of the most beautiful and fertile districts of south Germany, at the west foot of the Black Forest. It consists of the town proper, the fortifications of which have now been converted into pleasure-grounds, and of two suburbs, and is the seat of a superior civil and criminal court, and of several public offices. The buildings most deserving of notice are the münster or cathedral, a large and beautiful Gothic structure built of red sandstone, admired for its delicate symmetry and tasteful decorations, with a magnificent portal richly sculptured, and surmounted by a tower, partly of exquisite open work, 380 feet high; the university, founded in 1456; the merchant house, now the chief tax office, a quaint Gothic structure, resting on pointed arches, and decorated externally with fresco portraits of the Emperor Maximilian, his son Philip I., Charles V., and Ferdinand I.; and the grand-ducal palace and government buildings. Freiburg is the see of an archbishop, and the seat of the courts and offices for the circle of the upper Rhine. Pop. (1900) 61,506.

Freiburg. See FRIBOURG.

Freight, formerly a charge paid to the owner of a ship for the carriage and safe delivery of goods; but the term now extends to transportation by land, especially on railroads. In cases of maritime freight, a person chartering a ship pays freight for the goods sent by it, and dead freight in respect of any deficiency of cargo; the terms of the agreement are fixed by the charter party. A person sending goods by a general ship pays freight for them; and the contract takes the form of a bill of lading. So far as the rights of parties are not made the subjects of positive stipulation in the contract of affreightment, they are ascertained with reference to the usage of trade. The carrier's duty is to have the ship ready to start at the time appointed, and to receive the goods and carry them to their destination; having performed these duties, he has a lien on the goods and a right of action in case of non-payment of freight. The shipper's duty is to have his goods forward in time. Freight is not usually payable unless the voyage is completed; but it is sometimes prepaid, in whole or in part, at the risk of the shipper. See BILL OF LADING; CARRIER, COMMON; CHARTER; TRANSPORTATION.

Freiligrath, frī'lig-rät, **Ferdinand**, German poet: b. Detmold 17 June 1810; d. Cannstadt, Würtemberg, 17 March 1876. In 1838 he published at Mainz a volume of his collected poems, and as it proved successful he determined to devote himself entirely to literature. In 1842 he received a small pension from the king of Prussia; but this he retained for only two years, for having embraced views in politics of an advanced liberal stamp which placed him in opposition to the government, he felt bound to resign the benefits of royal favor. At the same time (1844) he published a poem entitled a 'Confession of Faith' (Glaubensbekenntnis), in which he became the champion of the political creed he had adopted. In 1848 other three political poems by him: 'Die Revolution'; 'Februarklänge'; and 'Die Todten an die Lebenden,' saw the light; and the last of these led to his being put on trial for treason. This trial, in which he was acquitted, is memorable for another reason, being the first jury trial ever held in Prussia. From 1851 till 1867 Freiligrath resided in England as manager of the London branch of a Swiss banking establishment. On the failure of the bank a national subscription was got up in his behalf in Germany, and the proceeds of it enabled him to return to private life. The early poems of Freiligrath are distinguished by a wealth of glowing and highly-colored imagery, and by the prevalence of Oriental scenes and subjects. His political poems are too full of the tones of party warfare to live as poetry; but many of his lyrics seem destined to hold an abiding place in German literature. Germany is also indebted to him for many admirable translations from foreign languages, as from Burns, Tannahill, Moore, Hemans, Shakespeare, Longfellow, and Victor Hugo.

Freire, frā'rĕ, **Ramon,** Chilean general: b. Santiago 29 Nov. 1787; d. there 9 Dec. 1851. He was a grandson of Freire de Andrada (q.v.). He fought in the patriot army in the war for independence (1811–20), and defeated Benevides at Concepcion 27 Nov. 1820. He became the leader of the Liberals, and upon the deposition of O'Higgins in 1823, supreme director, with dictatorial powers. In 1826 he ended Spanish rule in Chile by expelling the remaining Spanish forces from Chiloé in 1826. He was re-elected supreme director in 1827, but resigned not long after. The Conservatives having gained control, he led an insurrection against them, was defeated at Lircai (1831), and banished to Peru, whence return was not permitted him until 1842.

Freire de Andrada, dā ān-drä'dä, **Gomes,** Portuguese colonial administrator: b. Coimbra 1684; d. Rio de Janeiro 3 Jan. 1763. He served in the Portuguese army, and became governor and captain-general of Rio de Janeiro in 1733, his authority extending over most of southern Brazil. His administration of almost 30 years was the most successful and prosperous, as well as the longest, in the colonial annals of Brazil. The gold mines were effectively worked, and colonization was greatly furthered. Freire de Andrada was made Count of Bobadilla in 1758.

Frejes, Francisco, frän-sēs'kō frā'hĕs, Mexican historian: b. Guadalajara, Mexico; d. 1845. He was trained for priestly and monastic life, became known as a Franciscan of remarkable eloquence, but retired from publicity in 1838, and eventually became superior of the monastery of Guadaloupe, near Zacatecas, Mexico. His object in his retirement was the prosecution of historical study, and his work: 'Historia Breve de la Conquista de los Estados Independientes del Imperio Mejicana,' is a valuable authority on the subject it treats.

Frelinghuysen, frē'lĭng-hī-zĕn, **Frederick,** American lawyer: b. Somerset County, N. J., 13 April 1753; d. 13 April 1804. He was graduated at the College of New Jersey in 1770; studied law, and was admitted to the bar in 1773. Two years later he was chosen a member of the Provincial Congress of New Jersey. He was a member of the Continental Congress much of the time during the Revolutionary War; served as a captain in the army; filled various State and county offices; led an expedition against the western Indians in 1790; and was United States senator 1793–6.

Frelinghuysen, Frederick Theodore, American statesman: b. Millstone, N. J., 4 Aug. 1817; d. Newark, N. J., 20 May 1885. He was a nephew and adopted son of T. Frelinghuysen (q.v.). He was graduated at Rutgers College in 1836, and became an eminent lawyer. He was attorney-general of New Jersey 1861–6; United States senator in 1868–77; and secretary of state under President Arthur in 1881–5.

Frelinghuysen, Theodore, American lawyer: b. Millstone, N. J., 28 March 1787; d. New Brunswick, N. J., 12 April 1862. He was a son of F. Frelinghuysen (q.v.). He was graduated at the College of New Jersey in 1804; and admitted to the bar in 1808. In the War of 1812 he commanded a company of volunteers, and in 1817 became attorney-general of New Jersey, which office he held till 1829 when elected United States senator. He was chosen chancellor of the University of New York in 1838; was nominated for vice-president of the United States in 1844; and in 1850 became president of Rutgers College.

Fremantle, Australia, the chief seaport of Western Australia, at the mouth of the Swan River, 12 miles from Perth. The manufactures include aërated waters, boots, soap, furniture, confectionery, etc. Pop. of town and suburbs (1901) about 22,200.

Frémont, Jessie Benton, American author: b. Virginia 1824; d. Los Angeles, Cal., Jan. 1903. She was a daughter of Thomas H. Benton (q.v.), and married John C. Frémont (q.v.) in 1841. She published: 'Story of the Guard: a Chronicle of the War,' with a German translation (1863); 'A Year of American Travel'; 'Far West Sketches'; a sketch of her father prefixed to her husband's memoirs (1886); 'Souvenirs of My Time' (1887); 'The Will and the Way Stories.'

Frémont, John Charles, American soldier and politician: b. Savannah, Ga., 31 Jan. 1813; d. New York 13 July 1890. He was of mixed French and Virginian parentage. In 1833 he was appointed teacher of mathematics on board the United States sloop of war Natchez, with which he proceeded on a cruise to South America. On his return he turned his attention to civil engineering, and in 1838–9 undertook the exploration of the country between the Missouri River and the British frontier. Shortly afterward, he proposed to the government to undertake the exploration of the Rocky Mountains — at that day a terra incognita. His plan being approved, he, in 1842, started with a handful of picked men, and reached and explored the South Pass. Not only did he fix the locality of that great defile but he defined the astronomy, geography, botany, geology, and meteorology of that region, described the route since followed, and designated the points upon which a line of United States forts were subsequently erected. In 1845 he cleared the north part of California of Mexican troops, and then, seeking a broader field of activity, planned an expedition to the distant Territory of Oregon. He approached the Rocky Mountains by a new line, scaled the summit south of the South Pass, deflected to the Great Salt Lake, pushed investigations right and left his entire course, and at the same time connected his survey with that of Commodore Wilkes' exploring expedition. Later in the winter, without adequate supplies, or a guide, he traversed the wilderness to the Rocky Mountains. In this daring expedition he crossed 3,500 miles of country in sight of eternal snows, discovering the grand features of Alta California, its great basin, the Sierra Nevada, the valleys of San Joaquin and Sacramento, and determined the geographical position of the west portion of the North American continent. In 1846 he was promoted military commandant and civil governor of the Territory of California, in which capacity he in 1847 concluded those articles of capitulation by which Mexico conceded exclusive possession of that territory to the United States. In 1853 he undertook a fifth expedition across the continent, made new discoveries, and reached California after enduring almost incredible hardships. In 1856 he was the first candidate of the Republican party for the presidency; and in 1861, on the outbreak of the Civil War, was appointed a major-general of volunteers. He then, as commander of the Western Union army, marched into Missouri with the view of encountering Gen. Price's Confederate force then in possession of that State, but an unfortunate dispute with a subordinate officer caused the War Department to relieve him of his command. He was governor of Arizona 1878–81. His publications include: 'Report of the Exploring Expedition to the Rocky Mountains in 1842, and to Oregon and North California in 1843–44'; 'Col. J. C. Frémont's Explorations'; and 'Memoirs of My Life.'

Fremont, Neb., a city and the county-seat of Dodge County, in the central eastern part of the State, on the Fremont, E. & M. V., the Union P., and the Sioux C. & P. R.R.'s, 37 miles northwest of Omaha. The town was settled in 1857 and was incorporated in 1871; it has a telephone system, gas works, and a municipal water supply and electric lighting plant. It is an important market for horses, cattle, sheep, and swine, and has pork-packing establishments, flouring mills, and planing mills. The educational institutions include a normal school and a business college. Pop. (1900) 7,241.

Fremont, Ohio, city, county-seat of Sandusky County; on the Lake Erie & W., the Lake Shore & M. S., and other railroads, and at the head of navigation on the Sandusky River, 30 miles east of Toledo. It occupies the site of a trading post established in 1785, and of Fort Stephenson built in 1812. In 1813 it witnessed the defeat of a body of British and Indian troops under Gen. Proctor, who were repulsed by Maj. George Groghan with 150 men, the British having 94 killed and wounded, and the Americans 1 killed and 7 wounded. In 1850 its former name of Lower Sandusky was changed in honor of J. C. Frémont. It is a busy agricultural and industrial centre with neighboring oil and natural-gas fields, and manufactures machinery, cutlery, agricultural implements, electrocarbons, woolens, beet-sugar, doors, sashes, etc. Steamers connect the city with the principal ports of Lake Erie and carry on a considerable trade. The city has street railways, gas and electric lighting, municipal waterworks and maintains several public parks. The educational institutions include normal and business schools, and the Birchard Public Library, founded by an uncle of ex-President Hayes, whose home here — Spiegel Grove — is occupied by members of the family. Pop. (1900) 8,439.

French, Alice ("Octave Thanet"), American novelist: b. Andover, Mass., 19 March 1850. She was educated at Abbot Academy in her native town and has since lived in Iowa and Arkansas, her works reflecting the local color of both States. She has published: 'Knitters in the Sun: Short Stories' (1877); 'Otto the Knight and Other Trans-Mississippi Stories' (1891); 'Stories of a Western Town' (1893); 'An Adventure in Photography'; 'Expiation' (1890); 'We All' (1891); 'A Book of True Lovers' (1893); 'The Heart of Toil'; 'Man and His Neighbors'; etc.

French, Daniel Chester, American sculptor: b. Exeter, N. H., 20 April 1850. He was educated in Boston and in Florence, Italy; had studios in Boston and Concord, N. H., 1878–87, and in New York city 1887–1900. His principal works include: 'The Minute Man of Concord'; statues of Gen. Cass, Rufus Choate, John Harvard, and Thomas Starr King; 'Dr. Gallaudet and His First Deaf Mute Pupil'; 'Statue of the Republic'; and the Milmore Memorial. He was placed in charge of the sculpture department of the St. Louis exhibition.

French, Henry Willard, American journalist and author: b. Hartford, Conn., 1854. He is known as a war correspondent and lecturer and among his writings may be mentioned: 'Nuna, The Brahmin Girl'; 'Desmonde, M.D.'; 'Art and Artists'; 'Our Boys in China'; 'Our Boys in India'; 'Our Boys in Ireland.'

French, John Denton Pinkstone, English soldier: b. Ripple, Kent, England, 28 Sept. 1852. He served in the navy 1866–7, entered the army 1874 and fought in the Sudan campaign of 1884. In the Boer war in South Africa (1900) he commanded the cavalry division, directed the operations about Colesberg from 10 Nov. 1899 to 31 Jan. 1900, and commanded the cavalry in the movements that led to the relief of Kimberley in February 1900, and the capture of Bloemfontein and Pretoria. His services in South Africa were recognized by his promotion to the command of the First Army Corps at Aldershot, in which he ranks as major-general.

French, L. Virginia (Smith), American poet: b. Maryland 1830; d. McMinnville, Tenn., 31 March 1881. She was associate editor of the 'Southern Lady's Book,' a fashion magazine, published in New Orleans (1852). Her collected works are: 'Wind Whispers,' poems (1856); 'Iztalilxo,' a tragedy (1859); and 'Legends of the South' (1867).

French, Mansfield, American educator: b. Manchester, Vt., 1810; d. 1876. He was educated at Kenyon College, Ohio, and from 1845 to 1848 was president of the Female College, Xenia, Ohio. He was active in the founding of Wilberforce University, the first college for the colored race, as he had been one of the founders of Marietta College. An ardent abolitionist, he laid before President Lincoln his plans for the education of the negroes as preliminary to their emancipation. The National Freedman's Relief Association was the realization of his views, as he had stated them at a mass meeting held in Cooper Union, New York, February 1862.

French, William Henry, American soldier: b. Baltimore, Md., 13 Jan. 1815; d. 20 May 1881. He was graduated from West Point in 1837, served in the Seminole and Mexican wars, was commissioned brigadier-general of volunteers and major of United States artillery, and was mustered out of the volunteer service in 1864 after having for a time commanded the 3d Army Corps. He commanded the 2d Artillery 1865–72, and was retired with rank of colonel in 1880. He commanded the forces which suppressed the Baltimore & Ohio Railroad riots (1887).

French Alliance, The, in American history, an alliance, offensive and defensive, between France and the American colonies, signed in 1778. Three American commissioners, Benjamin Franklin, Silas Deane, and Arthur Lee, sent to the court of France at Versailles, obtained recognition of the independence of the United States, and effected an alliance between the greatest European rival of Great Britain and her revolting colonies in America. The treaty stipulated that should war ensue between France and England it should be made a common cause, that neither France nor America would make peace without the consent of the other, nor should either lay down its arms until the independence of the colonies should be established. The news of the alliance provoked great enthusiasm in the American colonies. See UNITED STATES — AMERICAN REVOLUTION.

French and Indian War. See COLONIAL WARS IN AMERICA.

French Broad River, a river of North Carolina and Tennessee, rising in Henderson County, of the former State, near the foot of the Blue Ridge, flowing northwest into Tennessee, and discharging into Holston River, four miles above Knoxville. It is about 200 miles long. From Asheville to the Tennessee line it is remarkable for its beautiful scenery, flowing through deep mountain gorges, or overhung by high cliffs. In Buncombe County, N. C., are precipices known as the Chimneys and the Painted Rocks. The latter, which are between 200 and 300 feet high, derive their name from some Indian pictures still to be seen on them.

French Chalk, a variety of steatite or talc (q.v.) occurring in fine-granular or scaly masses of milky-white color and pearly lustre. It is extensively used by tailors as a crayon for marking cloth, also as an absorbent in removing grease spots.

French Congo, Africa, a large French territory on the west coast between the Lower Congo and the German Kamerun country, and stretching inland to Lake Chad; total area, about 500,000 square miles. The chief rivers are the Muni, Gabun, Ogowe, and Kuilu, and the stations already founded include Libreville, the capital (pop. 3,000), Brazzaville, Njola, Philippeville, Bonga, Loango, Franceville, and about 20 others. The district is under a commissioner-general, assisted by two lieutenant-governors. Though it is unhealthy even in the more elevated districts for Europeans, considerable trade is carried on, the exports comprising caoutchouc, cocoa, coffee, ivory, ebony, mahogany, palm-oil, gum-copal, etc. Pop. 8,000,000 to 12,000,000, of whom 1,200 are Europeans.

French Creek, N. Y., in the War of 1812. In the course of Wilkinson's invasion of Canada late in 1813 (see CHRYSTLER'S FARM), Gen. Jacob Brown posted himself on the St. Lawrence near the present Clayton, N. Y. On 1 November the British sent two brigs, two schooners, and eight gunboats to dislodge him; but his three-gun battery on a hill at the mouth of French Creek drove them off. They returned the next morning and were again repulsed, with severe loss. The Americans lost two killed, four wounded.

French East India Company. See EAST INDIA COMPANIES.

French Guiana. See GUIANA.

French Guinea, gĭn'ĭ, West Africa, a French colonial possession, between Sierra Leone, Liberia, Senegal, and Portuguese Guinea. The area is about 95,000 square miles and the population (1901) 2,200,000. The centres of population are Konakry, the capital, on the Isle of Tombo, and Boké, Ubrêka, and Timbo. The products are rice, millet, earth-nuts, gum, and rubber. A railroad of 80 miles has been built from Konakry to the Niger. There are 1,060 miles of telegraph line in the colony. In 1900 the imports were $2,755,250, and the exports $1,887,600. The colony is under the administration of a governor, who is under the governor-general of French West Africa. The French colonized the section as early as 1685.

French Indo-China, generally, the French possessions in southeast Asia, which include Cochin-China and the protectorates of Tongking, Laos, Annam, and Cambodia. French Indo-China is bounded by the China Sea, the Gulf of Siam, and the Mekong River. The area and population are given (1901) as follows:

PROTECTORATE	Area Sq. m.	Population
Annam	52,100	6,124,000
Cambodia	37,400	1,103,000
Cochin-China	22,000	2,968,529
Laos	98,000	605,000
Tongking	46,400	7,036,900
	255,900	17,837,429

The military forces of Indo-China consist of 10,901 European troops and 15,000 native soldiers. Over 1,000 miles of railroad were in operation in 1902. Indo-China is under the administration of a governor-general, and lieutenant-governor or resident superiors. The local revenue of the possessions equal the expenditure. See ANNAM; CAMBODIA; COCHIN-CHINA; LAOS; TONGKING.

French Language. See FRANCE.

French Literature. See FRANCE.

French Polishing, a process, generally employed for giving a smooth surface-coating to furniture and cabinet-work. The surface of the wood being finished off with glass-paper and placed opposite the light, the rubber (a ball of wool covered with rag), dipped in the varnish (or polish), is passed quickly and lightly over the surface in the direction of the grain of the wood, and rubbed till dry. This operation must be repeated several times. The most common of the varnishes known under the name of French polish are prepared as follows: Pale shellac, 5½ ounces; finest wood-naphtha, 1 pint; dissolve. Before applying any of these varnishes the rubber must be first slightly moistened with raw linseed oil. See VARNISH.

French Revolution. See FRANCE, *History of.*

French River, Canada, a stream in Ontario. It empties into Lake Huron after a course of 55 miles. For 150 years it was the regular route to the upper lakes.

French Shore. See NEWFOUNDLAND.

French Somaliland, sō-mä'lē-lănd, Africa, a French colonial possession on the west shore of the Gulf of Aden, adjoining Abyssinia. The area is about 46,000 square miles and the population about 200,000. It is administered by a governor and general council. The sea fisheries and interior trade are the only commercial industries. In 1900 the imports were $1,200,000 and the exports $800,000. Among the exports are coffee, ivory, gold, and sheepskins. French and English vessels visit the coast regularly and there are 100 miles of railroad in operation. The principal towns are Jibutil, the capital, Obok, Tagurah, Ambado, Gobad, and Sagallo.

French Spoliation Claims. During the great European wars from 1793 on, French privateers assailed neutral commerce, of which the American was chief, under various pretexts or without any; one was that the United States had violated the treaty of 1778. In the virtual French-American war of 1798–9, their privateers about the West Indies and elsewhere made prize of a great quantity of American shipping, for which our commissioners vainly endeavored to obtain indemnification. Finally, in the treaty of 30 Sept. 1800, as there was no hope of getting the money from Napoleon, the United States for other considerations waived the claim; and in the Louisiana Purchase Treaty of 30 April 1803 a part of the consideration was the assumption by the United States of its citizens' claims against France, then amounting to $3,750,000. Thence till 1885, when the cases were referred to the court of claims, nearly every year saw a bill before Congress to pay these claims, and twice a vote for it was obtained, which was vetoed by the President in each case — Polk and Pierce. The court finally adjudicated several thousand claims, and awarded some $4,800,000.

French Sudan', Africa, the name officially given to a large tract of country in the western Sudan, including the upper basin of the Senegal and the countries watered by the Upper and Middle Niger. It is bounded on the west by Senegal, on the south partly by the French territory of Rivières du Sud, and on the east by independent tribes and by British territory. Officially it is divided into "annexed territories," mostly in the western part, and protectorates. The former have an area of 54,000 square miles and a population of 360,000, while the latter have an extent of 300,000 square miles with a population of about 2,500,000. The control of this region is entrusted to a military commandant subject to the governor of Senegal and residing at Kayes on the Senegal River. A railway has been opened between Kayes and Bafoulabe at the junction of the head-streams of the Senegal.

Frenchman's Bay, Maine, an ocean inlet in Hancock County, extending inland 25 miles with a width of 10 miles. It contains a number of islands, among them Mount Desert, whereon is situated Bar Harbor (q.v.).

Frenchtown, Md., in the War of 1812. As part of the British operations on Chesapeake Bay in 1813, Sir George Cockburn was sent to close its head. Establishing himself first at the mouth of the Susquehanna, then on Elk River, on 28 April he sent 150 marines to destroy the stores at Frenchtown, a small village much used in the land transport between Baltimore and Philadelphia since the closure of the Bay. They drove off the Americans, and burned the stores and five vessels lying near.

Frenchtown, Mich., a township in Monroe County; 22 miles southwest of Detroit. In this vicinity 14 Jan. 1813 an American force of 650 defeated 500 British and Indians. On 20 Jan. the American forces were defeated and taken prisoners. On the 23d the wounded were massacred in what is known as "the massacre of the River Raisin." See WAR OF 1812, THE.

Freneau, Philip, American poet: b. New York 2 Jan. 1752; d. near Freehold, N. J., 18 Dec. 1832. Graduated from Princeton in 1771, he was captured in 1780, during a voyage to the West Indies, by an English cruiser, and his experiences while under detention he later recorded in 'The British Prison-Ship.' Having regained his liberty, he wrote much for the 'Freeman's Journal' of Philadelphia. In 1790 he became editor of the *Daily Advertiser* (New York), and in 1791 of the *National Gazette* (Philadelphia). After an interval at sea he permanently settled in New Jersey. Freneau was the first national poet of America, and a lyrist of real though uneven gifts. His elegy, 'The Battle of Eutaw Springs,' was praised by Scott, who called it "as fine a thing of the kind as there is in the language." During the Revolution he was active in satirical verse. His work attests his extensive culture; and though it conforms in the main to the conventions of the 18th century, it does not lack distinction. He wrote also several volumes of prose, published under the pseudonym "Robert Slender" and of small merit. Until recently his poetry has been strangely neglected; but in 1901 appeared a biography by Austin, and in 1903 an edition of the poems, with a 'Life,' prepared by F. L. Pattee. During Freneau's life there were editions in 1786, 1788, 1809, and 1815. There were reprints of the 1786 edition in 1861 and 1865. Consult further: Tyler, 'Literary History of the American Revolution' (1897); and Wendell, 'Literary History of America' (1900).

Frère, Charles Théodore, shärl tā-ō-dōr frār, French painter: b. Paris 24 June 1815; d. there 25 March 1888. He was a pupil of Cogniet and Roquelan, and made his first exhibit in 1834. He was present at the fall of Constantine, Algeria, in 1837, and from that time chose scenes from eastern life. His pictures illustrating Constantine (1840–8) are among the best he painted.

Frere, frēr, SIR **Henry Bartle Edward,** English statesman and administrator: b. Clydach, Brecknockshire, Wales, 29 March 1815; d. Wimbledon, Surrey, 29 May 1884. He was educated at Haileybury College; entered the East India Company's Civil Service in 1833; introduced improvements into the system of tax collection, and distinguished himself as an administrator. At the outbreak of the Mutiny in 1857 he promptly seized the fortress of Multan, retained command over his own province, and was enabled to assist the neighboring provinces. In 1862 he became governor of Bombay, and in 1867 he was knighted. In 1872, as British commissioner, he negotiated a treaty with the sultan of Zanzibar abolishing the traffic in slaves. In

1877 he was appointed governor of the Cape, and high commissioner in South Africa to settle native and colonial affairs, but the war which he provoked with the Zulus gave so much dissatisfaction to the government that in 1880 he was recalled. See 'Life,' by J. Martineau (1895).

Frere, John Hookham, English poet, translator, and diplomatist: b. London 21 May 1769; d. Malta 7 Jan. 1846. After a career in the diplomatic service, he produced his original 'Prospectus and Specimen of an Intended National Work . . . Relating to King Arthur and His Round Table' (1817), better known as 'The Monks and the Giants'; a literary burlesque, full of charming verse and of excellent character-drawing. It naturalized in English the *ottava rima* afterward used by Byron in 'Beppo' and 'Don Juan.' A version of a large part of Aristophanes succeeded this effort.

Frère, Pierre Edouard, pē-ăr ā-doo-ăr frăr, brother of Charles Théodore Frère (q.v.), French painter: b. Paris 10 Jan. 1819; d. Anvers-sur-Oise June 1886. He studied under Paul Delaroche, and chose sentimental genre as his specialty; many of his delineations of home- and child-life are full of true and simple feeling and have been frequently reproduced. In technique he was remarkable as a colorist, and his 'Little Gourmand'; 'Curiosity'; 'Repose'; 'The Little Cook'; 'First Steps'; 'Going to School' have long been favorites in the print-shop windows.

Fresco, in art, a term applied, originally by the Italian artists, to pictures executed in water-colors upon a freshly-plastered wall. Mineral or earthy pigments are employed which resist the chemical action of lime, and in drying the colors become permanent. On the revival of the arts in Europe it became customary to decorate the walls of churches, palaces, cloisters, and convents with fresco paintings. The Romans found plaster paintings on brick walls at Sparta, cut them out, packed them in wooden cases, and transported them to Rome. Fresco painting was first made of real importance by the Italians in the 16th century. It is a very common error in this country with antiquarians and writers in general to term the ancient paintings frequently found on church walls, etc., frescos; but there is scarcely an instance of a genuine fresco among them. They are distemper paintings on plaster, and quite distinct in their style, durability, and mode of manipulation. The art is very ancient and widely spread, frescos of early date being found in India, Egypt, Mexico, etc., as also in Pompeii and other places. The example of Michelangelo and Raphael shows how worthy it is of the greatest artists. The painter cannot seduce the senses by soft tints and tender harmony of colors; he is, therefore, reduced to depend solely on form, character, expression.

The methods employed in painting frescos is described as follows in a treatise upon painting by the monk known as Theophilus, a work certainly written before the close of the 12th century: "When figures or other objects are drawn on a dry wall, the surface should be first sprinkled with water till it is quite moist. While the wall is in this state, the colors are to be applied, all the tints being mixed with lime, and drying as the wall dries, in order that they may adhere." The method is still in general use in Italy and in Munich, for the production of both exterior and interior decoration. In modern practice lime and fine sand are used for the final coating of plaster, which is allowed to dry thoroughly, and then smoothed by the application of pumice-stone. On the evening before the painter is to begin his work the surface is thoroughly damped with water in which a little lime has been dissolved, and the process is again repeated next morning. The colors are the same as those used in true fresco-painting, which we next describe; but *fresco secco* possesses this advantage over true fresco, that the artist can leave his work at any point, and, having simply redamped the wall, again resume it. The *secco* process is excellently adapted for rough decorative work, and is as durable as true fresco; but it is less suited for delicate and refined artistic productions.

Fresco-painting was accordingly the chosen method by which the greatest Italian masters expressed, upon the walls of cathedral and council-room, their deepest conceptions of religion and polity. Giotto employed it in the Arena Chapel of Padua and the Church of St. Francis at Assisi; Orcagna in the Church of Sta. Maria Novella; Fra Angelico in the Convent of St. Mark; Masaccio in the Brancacci Chapel of the Carmine, Gozzoli in the Riccardi Chapel, at Florence; Perugino in the Sala del Cambio of his native city; Luini in the churches of Milan, Lugano, and Saronno; Pinturicchio in the cathedral library of Siena; Correggio in the Cathedral of Parma; Raphael in the Vatican; and when Michelangelo was directed by Pope Paul III. to paint his 'Last Judgment' in the Sistine Chapel in oils, instead of in fresco as at first agreed on, he protested that oil-painting was an art for women and indolent persons, that fresco was the art for men and painters, and was allowed to have his way. The celebrated 'Last Supper' of Leonardo at Milan is a mural painting in oils, not fresco; and the method used, combined with the fact that the production of the work extended over a period of years, and that the faulty masonry of the wall afforded insufficient protection against damp, accounts for the ruined state in which the subject now exists.

Germany has produced the most distinguished fresco painters in modern times, and Cornelius has established his fame by his grand fresco pictures in the Glyptotheca in Munich. Schnorr is also distinguished in this line, and the Villa Massimi, near Rome, is a fine monument of contemporary German art, as Overbeck, Schnorr, and Feith painted the three rooms in fresco. Fresco painting was long disregarded, when all noble and grand conceptions seemed to have fled from the art; and it is only in recent times that it has been taken up again, chiefly by the Germans. Several works of this kind have been executed in the British Houses of Parliament. See ART; MURAL DECORATION; PAINTING.

Frescos, Boscoreale. See METROPOLITAN MUSEUM OF ART.

Fresh-air Work, a form of benevolence or helpfulness; in this particular the taking of poor children from the tenements and slums of large cities to the country or seashore for recreation. It is said to have originated in 1849, when William A. Muhlenberg of New York sent a large number of poor children and invalids to the country for short vacations. The first general fresh-air societies were organized in

1874, and since then a number of newpapers have inaugurated fresh-air funds. There are now societies in 38 cities and 14 fresh-air organizations in New York. In Europe, Switzerland was the first to take up the movement in 1876. In 1895 there were 73 fresh-air colonies in that country. Nearly all European countries and Argentina in South America have taken up the work. Consult, 'Fresh Air Charity in the United States' (1897).

Fresh-water Insects. Insects are essentially creatures of the air and the land; yet a considerable number pass the whole or the greater part of their lives in rivers, lakes, and ponds. Among insects aquatic in all stages we can distinguish between those which glide or skate over the surface of the water, diving not at all, or only exceptionally, and those which habitually dive and swim through the water after the manner of fishes. The most typical of the surface-dwellers are the bugs of the family Hydrometridæ. See POND-SKATERS.

Among the Coleoptera the whirligig beetles (*Gyrinidæ*) frequent the surface of ponds and brooks where they may be seen in small companies, performing a whirling, mazy dance over the surface-film. These insects, when they dive, carry down with them a small air-bubble; enclosed in a film between the tip of the wing-covers to the hinder end of the abdomen. They are not, like the pond-skaters, completely enveloped in air while under water. The beetles of a nearly related family (*Dyticidæ*), well called "diving-beetles," belong to the group of insects which live habitually submerged. Their contours are admirably adapted for motion through the water, but there is no dense hairy covering to ensure the formation of an air-bubble and the breathing is provided for in quite another way. The abdominal spiracles open on the upper surface of the segments, which are completely covered by the wing-cases when the wings are shut. The wing-cases being convex and the upper surface of the abdomen depressed, a considerable amount of air is enclosed, allowing the insect to remain submerged for some time.

Another mode of adaptation to life in the water is shown by the water-scorpions (*Nepidæ*). They are provided with a pair of long-grooved appendages at the tail-end of the body; these can be closely pressed together and form a tube, the tip of which pierces the surface-film and conveys a supply of air to the spiracles. These insects, like the allied "water-boatmen" (*Notonectidæ*), have well-developed wings, and make excursions by night to new watery dwelling-places.

Many insects lead an aquatic life only during their larval stage. Naturally enough, however, such insects when adult are to be found flying chiefly in the neighborhood of water in which they will lay their eggs — the May-flies and midges for example. The contrast between the conditions of the larval and the imaginal life in such cases is most striking, and can only have been brought about by slow degrees. A certain amount of moisture in the earth is necessary to the well-being of many burrowing larvæ, while some are found in semi-liquid mud, in decaying refuse, or in animal excrement. In such surroundings breathing through the lateral spiracles becomes impossible, and we find that access to the air-tubes takes place only by one or two pairs of spiracles near the head or tail-end of the body, sometimes opening through "respiratory trumpets" whose expanded mouths can be thrust out of the clogging surroundings of the mud or refuse into the fresh air, while the grub remains concealed and continues to feed. A similar suppression of most of the spiracles, with the development of a tubular process at the tail end of the body in connection with the tracheal system, is the adaptation by which many aquatic larvæ breathe — for example, the grub of the mosquito. The families of insects nearly related to these have larvæ which live in mud and damp earth, and this suggests that it was from the shores that the waters were invaded by these insect-hosts.

But there is another division of aquatic larvæ still more perfectly adapted to life in the water. The grub of the gnat or the drone-fly needs to rise to the surface at intervals and pierce the film with its air-tube in order to get a fresh supply of oxygen. But the pupa of the sand-midge, with its tubular gill-filaments, or the larva of a May-fly with its tracheal gill-plates, can remain in the water throughout its life, drawing, as do the fishes, sufficient oxygen from the dissolved air. It is interesting to notice that within the limits of a single and restricted order — the dragon-flies — we find some larvæ breathing by means of tracheal gill-plates, and others taking supplies of water into the hind-gut over whose walls run branching air-tubes; while in the final nymph stage the thoracic spiracles are open, and the insect raising the front part of its body above the surface, breathes through them after the manner of an imago. These various adaptations to an aquatic life within a single group indicate clearly that the habit of living in water is not primitive among insects, but that it has become acquired by different races at different times in the course of the development. It may be presumed that larvæ with the more perfect adaptations for breathing when submerged — leaf-like or thread-like gills — are older inhabitants of the water than those which have to rise periodically to the surface to take in a supply of air.

Fresh-water Mussels, bivalved mollusks that dwell in lakes and rivers; river-mussels, or river-clams. They belong to the family *Unionidæ,* allied to the cockles, which has a large and thick foot, no byssus, siphon short (when present), and a parasitic embryonic growth. The shells are equivalve, varying according from thin and smooth to very thick, rugose and knobbed; the hinge variable (in *Anodonta* having no hinge-teeth); and the interior always thickly nacreous, making it useful in the arts as "mother of pearl," and often producing fine pearls. The family is world-wide in its distribution and includes about a dozen genera, two of which (*Unio* and *Anodonta*) occur in most parts of the world. These mollusks dwell in rivers and ponds, and vary greatly according to the character of their home, whereby a great number of supposed species have been named that are now known to be merely varieties of the same stock resulting from different environment. They stand upright in the sand on the blades of the shell, so that the heavy hinge margin receives any blow from drifting stones, or other harm; and slowly move about, sucking in the minute animal and vegetable organisms upon which they feed. (See PELECYPODA.) The development of their young is most unusual. The eggs when ejected from the ovaries are caught in the gills of the mother and are sustained by a nutritive mucuslike secretion, until they reach a certain degree of age, when they become "glochidia."

They then have a larval shell, provided with strong hooks, and possess a long filament. After a period they are expelled through the exhalent siphon into the water, and this ejection may be timed to the passing of a small fish, to whose body if they touch it the glochidia at once cling by means of the hooks. Should they miss striking against a fish when thrown out the embryos sink and lie upon the bottom with their shells gaping and the filament floating upward. There they remain until a "host" comes within reach; but this must soon happen or they will perish. The glochidia of *Unio* usually become attached to the gills; those of *Anodonta* to the skin or the fins. In this position they become overgrown by the skin or mucous membrane of their host, and are nourished by his juices. This goes on for about 10 weeks, during which time the glochidium has been metamorphosed into a young normal mussel, drops off and begins the ordinary course of life. Their life is probably long.

Mussels abound in all the rivers of the United States and were extremely numerous and varied in those of the Mississippi; and they entered very largely into the fare of the native red men, as is attested by the large refuse-heaps of their shells to be found in all the river courses. It was long ago discovered, however, that these shells yielded pearls of great beauty and price (see PEARL), while the mother-of-pearl of many species was marketable for the manufacture of buttons and similar articles. The result has been a serious depletion of the mussels of many parts of the Middle West, and nearly an extinction of some species.

Fresnel, frā-nĕl, **Augustin Jean**, French physicist: b. Broglie, France, 10 May 1788; d. Ville d'Avray, near Paris, 14 July 1827. He was educated at the Ecole Polytechnique, and early devoted himself to the practice of civil engineering. In 1815 he became distinguished as the discoverer of the polarization of light, and in 1823 was elected a member of the Academy. He made important researches respecting the wave theory of light. The result of his great discovery is shown in the system of lens lighting apparatus, which has changed the mode of lighthouse illumination over the whole world, and is universally known as the "Fresnel system." In 1825 Fresnel was elected F. R. S. of London, and in 1827 received the Rumford medal of the society.

Fresnel's Surface. See LIGHT.

Fresnillo, frĕs-nēl'yō, Mexico, a city in the State of Zacatecas. It has a spacious square, with a costly fountain in the centre, and contains several large churches. In its vicinity are the celebrated mines of Fresnillo, reckoned among the most productive in Mexico. Pop. 13,000.

Fresno, Cal., a city and county-seat of Fresno County, situated on the San Francisco & S. J. V., the Southern P., and Atchison, T. & S. F. R.R.'s. The city is an important fruit-growing centre, the raisin trade alone being valued at $3,000,000 annually. Other important industries are the cultivation and exporting of oranges, grapes, and olives, besides a large live-stock trade.

Fresno was settled in 1872, became the county-seat in 1874, and received a charter as a city in 1885. The government is controlled by a mayor, chosen every four years, a municipal council, and other administrative officials. The assessed property valuation is about $6,000,000. Pop. (1900) 12,470.

Freund, froint, **Herman Ernst**, Danish sculptor: b. Uthlede 15 Oct. 1786; d. 30 June 1840. At first a blacksmith, he studied at the Copenhagen Academy of Fine Arts, won the Academy's large gold medal with allowance for foreign study, and resided in Rome, where he was greatly assisted in artistic progress by Thorwaldsen and executed his 'Mercury' and 'Luke.' His conspicuous successes were produced in the domain of Norse mythology, to which field belongs his Ragnarök frieze, done in 1827 for the Christianborg Palace, where it was nearly destroyed by fire in 1884, and later restored by Ginding. Further works by him are 'Eurydice,' 'Thor,' and 'Mimer and Bolder Consulting the Norns.' See Life by Victor Freund (1883).

Frey, frī, **Albert Romer**, American author: b. N. Y. 17 Feb. 1858. He is secretary of the Shakespeare Society of New York and has written in refutation of Ignatius Donnelly's 'cipher' theory of Shakespearian authorship. Among his other writings are 'William Shakespeare and alleged Spanish Prototypes' (1885); 'Soubriquets and Nicknames' (1887).

Frey, Emil, Swiss president: b. Arlesheim, near Basel, 24 Oct. 1838. While in the United States in 1861 he enlisted as a sergeant in the Federal army, was taken captive at Gettysburg and confined in Libby prison. He returned to Switzerland in 1865, there becoming prominent as a journalist, and was minister from Switzerland to the United States 1882–7. He was elected president of the Swiss Confederation 14 Dec. 1893. He is a noted advocate of educational progress and reform and has been prominent in the furtherance of public works and of army improvement.

Frey, Heinrich, German anatomist and zoologist: b. Frankfort-on-the-Main 15 June 1822; d. Zürich 17 Jan. 1890. He began his studies at Bonn in 1840, and continued them up to 1845 at Berlin and Göttingen, when he took the degree of Doctor in medicine and at the last named university became assistant professor of physiology. In 1848 he was appointed professor of histology and comparative anatomy at Zürich. He was considered one of the first microlepidopterologists of Germany. The range of his published works is wide. He wrote a 'Text-Book of Zootomy' (1847); 'An Introduction to the Study of Invertebrates' (1847); several works on histology, a book on the microscope, and an elaborate account of the lepidoptera of Switzerland.

Freyberg, frī'berg, **Konrad**, German painter: b. Stettin 14 May 1842. He studied at the Art Academy of Berlin and entered the studio of Steffecks, applying himself to the delineation of military subjects, especially cavalry scenes. His canvases are small, but his portraits of the mounted troops are finished and elegant. He has painted in this style many of the principal figures in the Franco-Prussian War. Among his works may be mentioned 'Prince Karl of Prussia with his Staff' (1872); 'Group of Officers of the Guard' (1875); 'Royal Hunt at Letzlingen' (1881); 'Prince Frederick of Hohenzollern at the head of the Second Regiment of Dragoon Guards' (1885).

Freyburg. See FREIBURG.

Freycinet, Charles Louis de Saulces de, shärl loo-ē dė soos dė frā-sē-nā, French statesman: b. Foix (Ariège) 14 Nov. 1828. He was trained as an engineer, and held several important appointments, being associated with Gambetta in the war department in 1871. He was elected to the senate in 1876, and became minister of public works in the following year. He was minister of foreign affairs and president of the council 1879-80, and these posts he held on several subsequent occasions. In 1888 he became minister for war, and continued to hold that office for five years, during two of which (1890-2) he was also premier. In 1893 he had to resign owing to the Panama scandals. As head of the war department he did much to strengthen and develop the French army. He is the author of several important works on engineering and sanitation, and of 'La Guerre en Province pendant le Siège de Paris' (1871). In 1890 he was elected to the French Academy.

Freytag, Gustav, goos'täf frī'täg, German author: b. Kreuzburg, Prussia, 13 July 1816; d. Wiesbaden 30 April 1895. His first dramatic composition was 'The Bridal Tour,' a comedy (1844); it was followed by a little one-act tragedy, 'The Savant' (1844), and by a small volume of poems, 'In Breslau' (1845); after which he produced 'The Valentine' (1846); 'Count Valdemar' (1847), and 'The Journalist' (1853). Among his works outside of the drama may be mentioned his great novel of social life, 'Debit and Credit' (1855; 40th ed. 1893); 'Pictures from the German Past' (1859); 'The Lost MS.' (1864; 23d ed. 1893); 'Die Ahnen' ('Ancestors'), a cycle of six stories portraying the German civilization from the beginning of historic times; and 'Charlemagne' (1894).

Fri'ar, from the French *frère,* Latin *frater,* signifying brother, is a name common to the male members of any religious order. Thus the Capuchins were originally called Friars Hermits Minor, and the Observants Friars Observants. The term, however, is more exclusively applied to those of the mendicant orders; of which the four chief were the Dominicans (Black Friars), Franciscans (Gray), Carmelites (White), and Augustinians.

Friar-bird, a familiar woodland bird of Australia, of moderate size, with brownish-drab plumage, head and neck bare of feathers and a cowl-like neck-ruff. It is an aberrant form of honey-eater (*Meliphagidæ*), some 16 species, all of the Malayan and Australian regions are grouped in the genus *Philemon,* of which the present species is named *P. corniculatus,* in reference to a horny excrescence upon the base of the culmen of the beak. Its loud cries and other peculiarities have given it many local names, such as 'monk,' 'leatherhead,' 'poor soldier,' 'pimlico,' and 'four o'clock.'

Fribourg, or **Freiburg,** Switzerland, a town picturesquely situated on the Saane, which is here crossed by a magnificent suspension bridge, 905 feet long. It is partly surrounded with walls and towers, and among the chief buildings are the Church of St. Nicholas, a handsome Gothic structure, with a spire 240 feet high, and one of the finest organs in Europe; a town-house with a lime-tree near it, which was planted in 1476, on the day of the battle of Morat (Murten), the cantonal university, founded in 1889, and a Jesuit college. A gorge close to the town is crossed by a second suspension bridge, 689 feet in length and 317 feet high. Pop. (1900) 15,794.

Frick, Henry Clay, American manufacturer: b. West Overton, Pa., 19 Dec. 1849. He began commercial life in a small coke business, which grew to be the largest in the country, and is now president of the H. C. Frick Coke Co. He was prominent as instrumental in putting an end to the Homestead Strike (1892) and has been president of the Carnegie Steel Co.

Friction, the resistance which opposes the sliding or slipping of one body relatively to another body with which it is in contact. It is doubtless chiefly due to the minute irregularities that exist upon the surfaces in contact, the motion being opposed by the interlocking of these irregularities. Two kinds of friction may be recognized: (1) "Static friction," between bodies that are relatively at rest, and (2) "Kinetic friction," between bodies that are actually slipping over each other. Static friction is measured by the force that is required to just cause one body to move upon the other, when the two are pressed together by a certain definite pressure; and the ratio of this force to the pressure with which the bodies are held in contact is called the "coefficient of statical friction." Kinetic friction is measured by the force that is required to maintain one of the bodies that are in contact, in a state of uniform motion with respect to the other one; and the ratio of this force to the force with which the bodies are pressed together is called the "coefficient of kinetic friction." The coefficient of static friction between two given substances may be determined by causing a weight composed of one of the substances to rest upon a smooth plane composed of the other substance. If the plane is nearly horizontal, the weight will not slip upon it; but by increasing the angle of inclination, a position will be found for the plane, such that the weight is just on the point of sliding. The angle that the plane then makes with the horizontal is called the "angle of repose" of the pair of substances of which the plane and the weight are composed; and it may be shown by the elementary principles of mechanics that the coefficient of statical friction for these substances is numerically equal to the natural tangent of the angle of repose. Following are a few coefficients of statical friction, as given by Rankine: Wood upon wood, dry, 0.25 to 0.50; leather on metals, dry, 0.56; leather on metals, greasy, 0.23; metals on metals, dry, 0.15 to 0.20. Rennie found somewhat larger values for the coefficient between metals. Thus for statical friction between dry surfaces, he found: Steel on cast iron, 0.33 for ordinary loads; and for similar loads he found 0.22 for brass upon cast iron. Coefficients of kinetic friction are smaller than the coefficients of statical friction between the same substances, and all friction is greatly diminished by introducing oils or other lubricants between the rubbing surfaces. In kinetic friction between surfaces that are smooth and well lubricated, the results depend far more upon the nature of the lubricant than they do upon the nature of the rubbing surfaces; and they are also greatly dependent upon the method by which the lubricant is applied. When a journal is lubricated by means of a pad placed underneath it, the friction may be more than six times as great as when the same journal is run in a bath of the same oil. Speed also has a great influence upon the amount of friction developed. Morin's «laws of friction,» given in 1831, are as follows: (1) The coefficient of kinetic friction is independent of the pressure with which the rubbing surfaces are pressed together; (2) the coefficient of friction, and the total friction, are independent of the areas in contact, so long as the total pressure between the two rubbing bodies is constant; and (3) the coefficient of friction is independent of the velocity, although static friction is greater than kinetic friction. These laws, which are often given in text-books and elsewhere as reliable presentations of the known facts, are now known to be exceedingly imperfect. Morin gave them for ordinary conditions of shafting and journals, where no special care has been taken with the journals, and no artificial means have been provided for the free supply of oil. It is now certain that they cannot be assumed to apply under other conditions, and it has been pointed out that «there are many conditions under which they lead to the wildest kind of error.» The phenomena of friction are in reality quite complicated, and a thorough study of the subject is necessary before the friction that may be expected in any given case can be calculated with even a rough degree of approximation. Consult: Thurston, 'Friction and Lost Work'; Kent, 'Mechanical Engineer's Pocket-Book.'

«Rolling friction,» so called, is not true friction, in the sense in which the word has here been defined. It is due mainly to the fact that a wheel when rolling upon a smooth track or other surface, creates a slight depression by its weight, and is also slightly deformed itself at the same time. The energy which is absorbed in producing these slight deformations is in considerable measure dissipated as heat; but the retardation of the moving body from this cause is seldom comparable with that due to sliding friction. For the internal friction of fluids, see VISCOSITY.

Friday, the sixth day of the week, so named from the Anglo-Saxon *Frigedag,* the day of Friga, the wife of Odin and the Teutonic goddess of love. The Anglo-Saxon is a translation of the Lat. *Veneris dies,* day of Venus, whence the French *Vendredi,* Friday. Its religious associations are varied. According to the Mohammedans it was the day when Adam was created, entered Paradise, was expelled therefrom, the day of his repentance, of his death, and is to be the day of resurrection. It is the Moslem «day of assembly» or sabbath. As the day of Christ's crucifixion it is generally observed in the Greek, Latin, and other Christian episcopal churches as a fast day, and is especially observed on Good Friday (q.v.). From the same cause, also, it is regarded among the superstitious as an unlucky day, and was long associated in the public mind with the execution of criminals sentenced to death, which usually took place on Friday and was commonly called hangman's day.

Friedel, frē'dĕl, **Charles,** French chemist: b. Strasburg 1832; d. 1899. He studied under Pasteur in his native town and continued his scientific education at Paris, entering the laboratory of Wurtz. In 1869 he was graduated with two remarkable theses and in 1876 became professor of mineralogy in the Sorbonne. He eventually succeeded Wurtz (1884) as professor of organic chemistry and director of the research laboratory in the Sorbonne, a position he maintained till his death. His researches are record by him in 254 original memoirs and entitle him to a place among the foremost scientific men of the 19th century. His name is especially connected in association with James Mason Crafts (q.v.) with the synthetic method known as the 'Friedel and Crafts reaction' (q.v.). He published, in addition to text-books on mineralogy and crystallography, 'Cours de Chimie Organique Professé a la Faculté des Sciences de Paris' (1887).

Friedel and Craft's Reaction, in chemistry, a synthetic method discovered by the French chemist, Charles Friedel, in conjunction with James Mason Craft. This discovery revealed the action of various chlorinated compounds on hydrocarbons in the presence of aluminum chloride. A vast number of varying organic compounds may thus be produced in any ordinary quantity, for example, triphenyl methane is a commercial compound, necessary to the production of valuable dyes; by Friedel and Craft's Reaction process it can be produced rapidly and cheaply in any quantity required.

Fried'elite, an acid silicate of manganese, containing some chlorine, and crystallizing in the rhombohedral system, but also occurring massive. It is rose-red in color, and is found in a manganese mine at Aderville, France.

Friedericia, frē-dā-rē'sē-ä, **Julius Albert,** Danish historian: b. Copenhagen 1849. He became assistant librarian of the library of the University of Copenhagen in 1891. He has published 'Danmarks ydre politiske Historie i Tiden fra Freden i Lybek til Freden i Brömsebro' (1876–81); 'Adelsvoeldens sidste Dage Danmarks Historie fra Christians IV.'s Dod til Enevoeldens Indforelse' (1894).

Friedland, frēd'länt, **Valentin,** surnamed Trotzendorf, German educator: b. Trotzendorf, Upper Lusatia, Germany, 14 Feb. 1490; d. Liegnitz, 26 April 1556. He became a teacher at Görlitz in 1515. He was for many years at the head of the gymnasium in Goldberg where the students, at times over 1,000 in number, were organized like a Roman republic, with senate, consuls, censors, and the like, with Friedland as perpetual dictator. See Pinzger, 'Valentin Friedland, gennant Trotzendorf' (1825); Lösche, 'Valentin Trotzendorf' (1856).

Friedland, Prussia, a small town 28 miles southeast of Königsberg, on the river Alle. The Russians under Benningsen were here defeated on 14 June 1807 by the French under Napoleon (q.v.) Pop. (1900) 2,824.

Friedländer, Friedrich, frēd'rĭн frēd'lĕn-dėr, Austrian painter: b. Kohljanowitz, Bohemia, 10 Jan. 1825; d. 1901. Among his works, which are confined to historical or genre themes are 'The Death of Tasso' (1852); 'The War Veterans' (1875); 'News' (1883); 'Distribution of Wine' (1884).

Friedländer, Ludwig, lood'vĭg, German classical scholar: b. Königsberg, Prussia, 24 July 1824. His most representative work is 'Typical Studies in the History of Roman Manners and Morals' (6th ed. 1889), written in popular style. 'The Remains of Nicanor's Emendations of the Punctuation of the Iliad' (1850), and like theses, constitute him an authority in Homeric criticism.

Friedman, frēd'man, **Isaac Kahn**, American journalist and novelist: b. Chicago, Ill., 3 Nov. 1870. He was graduated from the University of Michigan in 1893 and has since been engaged in newspaper work in Chicago. He has published 'The Lucky Number,' a collection of short stories of the Chicago slums (1896); 'Poor People,' a novel (1900).

Friedmann, frēd'män, **Alfred**, German poet and novelist: b. Frankfort-on-the-Main, Prussia, 26 Oct. 1845. Among his poems are: 'Merlin,' 'Orpheus' (1874), two ballads; 'Biblical Stars' (1875), comprising three idylls; 'Love's Fire Test, Angioletta'; 'Lays of the Heart' (1888). He is the author of many novels, including: 'Two Marriages'; 'Suddenly Rich' (1891); 'The Wild Rose' (1893).

Friedrich, Johannes, frēd'rĭн yō-hän'nĕs, German Old Catholic theologian: b. Poxdorf, Bavaria, 5 May 1836. After studying at the universities of Bamberg and Munich he entered the Roman Catholic priesthood in 1859. In 1865 he became professor of theology in the University of Munich. At the Vatican Council, 1869–70, he united with his colleague Döllinger (q.v.) in opposing the dogma of papal infallibility, and when acceptance of the dogma was demanded by the archbishop of Munich of the faculty of the Munich University, he with Döllinger declined and was excommunicated. In 1882, however, he was given another professorship, and in 1882 was transferred to the philosophical faculty. He was one of the leaders in founding the Old Catholic Church, but withdrew from active leadership in 1878 when the Old Catholic Synod voted to allow its priests to marry. Among his many writings are 'Tagebuch während des vaticanischen Concils' (1871); 'Zur Verteidigung meines Tagebuchs' (1872); 'Geschichte des Vaticanischen Concils' (1877–87), and 'Life of Döllinger' (1899–1901).

Friedrich, John, American violin-maker: b. Cassel, Germany, 1858. Having studied violin making under Oswald Möckel, he came to the United States in 1883, and shortly took prominent rank in his calling. In 1893 he obtained the highest award for violins, violas, and violoncellos at the World's Columbian Exposition. He has also made bows of very excellent workmanship, and came to be recognized as an expert in identifying and appraising rare specimens.

Friedrich, Kaspar David, German painter: b. Greifswald 5 Sept. 1774; d. Dresden 7 May 1840. He obtained his training in the Copenhagen Academy of Fine Arts, and in 1795 settled at Dresden, where he became member and professor of the Academy. He excelled in depicting nature as seen through the psychologic medium of transitory human moods. Favorite motifs are the gloom of the forest, night scenes with moonlight, or storms at sea. The Castle of Berlin contains two fine examples: 'Abbey in an Oak Forest on a Winter's Evening,' and 'Pilgrim on the Shore.'

Friedrich, Woldemar, vŏl'dė-mär, German painter: b. Gnadau, Saxony, 20 Aug. 1846. He accompanied the German troops in the Franco-German War, and thence gained material for his illustrations in Daheim and in Hiltl's 'Der französische Krieg von 1870–71' (6th ed. 1891). In 1881 he became professor in the art school at Weimar and in 1885 in the Berlin Academy. He executed decorative paintings in Castle Hummelshain, Weimar; the Weimar gymnasium; and the booksellers' exchange at Leipsic. He also painted a series of aquarelles and numerous genre-works in oils.

Friedrichs, frēd'rĭнs, **Hermann**, German author: b. St. Goar, on the Rhine, Germany, 14 June 1854. He distinguished himself in periodical journalism, and also wrote: 'The Revenge of the Bayadere' (1880), a lyric; 'Love Ordeals' (1888), a volume of stories; and 'Forms and Passions' (1889), a book of poems.

Friendly Islands. See Tonga.

Friendly Societies in America. See Fraternal Societies in America.

Friendly Sons of Saint Patrick, Philadelphia, Pa., organized in 1790 as the Hibernian Society. The first president was Hon. Thomas McKean, a signer of the Declaration of Independence. Among other prominent members of the society have been Gen. Walter Stewart, Commodore John Barry, Gen. Edward Hand, Col. Francis Nichols, Col. Thomas Proctor, Hon. Thomas Fitz Simons, and Gen. Andrew Jackson. The organization still exists, has a membership of over 600, and has in its treasury $75,000 or $80,000. In December 1897 the name Hibernian Society was dropped and that of the Friendly Sons of Saint Patrick adopted. The latter name had been borne by a Philadelphia society which was organized in 1771 and went out of existence sometime after 1805.

Friendly Sons of Saint Patrick, Society of the, New York city; founded in 1784. To-day, as at all times during its long existence, it numbers in its membership a great many of the most eminent merchants and professional men of New York. Among its presidents have been Hon. Richard O'Gorman, Chief Justice Charles P. Daly, Hon. James T. Brady, Eugene Kelly, Hon. Hugh J. Hastings, Joseph J. O'Donohue, David McClure, Samuel Sloan, John D. Crimmins, Hon. Morgan J. O'Brien, Hon. James A. O'Gorman, and Hon. James Fitzgerald. There are no creed or political tests for membership in the organization.

Friends, The Religious Society of. The Religious Society of Friends, commonly called Quakers, had its origin in England about the middle of the 17th century, and was largely the result of the ministry of George Fox, who is often called its founder.

Early History.— George Fox, the son of a weaver, was born at Drayton, in Leicestershire, 1624, and began his public preaching about the year 1648. His spiritual views and practical application of Christian doctrines met a ready response in many pious persons (both Churchmen and Dissenters), and bitter opposition from others whose practices they condemned. His followers increased rapidly, and were known as "Children of Light," "Children of Truth," and "Friends of Truth"; finally adopting the name "Religious Society of Friends." Among them were many itinerant preachers; Fox in his journal (1654) says, above 60 in number. From the first imprisonment of Fox in 1649 to 1687 Friends were the objects of almost continuous persecution. In 1656 Fox computed there were seldom less than 1,000 in prison. Between the years 1661 and 1697, over 13,000 Friends were imprisoned in England, 198 were transported as slaves, and 338 died in prison or of wounds received in assaults while attending meetings. These persecutions were upon various pretexts, as, the refusal to pay tithes, to swear, or to remove the hat; for preaching in public places; as disturbers of public worship, for speaking in "churches" (a practice then not uncommon); and as Sabbath breakers, for traveling to their meetings on the day called the Sabbath. Many were apprehended for keeping an unlawful assembly under the Conventicle Act. Scotland, Ireland, the Continent, and America were early visited by their ministers.

The first to arrive in New England were two women, Ann Austin and Mary Fisher, who came to Massachusetts from Barbadoes in 1656. After five weeks' imprisonment and much cruel treatment they were sent back. Stringent laws were promptly enacted by that colony to prevent others from coming and owners of vessels from bringing them. Regardless of the cruel penalties of these laws, the Quakers continued to arrive and suffer their infliction. In numerous instances delicate women were "stripped naked from the middle up, tied to a cart's tail and whipped through the town" and thence through other towns. Four — one a woman — were hanged on Boston Common. Nevertheless they increased in numbers and spread to adjoining colonies.

The first Friends in New Jersey settled along the Raritan River in 1663. In 1677 over 200 came to this province and founded Burlington. William Penn joined the society in 1667. In 1681 he and several other Friends purchased East New Jersey, and in the same year Penn obtained from the crown the grant of Pennsylvania. A few Friends were in the province before Penn acquired it, and two shiploads came in the fall of 1681. The next year Penn himself came with others, and in less than three years the colony had a population of 7,000. For a period of 70 years, and so long as the influence of Friends predominated, there were no conflicts with the Indians. At an early date the society cleared itself of human slavery. Friends began to protest against it as early as 1688, and for nearly 100 years the agitation was continued, until "in the year 1787 there was not a slave in the possession of an acknowledged Quaker." This was largely due to the labors of John Woolman, a minister in New Jersey, whose journal has a literary reputation.

Organization and Discipline.— Fox and his co-laborers did not have an outward organization as an object. The organization and discipline were progressively developed. The first disciplinary meetings established were held monthly and were in a sense congregational. Some were held as early as 1656, but the practice does not appear to have become general before 1666. The first yearly meeting appears to have been held in 1656, the first in London in 1668, but it was not held there regularly until 1672. The first yearly meeting in America was held in Rhode Island in 1661. Monthly, quarterly and yearly meetings have geographical boundaries: and monthly meetings are subordinate to quarterly, and these to the yearly meeting, which is the source of discipline, and final judge of all questions. At stated periods monthly meetings appoint a few of their number as "Overseers," whose duty it is to have a loving oversight of the members. Men and women hold separate meetings for business, although some subjects are jointly considered. Of late years the practice of separate meetings has largely been discontinued. Elders are men and women chosen out of the body as "Friends of solid judgment, prudence, and experience," to sit with the ministers and to advise, encourage or caution them as seems needful. Persons — men or women — who speak and pray in public to the satisfaction of the members are, in due time, publicly acknowledged as ministers, or those in whom the body recognizes the "true gift." Such recognition does not confer upon them any new powers or authority. All members are embraced in a set of "Queries" which are answered, some quarterly — others annually, by meetings for discipline. These have reference to love and unity; attendance upon meetings; consistency in speech, behavior, and apparel; oaths, military service and fraudulent business; moderation in trade and living, and just payment of debts; encouragement of a stated or paid ministry; care of the poor and education of children; and keeping records of births, deaths and marriages. (The answering of "Queries" has been discontinued in many meetings.) Meetings have no presiding officer. In those for business a clerk is appointed, whose duty is to gather and record the sense or judgment of the meeting as expressed. No question is settled by a majority and no vote is taken. Christ is recognized as "the head over all things to the church."

Distinguishing Views.— In the essential doctrines of the Christian religion Friends were in accord with their fellow Christians. The principal points in which they differed were:

1. Immediate Divine Revelation. Barclay ('Apology') says: "Nothing is less minded and more rejected by all sorts of Christians than immediate divine revelation; insomuch that once to lay claim to it is matter of reproach." Again, "He that affirms himself so led (by the spirit of God) is, by the pretended orthodox of this age, presently proclaimed an heretic." Fox (Journal) says: "I saw that Christ had died for all men, and had enlightened all men and women with his divine and saving light. I was commanded to turn people to that inward light, spirit and grace, by which all might know their salvation and their way to God." Friends believed that this inward saving light of Christ was universal and came to both heathen and Christian.

2. Worship and Ministry. Barclay ('Apology') says: "All true and acceptable worship to God is offered in the inward and immediate moving and drawing of his own spirit. All other worship, praises, prayers, and preachings, which man sets about in his own

will, at his own appointment, and can begin and end at his pleasure are but superstitious will-worship." Again, "As our worship consisteth not in words, so neither in silence as silence; but in an holy dependence of the mind upon God: from which dependence silence necessarily follows in the first place, until words can be brought forth which are from God's spirit." Hence silence is the basis of meetings for worship, which can be, and often are, held without a minister or any vocal service. Neither ministers, nor others, are supposed to break this silence without an immediate opening of a subject, and a sense that the Lord requires the delivery of the message revealed. No special training or educational qualifications are considered necessary for the ministry, and no consistent "Quaker" minister accepts pecuniary compensation for services in that capacity. Accepting literally the command of Christ to his apostles, "Freely ye have received, freely give," Friends refuse to pay tithes or in other ways to contribute to the support of a paid ministry.

3. Sacraments. Sacraments require the services of a priest or minister. Friends denied this necessity, rejecting all types and outward ordinances. They taught that the only saving baptism was that of the Holy Spirit, and that the true communion was not partaking of bread and wine, but the spiritual "eating of the flesh and drinking of the blood" of Christ. They held that marriage was the Lord's joining of man and woman, and therefore was not performed by man — men were but witnesses.

4. War, Oaths, etc. Friends have always maintained that war and oaths were inconsistent with Christianity, being forbidden by Christ and his apostles in the New Testament. Consistent members refuse to perform military service or partake in war-like preparations. They refuse oaths in civil courts or elsewhere as forbidden by Christ's language, "Swear not at all." In their early history they suffered much on this account. They decline the use of complimentary titles and language, believing they proceed from pride and tend to foster it. They refuse the complimentary use of the plural pronoun to a single person, although the "thou" and "thee" to judges and magistrates has often resulted in suffering. They use the numerical language of Scripture instead of the names of months and days in honor of heathen deities. Their plainness of dress is a testimony against pride, and any uniformity the result of a refusal to change its style at the dictates of fashion.

Present Condition and Membership.— With some unimportant exceptions the society maintained a practical unity until the year 1827. At that time a separation occurred in Philadelphia Yearly Meeting and later in others. Since then two distinct bodies have claimed the title "Religious Society of Friends," commonly distinguished by the names "Hicksite" and "Orthodox," although not recognized or officially used by either body. The name "Hicksite" came from Elias Hicks, a talented and popular minister of Long Island, whose ministry was the immediate cause of the schism. The Orthodox party hold that unsound doctrines caused the separations. The followers of Hicks, admitting differences in doctrines, contend that the real cause was not so much these differences, as an arbitrary exercise of authority by the Orthodox party. Quotations from Hicks establish the contention that the divinity of Jesus Christ, the doctrine of atonement, and the inspiration and authority of the Bible were denied or questioned. There were probably some grounds for the charge of an arbitrary spirit on the part of the Orthodox. In the separations, two thirds of Philadelphia and New York Yearly Meetings were of the "Hicksite" party, and in Baltimore four fifths; in Ohio they were about evenly divided, while in Indiana Hicks had comparatively few sympathizers. No separations occurred in New England or North Carolina meetings, they continuing to be identified with the Orthodox bodies, which were officially recognized by London Yearly Meeting.

There are (1903) seven yearly meetings of "Hicksite" Friends: Philadelphia, Baltimore, New York, Genesee (Canada), Ohio, Indiana, and Illinois, numbering about 21,000 members. They are connected by epistolary correspondence. Their principal schools are Swarthmore College, and the George School in Pennsylvania, Friends Central in Philadelphia, and similar schools in New York and Baltimore. 'The Friends Intelligencer,' an ably conducted weekly paper, is published in Philadelphia.

Several of the Orthodox yearly meetings have experienced separations. Joseph John Gurney of England, a wealthy and educated minister and voluminous writer, expressed views which many in England and America regarded as subversive of some always held by the society. Prominent among those in America who opposed his views was John Wilbur, a minister in New England. This resulted in a division in that Yearly Meeting in 1845, which was followed by one in Ohio in 1854. These, and later separations in others, resulted in two distinct bodies of Orthodox Friends within the limits of six yearly meetings, including Canada. They have been distinguished by the respective names, "Gurney" and "Wilbur," and the terms "Progressive" and "Conservative." In Ohio the "Conservative" body was the larger, and in each of the others the smaller. London gave its official recognition to the "Progressive" bodies. There are now 13 of these, connected with each other and with London and Dublin Yearly Meetings by correspondence: New England, New York, Canada, Baltimore, North Carolina, Ohio, Wilmington (Ohio), Western, Indiana, Iowa, Kansas, Oregon, and California. Total membership in America about 88,500.

The six "Conservative" yearly meetings are: New England, Ohio, Canada, Western (Ind.), Iowa, and Kansas. These annually exchange epistles. Their membership is about 4,500.

Philadelphia occupies a unique position, not being connected with either of these groups of related yearly meetings. That its sympathies were with Wilbur against the views of Gurney was shown by the recognition of the "Wilbur" Friends in Ohio. Later, in the interest of peace, Philadelphia ceased correspondence with all yearly meetings, and has never regularly resumed it. The membership is about 4,500. Within most "Progressive" yearly meetings paid pastors, prescribed services, singing, instrumental music and revival methods have been introduced; until, in many localities, the so-called "Friends Churches" more nearly resemble "Methodists" than "Quakers." These yearly meetings have organized "The Five Years Meeting," held periodically as the name indicates, having advisory rather than legislative powers.

Most of them have recently adopted a «Uniform Discipline.» The principal schools of Orthodox Friends in America are: Haverford College, Pennsylvania; Earlham College, Iowa; Guilford College, North Carolina; Pacific College, Oregon; Westtown Boarding School, Pennsylvania; Friends Select School, Philadelphia; Friends Boarding School, Providence, R. I.; Friends Boarding School, Barnesville, Ohio. Their principal periodicals are: 'The Friend,' Philadelphia (weekly), in its 77th year of continuous publication of uniform size and style; 'The American Friend,' Philadelphia (weekly), organ of the Progressive Yearly Meetings.

STATISTICS.

London Yearly Meeting	17,476	
Dublin Yearly Meeting	2,528	
Australasia	550	
Continental: Norway, Denmark, Germany, France, Turkey	247	
Total abroad	20,801	
In America.		
Hicksite Friends	20,773	
Progressive Friends	88,401	
Conservative Friends, about	4,500	
Philadelphia Yearly Meeting, about	4,500	
Primitive Friends, about	225	
Total in America		118,399
Total in foreign countries		20,801
Total in the world		139,200

Bibliography.— Barclay, 'Apology' (1678); Evans, 'Exposition of Faith' (1827); 'Friends' Library' (14 vols. 1837–50); Fox, 'Journal' (1694); Gurney, 'Observations on Distinguishing Views and Practices' (1824); Hodgson, 'Society of — in 19th Century' (1876); Janney, 'History of' (1859); 'Life of Thomas Ellwood' (1714); 'Passages from Life and Writings of William Penn'; Sewel, 'History of Rise' (1722); Sharpless, 'Quaker Experiment in Government' (1898); Smith, 'Catalogue of Friends Books' (1867); Thomas, 'History of, in America' (1895); Wilbur, 'Journal' (1859); Woolman, 'Journal.'

Edwin P. Sellew,
Publisher of 'The Friend,' Philadelphia.

Fries, frēs, **Elias Magnus**, Swedish botanist: b. Smaland, Sweden, 15 Aug. 1794; d. Upsala 8 Feb. 1878. In 1834 he was called to the chair of practical economics at Upsala, with which in 1851 that of botany was conjoined. Fries introduced into Sweden the morphological theory in his 'Systems of the Vegetable World' (1825). His work on 'Mycology' (1820–32) was long the standard work on the classification of fungi, of which he gave a relatively complete catalogue in 'Scandinavian Flora' (1846–9). He wrote a series of useful books on the *Hymenomycetæ*, on lichens, and on the flora of Scandinavia, more particularly of Sweden. Among his monographs is one on the 'Hieraciеæ' (1848). In 1851 Fries was appointed director of the botanical museum and garden at Upsala, and in 1853 rector of the university.

Fries, Jakob Friedrich, yä'kōb frēd'rĭн, German philosopher: b. Barby, Prussia, 23 Aug. 1773; d. Wartburg, Germany, 10 Aug. 1843. He is a link between Kant's system and the so-called historical school. 'The New or Anthropological Critique of Reason' (1807) is his most important book. He wrote 'Handbook to Psychical Anthropology' (1820); 'System of Metaphysics' (1824), etc.

Fries, John, American insurgent: b. 1764; d. 1825. When in July 1798, Congress voted a direct tax of $2,000,000 the federal officers who were sent to Pennsylvania to collect the State quota of $237,000, were resisted by a party of opposition which Fries had rallied from among the Germans of Montgomery, Lehigh, Bucks and Berks counties. At Bethlehem, 7 March 1799, the United States marshal was compelled by this party to release 30 prisoners who had been arrested for refusing to obey the law. The «rebellion» was at length put down by the militia which President Adams ordered out, and among those captured was Fries, who was subsequently twice tried and on each occasion sentenced to death. In April 1800 he was pardoned by President Adams, who at the same time proclaimed an amnesty to all concerned in the «rebellion.»

Friese, frē'zė, **Richard**, German painter: b. Gumbinnen, East Prussia, 15 Dec. 1854. He studied at Berlin, and traveled in the East, as well as northward within the Arctic Circle. He is now considered one of the best of German animal painters, and is equally successful in depicting the lion in the desert and the deer in a German forest. In 1886 he was awarded a gold medal by the Berlin Academy, of which body he was elected a member in 1892. His most famous works are: 'Lions Surprising a Sleeping Caravan' (1884), in the Dresden Gallery; 'On the Bredszell Moor' (1895), in the Königsberg Museum.

Friesland, frēz'lănd, or **Vriesland**, frēs'-länt, a province in the Netherlands, bounded partly by the German Ocean and the Zuyder Zee. It is generally flat, and parts of it are below sea-level, being protected by dykes. Excellent horses, the best in Holland, cattle, and sheep are reared, and cattle and other agricultural produce are sent to England. It is sometimes called West Friesland, to distinguish it from East Friesland, now the district of Aurich in Hanover. It is divided into three districts — Leeuwarden, containing the capital of same name, Sneek, and Heerenveen. Area, 1,281 square miles. Pop. (1901) 345,004. See Netherlands.

Frieze, Henry Simmons, American educator: b. Boston 15 Sept. 1817; d. Ann Arbor, Mich., 7 Dec. 1889. He was graduated from Brown University in 1841, was instructor there from 1841–5, and in the grammar-school connected with the university 1845–54, and from 1854 professor of the Latin language and literature in the University of Michigan, of which in 1869–71 and 1880–1 he was the acting president. He did much to promote the interests of the university, obtaining for it a State appropriation of $75,000 and an important library in political science. He published: an edition (1860) of the 'Æneid,' and (1867) of the 'Ars Rhetorica'; and 'The Story of Giovanni Dupré' (1886).

Frieze, (1) the architectural term for that part of an entablature between architrave and cornice or any similar position, in a work of structural decoration. It is often enriched with figures of animals, etc., in relief, and is sometimes divided into triglyphs and metopes. One of the best known examples is the Panathenaic, frieze around the cella of the Parthenon. (See Architecture.) (2) The name of a thick woolen stuff or cloth with a nap on one side, in use since the 14th century for heavy outer garments. Frieze is largely made in Ireland, whence considerable quantities are exported.

Frigate, the designation in the days of wooden war vessels of a full-rigged ship with two decks, and so distinguished from a ship of the line which had three. Frigates were usually fast sailers, mounted with 28 to 60 guns, and were employed as scouts and as cruisers, to convoy merchantmen, etc. With the introduction of armor-clad war vessels the term frigate has been superseded by that of cruiser, but a large full-rigged merchantman is still sometimes so called. The name originally was used in the Mediterranean to designate a long, swift vessel propelled by oars and sails.

Frigate-bird, or **Frigate Pelican**. See MAN-OF-WAR HAWK.

Frill-lizard, a large Australian lizard (*Chlamydosaurus kingi*) of the family Agamidæ, so called in allusion to the erectile collar or ruff about its neck. This broad membrane is supported on each side of the neck by slender rods from the hyoid bone which extend to its margin like the sticks of a fan; and like a fan it may be folded close against the shoulders or spread until it stands up all around the back part of the head; but this erection can be accomplished only by opening the mouth widely, and always accompanies a stretching apart of the jaws. The exterior of the frill is of the general grayish-brown of the animal's body, but its interior or front is scarlet; and when it is suddenly spread in the face of an enemy behind the open hissing mouth, it is calculated to astonish and frighten the attacker in no small degree, as seems to be the purpose of the structure. These lizards are 6 to 8 inches long plus a long, lash-like tail. They spend their time on trees and logs, searching for the beetles which constitute their principal food; and have an extraordinary manner, when in haste, of rising and running upon their hind legs alone. The species has been extensively described and illustrated by Saville Kent in his books on the natural history of tropical Australia.

Fringe-tree (*Chionanthus virginica*), a beautiful tree of 10 or 20 feet in height, with somewhat oval, smooth, entire leaves, white narrow-petaled flowers in drooping racemes, and oval, purple drupes. Its blossoms are not only suggestive of its English name, but of the generic title of *Chionanthus*, "blossoms of the snow." It is found in the United States from latitude 39° to the Gulf of Mexico, and forms an attractive feature in garden shrubbery. In the southern States it is known as old-man's-beard.

Fringed Dragon, one of the names of the Australian lizards of the genus *Chlamydosaurus*, characterized by an erectile neck-ruff. See FRILL-LIZARD.

Fringillidæ, frĭn-jĭl'ĭ-dē, the finch and sparrow family, an extensive group of oscine birds, regarded as the most highly organized of all birds. The old name *Fringilla*, applied by Linnæus to the whole group, is retained only for the typical genus, represented by the chaffinch (q.v.). All the fringillines are small, compact and active, without eccentricity of form or plumage, and with organs adapted to an omnivorous diet, although seeds form the principal part of the fare. The bill is usually stout and cone-shaped, varying from a greatly swollen size in some of the grosbeaks to the slenderness of that of the goldfinch. The legs are short, and scutellate; the feet strong; and the wings and tail do not vary much from normal, but the wing has a minute outer primary. The plumage is varied, and in many genera the sexes are unlike. These birds mainly frequent fields, roadsides, and woodlands; and build their nests (often elaborate structures) in trees, in bushes or on the ground — never in burrows, or tree-holes, or composed of mud. Their eggs are usually five in number, and usually are spotted. The family includes extremely good singers, and furnishes us not only the canary but many other of the most popular cage-birds; also many whose flesh is considered a delicacy. The group is divided into scores of genera and contains hundreds of species, which predominate in the northern latitudes of the Old World, where many are resident throughout the year: but they also abound in all other parts of the world except Australia. See Evans 'Birds' (1900), and for America the exhaustive monograph by Ridgway in his 'Birds of North and Middle America,' Part I. (1901). See BUNTING, FINCH, GROSBEAK, LINNET, REDPOLL, SPARROW, and names of various species.

Frisian, or **Friesian**, the term applied to a native and to the language of Friesland. The Frisians are descended from a German tribe, who, at the beginning of the Christian era, occupied the territory between the mouths of the Rhine and the Ems, in the modern provinces of Groningen and Friesland. They became tributaries of Rome under Drusus, and lived for some time on friendly terms with their conquerors, but were driven to hostilities by oppression. They were partially subdued in 47 A.D., and rebelled again with the Batavians under Civilis. In the 5th century a host of Frisians joined the Angles and Saxons in invading Britain. About the end of the 7th century the Frisians in the southwest were subdued by the Franks under Pépin d'Héristal, who compelled them to accept Christianity. A century later the eastern branch of the tribe was conquered and Christianized by Charlemagne. Their country was divided into three districts, two of which were annexed on the division of the Carlovingian Empire to the possessions of Louis the German, and the other to those of Charles the Bald. The latter part was called West Frisia (West Friesland), and the two former East Friesia (East Friesland). The distinctive national features were gradually lost by assimilation with their neighbors, and their modern history is chiefly connected with Holland and Hanover.

The *Frisian Language*, a Low German dialect, holds in some respects an intermediate position between Anglo-Saxon and Old Norse. Of all the Teutonic dialects it is the most nearly related to English. Its ancient form exists in some remarkable collections of laws, of which each Gau or district had its own set written in its own language. The Asegabuch (dating from 1200) was a series of laws valid for all Friesland. An almost complete collection of those laws is to be found in Richthofen's 'Friesische Rechtsquellen' (1840). The modern Frisian is mostly confined to the peasantry. It is broken up into three dialects; the North Frisian on the west coast of Schleswig, its islands, and Helgoland; the Batavian comprising the common West Frisian, and those of Mulkweren and of Hindelopen; and the Westphalian, whose varieties are the East Frisian and those of Rustringen, Wursten, and Saterland, each of which is more or less unintelligible beyond the narrow district in which it is spoken. Among specimens of Frisian literature are, 'Waatze Gribberts Brilloft,' a comedy (1712); 'It Libben fen Aagtje Ysbrants,' a novel (1779); the writings of Japicx, Althuysen, the brothers Halbertsma, Dijkstra, Troelstra, and others. Consult: Grimm's 'Deutsche Grammatik'; the 'Altfries'; 'Wörterbuch' of Richthofen; Doornkaat Koolman's 'Wörterbuch der Ostfriesischen Sprache'; Van Helten's 'Altostfriesische Grammatik'; Hewett's 'Frisian Language and Literature.'

Frit. See Fritting Furnace; Glass.

Frith, William Powell, English painter: b. Studley, near Ripon, 9 Jan. 1819. Since 1840, when he exhibited 'Malvolio before Olivia' at the Royal Academy, he has produced a great number of scenes from Shakespeare, Molière, Dickens, Sterne, Goldsmith, etc., besides his immensely popular pictures, 'Coming of Age in the Olden Time' (1849); 'Life at the Sea-Side' (1854); 'The Derby Day' (1858); 'The Railway Station' (1862); 'Before Dinner at Boswell's Lodgings' (1868 — sold in 1875 for £4,567); 'The Private View at the Royal Academy' (1881), etc. He was commissioned by the queen to paint the marriage of the Prince of Wales. He was elected R.A. in 1852, and is a member of several foreign academies. His works do not exhibit the highest qualities of art, but, possibly in part because of this, they have been extremely popular. Large engravings have been produced from a number of his pictures. In 1887–8 he published his autobiography.

Fritillary, in botany, a plant of the genus *Fritillaria,* of the lily family, found in the North Temperate and Arctic zones. The plants are herbaceous, the leaves simple, alternate, though sometimes appearing opposite or verticillate; the flowers terminal and pendent; the perianth campanulate, of six petals; the stamens six; the style trifid. About a dozen species are known, several of which are cultivated in gardens, being hardy and highly ornamental plants. The *F. imperialis,* or crown imperial, supposed to be a native of Persia, has large orange or yellow flowers nodding beneath a terminal tuft of leaves. The bulb is poisonous, as is that of *F. meleagris,* though in a less degree.

Fritting Furnace, in glass-making, a reverberatory furnace in which the materials for making glass are calcined (fritted) as a process preliminary to melting. The object is to effect a partial union of the salicylic acid and alkali, to avoid volatilization in the latter in the subsequent vitrification. The materials (sand, chalk, soda-ash, and cullet) being introduced into the furnace, the temperature is gradually raised for three hours. The pasty mixture is stirred, and the temperature increased to incipient fusion. The frit is then raked out and transferred to the melting pot, or is placed in cast-iron trays, cut into blocks with a spade, and stored away as frit bricks. See Glass.

Fritz, John, American iron and steel expert: b. Londonderry, Pa., 1822. He was at first a machinist in shops at Parkersburg and Norristown, and subsequently was a constructor of rolling-mills, acquiring in the latter capacity an authoritative knowledge of iron and steel manufacture. He equipped the Bethlehem iron and steel works, and was for many years manager of that well-known establishment. Many methods of manufacture now in general use were employed by Fritz among the first in this country, including the Bessemer process. Several manufacturers and scientists established in 1902 the award of the Fritz medal to be given for discovery in the fields of science.

Friuli, frē'oo-lē, **Italy,** a formerly independent duchy, consisting, in its widest extent, of the modern Italian province of Udine, the Austrian county of Görz and Gradiska, and the circle of Idria. It was one of the most important duchies of the Longobard Kingdom, and after the overthrow of that monarchy by Charlemagne, and even up to the 15th century, when it was conquered by Venice and its territories dismembered, it retained a considerable degree of independence. The inhabitants, called Furlani, are Italian for the most part, but speak a peculiar dialect, into which a strong Celtic element has been introduced. See Italy.

Frobisher Bay, an Arctic inlet opening westward near the mouth of Davis Strait, at the southern end of Baffin Land. It is about 200 miles long by above 20 wide, with rugged mountainous shores. It was till Hall's voyage called Frobisher Strait, being erroneously regarded as a passage into Hudson Bay.

Froebel, Friedrich Wilhelm August, frēd'rĭh vĭl'hĕlm ow'goost frē'bĕl, German educationist: b. Oberweissbach, Thuringia, 21 April 1782; d. Marienthal 21 June 1852. It was Froebel who said, "The clearer the thread that runs through our lives backward to our childhood, the clearer will be our onward glance to the goal"; and in the fragment of autobiography he has left us, he illustrates forcibly the truth of his own saying. The motherless baby who plays alone in the village pastor's quiet house, the dreamy child who wanders solitary in the high-walled garden; the thoughtful lad, neglected, misunderstood, who forgets the harsh realities of life in pondering the mysteries of the flowers, the contradictions of existence, and the dogmas of orthodox theology; who decides in early boyhood that the pleasures of the senses are without enduring influence and therefore on no account to be eagerly pursued; — these presentments of himself, which he summons up for us from the past, show the vividness of his early recollections and indicate the course which the stream of his life is to run.

The coldness and injustice of the new mother who assumed control of the household when he was 4 years old, his isolation from other children, the merely casual notice he received from the busy father absorbed in his parish work, all tended to turn inward the tide of his mental and spiritual life. He studied himself, not only because it was the bent of his nature, but because he lacked outside objects of interest; and to this early habit of introspection we owe many of the valuable features of his educational philosophy. Whoever has learned thoroughly to understand one child, has conquered a spot of firm ground on which to rest while he studies the world of children; and because the great teacher realized this truth, because he longed to give to others the means of development denied him, he turns for us the heart-leaves of his boyhood.

It would appear that Froebel's characteristics were strongly marked and unusual from the beginning. Called by every one "a moon-struck child" in Oberweissbach, the village of his birth, he was just as unanimously considered "an old fool," when, crowned with the experience of 70 years, he played with the village children on the green hills of Thuringia. The intensity of his inward life, the white heat of his convictions, his absolute blindness to any selfish idea or aim, his enthusiasm, the exaltation of his spiritual nature, all furnish so many cogent reasons why the people of any day or of any community should have failed to understand him, and scorned what they could not comprehend. It is the old story of the seers and the prophets repeated as many times as they appear; for "these colossal souls," as Emerson said, "require a long focal distance to be seen."

At 10 years old the sensitive boy was fortunately removed from the uncongenial atmosphere of the parental household; and in his uncle's home he spent five free and happy years, being apprenticed at the end of this time to a forester in his native Thuringian woods. Then followed a year's course in the University of Jena, and four years spent in the study of farming, in clerical work of various kinds, and in land-surveying. All these employments, however, Froebel himself felt to be merely provisional; for like the hazel wand in the diviner's hand, his instinct was blindly seeking through these many restless years the well-spring of his life.

In Frankfort, where he had gone intending to study architecture, Destiny touched him on the shoulder, and he turned and knew her. Through a curious combination of circumstances he gained employment in Herr Gruner's Model School, and it was found at once that he was what the Germans love to call "a teacher by the grace of God." The first time he met his class of boys he tells us that he felt inexpressibly happy; the hazel wand had found the waters and was fixed at last. From this time on, all the events of his life were connected with his experience as a teacher. Impelled as soon as he had begun his work by a desire for more effective methods, he visited Yverdon, then the centre of educational thought, and studied with Pestalozzi. He went again in 1808, accompanied by three pupils, and spent two years there, alternately studying and teaching.

There was a year of lectures at Göttingen after this, and one at the University of Berlin, accompanied by unceasing study and research both in literary and scientific lines; but in the fateful year 1813 this quiet student life was broken in upon, for impelled by strong moral conviction, Froebel joined Baron von Lützow's famous volunteer corps, formed to harass the French by constant skirmishes and to encourage the smaller German States to rise against Napoleon.

No thirst for glory prompted this action, but a lofty conception of the office of the educator. How could any young man capable of bearing arms, Froebel says, become a teacher of children whose Fatherland he had refused to defend? how could he in after years incite his pupils to do something noble, something calling for sacrifice and unselfishness, without exposing himself to their derision and contempt? The reasoning was perfect, and he made practice follow upon the heels of theory as closely as he had always done since he became master of his fate.

After the Peace of Paris he settled down for a time to a quiet life in the mineralogical museum at the University of Berlin, his duties being the care, arrangement, and investigation of crystals. Surrounded thus by the exquisite formations whose development according to law is so perfect, whose obedience to the promptings of an inward ideal so complete, he could not but learn from their unconscious ethics to look into the depths of his own nature, and there recognize more clearly the purpose it was intended to work out.

In 1816 he quietly gave up his position, and taking as pupils five of his nephews, three of whom were fatherless, he entered upon his life work, the first step in which was the carrying out of his plan for a "Universal German Educational Institute." He was without money, of course, as he had always been and always would be,—his hands were made for giving not for getting; he slept in a barn on a wisp of straw while arranging for his first school at Griesheim; but outward things were so little real to him in comparison with the life of the spirit, that bodily privations seemed scarcely worth considering. The school at Keilhau, to which he soon removed, the institutions later established in Wartensee and Willisau, the orphanage in Burgdorf, all were most successful educationally, but, it is hardly necessary to say, were never a source of profit to their head and founder.

Through the twenty succeeding years, busy as he was in teaching, in lecturing, in writing, he was constantly shadowed by dissatisfaction with the foundation upon which he was building. A nebulous idea for the betterment of things was floating before him; but it was not until 1836 that it appeared to his eyes as a "definite truth." This definite truth, the discovery of his old age, was of course the kindergarten; and from this time until the end, all other work was laid aside, and his entire strength given to the consummate flower of his educational thought.

The first kindergarten was opened in 1837 at Blankenburg (where a memorial school is now conducted), and in 1850 the institution at Marienthal for the training of kindergartners was founded, Froebel remaining at its head until his death two years after.

With the exception of that remarkable book 'The Education of Man' (1826), his most important literary work was done after 1836; 'Pedagogics of the Kindergarten,' the first great European contribution to the subject of child-study, appearing from 1837 to 1840 in the form of separate essays, and the 'Mutter-und-Kose Lieder' (Mother-Play) in 1843. Many of his educational aphorisms and occasional speeches were preserved by his great disciple the Baroness von Marenholtz-Bülow in her 'Reminiscences of Froebel'; and though two most interesting volumes of his correspondence have been published, there remain a number of letters, as well as essays and educational sketches, not yet rendered into English.

Froebel's literary style is often stiff and involved, its phrases somewhat labored, and its substance exceedingly difficult to translate with spirit and fidelity; yet after all, his mannerisms are of a kind to which one easily becomes accustomed, and the kernel of his thought when reached is found well worth the trouble of removing a layer of husk. He had always an infinitude of things to say, and they were all things of purpose and of meaning; but in writing, as well as in formal speaking, the language to clothe the thought came to him slowly and with difficulty. Yet it appears that in friendly private intercourse he spoke fluently, and one of his students reports that in his classes he was often "overpowering and sublime, the stream of his words pouring forth like fiery rain."

Froebel's educational creed cannot here be cited at length, but some of its fundamental articles are:

The education of the child should begin with its birth, and should be threefold, addressing the mental, spiritual, and physical natures.

It should be continued as it has begun, by appealing to the heart and the emotions as the starting-point of the human soul.

There should be sequence, orderly progression, and one continuous purpose throughout the entire scheme of education, from kindergarten to university.

Education should be conducted according to nature, and should be a free, spontaneous growth,— a development from within, never a prescription from without.

The training of the child should be conducted by means of the activities, needs, desires, and delights, which are the common heritage of childhood.

The child should be led from the beginning to feel that one life thrills through every manifestation of the universe, and that he is a part of all that is.

The object of education is the development of the human being in the totality of his powers as a child of nature, a child of man, and a child of God.

These principles of Froebel's, many of them the products of his own mind, others the pure gold of educational currency upon which he has but stamped his own image, are so true and so far-reaching that they have already begun to modify all education and are destined to work greater magic in the future. The great teacher's place in history may be determined, by-and-by, more by the wonderful uplift and impetus he gave to the whole educational world, than by the particular system of child-culture in connection with which he is best known to-day.

Judged by ordinary worldly standards, his life was an unsuccessful one, full of trials and privations, and empty of reward. His death-blow was doubtless struck by the prohibition of kindergartens in Prussia in 1851, an edict which remained nine years in force. His strength had been too sorely tried to resist this final crushing misfortune, and he passed away the following year. His body was borne to the grave through a heavy storm of wind and rain that seemed to symbolize the vicissitudes of his earthly days, while as a forecast of the future the sun shone out at the last moment, and the train of mourners looked back to see the low mound irradiated with glory.

In Thuringia, where the great child-lover was born, the kindergartens, his best memorials, cluster thickly now; and on the face of the cliffs that overhang the bridle-path across the Glockner Mountain may be seen in great letters the single word *Froebel,* hewn deep into the solid rock. Consult: von Marenholtz-Bülow, 'Reminiscences of Friedrich Froebel'; Barnard, 'Papers on Froebel's Kindergarten' (1881); Hauschmann, 'Froebel's Kindergarten System'; Bowen, 'Froebel' (1897); Quick, 'Educational Reformers.' NORA ARCHIBALD SMITH.

Frog. This familiar animal is the type of the anurous *Amphibia* (order *Anura*). The family *Ranidæ,* to which it belongs, is characterized by having the skin smooth, the hind legs long, and the feet usually completely webbed; teeth are present in the upper jaw and palate, seldom in the lower jaw. The tympanic membrane is situated behind the eyes, and is not concealed. The nostrils are placed at the extremity of the rounded muzzle just above its margin, and open directly into the mouth. When the mouth is filled with air the nostrils are closed, and the animal swallows the bolus of air into the sacculate lungs, there being, in the absence of ribs, no provision for such respiratory movements as take place in the chest of mammals. Frogs are thus air breathers, but they are capable of remaining for a considerable time under water. They swim with great vigor, and on land progress by a series of violent leaps, the long hind limbs being powerful levers. Their food is chiefly insects, which they capture by means of the tongue: this organ is covered with a viscid secretion and is attached in front, its free border being behind; it is rapidly projected from the mouth, the insect adheres to it, and is at once swallowed. The frog does not drink, but its soft skin absorbs fluids rapidly, and thus has a double function both of nutrition and as an aid to respiration. As the frog grows the old outer skin cracks from time to time, and is pulled off and swallowed. The animal retires in winter to the bottom of ponds, from which clusters of frogs may be drawn buried in mud. This hibernation, which is associated with low vital energy, ends in February; in March the spawn is deposited in gelatinous masses of many hundreds of eggs, the males riding for a long period at that season on the backs of the females, and fertilizing the eggs as fast as they are extruded. The eggs soon manifest change, and after a time the young escapes as a "tadpole," a larval animal with short body, circular suctorial mouth, and long tail, compressed from side to side. Gills project on either side of the head from a cleft which answers in position to the gill opening of fishes. The hind limbs first appear as buds, later the fore limbs project, the gills disappear, the lungs becoming more fully developed; the tail gradually shrinks and disappears, and the animal, which was at first fish-like, then closely resembled a newt (or urodele amphibian), finally assumes the adult or anurous form. This is a true process of metamorphosis as complete as that of the butterfly; since there is a change not merely of form and proportion, but also of internal organs. The frog is highest among *Amphibia,* and the successive stages of its development resemble each the adult form of a lower group in its line of ancestry.

Frogs, themselves useful in clearing gardens of slugs and insects, are in turn the prey of birds, especially herons and aquatic birds, of serpents, and fish, the latter destroying large quantities of the spawn. Though exposed to droughts, they can bury themselves in the moist soil and thus live after the ponds are dried up. Though thus tenacious of life, the stories of frogs being found in stone and in trees are for the most part founded on imperfectly noted facts, though it is possible that a frog may now and then get closed into a cavity for which, after entering, it had grown too large; but an aperture must always be present by which water can get access to them. Their fossil history goes back to the early Tertiary days, and probably will be found to extend farther, as Eocene examples differ little from modern forms. See AMPHIBIA.

It is by no means easy to define the word "frog" in classification, as distinguished from "toad" (q.v.), and the safest method here will be to deal only with the aquatic family *Ranidæ*, already defined, accepted as the most highly developed of amphibians. It contains about 280 species and is represented in every part of the world not too cold except southern South America and Australia, where all the so-called frogs belong to a related family, the *Cystignathidæ*, whose members, especially of the sub-family *Cystignathinæ*, may be said to represent the *Ranidæ* in Notogæa. "Some of them," says Gadow, "can be distinguished from the true, typical frogs solely by the arciferous type of the shoulder-girdle and sternum.

The type-genus *Rana* contains more than half the known species, and is scattered all over the northern hemisphere, but is absent from the southern. It is to this genus that the common frogs of Europe and the United States belong — the bull-frog, spring-frog, European grass-frog, etc. The American bull-frog (*R. catesbiana*) is the largest of the whole tribe, occasionally reaching a length of eight inches; and its muffled grunting cry may be heard a mile or more over the water. It is greenish bright upon the head and mottled elsewhere, while the legs are distinctly blotched. This species abounds in all sluggish waters from Kansas eastward, laying its eggs in long strings, and its tadpoles require two years to reach maturity. It is bold and voracious, catching fish, salamanders, other frogs and even ducklings. Its size and the chicken-like daintiness of the flesh in its hind legs, or "saddle," make it the favorite frog for market, and great quantities are eaten in all parts of the country. In the springs, swamps and ditches lives the green frog (*R. clamata*), not half as big, but very similar in color except that it is yellowish or white below. Another green aquatic frog, still smaller, is the leopard frog (*R. virescens*), whose bright coat is marked with irregular blotches of black edged with whitish, in two rows along the back, and the legs are barred. This species is numerous everywhere as far west as the Sierra Nevada. Another checkered frog, confined to the Eastern States, is the pickerel frog (*R. palustris*), which is light-brown with two rows of large oblong square blotches of dark brown on the back, and one or two on the sides. The head is short, and a dark line extends from the nostril to the eye, while the upper jaw is white, spotted with black spots. Another well-known little kind is the wood-frog (*R. sylvatica*), which goes to the water to breed in early spring, but during most of the year lives in the dry woods. It is a variable reddish brown, with the side of the head marked with a dark-brown band. Several other less conspicuous species of frog inhabit North America, including a few representatives of another family (*Engystomidæ*), besides the tree-frogs, elsewhere described.

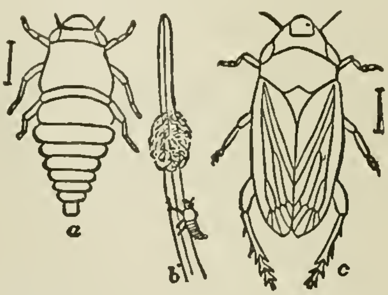
For frogs generally consult Gadow's 'Amphibia and Reptiles' (1901); for those of the United States the writings of Holbrook, C. C. Abbott, O. P. Hay, A. W. Butler, and especially 'North American Batrachia,' by E. D. Cope. See also AMPHIBIA; METACHROSIS.

Frog-mouths, a group of large Australian and Indian nightjars constituting the sub-family *Podarginæ* and remarkable for their huge mouths. The Australian More-pork (q.v.) is an example.

Frog-shell, a small mollusk of the *Triton* family (genus *Ranella*), so called because of its shape and mottled colors.

Frogfish, any of several sea-fishes of low organization, toad-like forms and carnivorous habits, constituting the family *Antennariidæ*, and related to the goosefish (q.v.), itself sometimes called "fishing frog."

Froghoppers, or **Froth-flies**, minute plant-feeding homopterous bugs of the family *Cercopidæ*, which dwell upon plants and may, when very numerous, seriously damage grass-crops. The eggs are laid on the stems of plants in the autumn, and survive in the winter. When the embryos hatch (and these resemble the parents,



a, immature young (enlarged); *b*, froth about eggs, and young froghopper, natural size; *c*, adult (enlarged).

but are wingless) they exude a viscid liquid which is whipped into froth, called in England "cuckoo-spit," by the thrashing of the "tail," an anal appendage probably respiratory in function. The "spittle" is supposed to be a protective disguise, nevertheless the immature insects are preyed upon by wasps, etc. These bugs are called "froghoppers" in double allusion to the froth about their eggs and to their great leaping powers.

Froh'man, Charles, American theatrical manager: b. Sandusky, Ohio, 1858. Having managed several road companies, he took charge of the Empire Theatre, New York, in 1893, and in 1895–6 organized the syndicate which exercises so large a monopoly in American theatrical affairs.

Frohman, Daniel, American theatrical manager: b. Sandusky, Ohio, 1853. He began business life with five years in newspaper offices; he subsequently became manager of a traveling theatrical company, since which he has successfully managed several New York theatres, as well as English and American stars and theatrical companies. He is at present manager of the

Lyceum Theatre, Daly's Theatre, and the Daniel Frohman Stock Company.

Froissart, Jean, zhŏn frä-swä or froi'särt, French chronicler: b. Valenciennes, Hainault, 1333; d. Chimay 1419. He began at 20 to write the history of the wars of the time and made several journeys to examine the theatre of the events he was about to relate. His 'Chronicle' (as the title is usually abbreviated) covering the years 1326–1400, is of capital importance for its period. To a collection of the verses of Wenceslaus of Brabant, Froissart added some of his own, and gave to the whole the title 'Meliador, or the Knight of the Golden Sun.' All his extant poems were published at Brussels (1870–2). His chronicles form a work of permanent value, because of their accurate and impartial account of important events of the 14th century, and of the vivid pictures which they contain of the life of an age so strikingly different from our own. They narrate events connected with France, England, Scotland, Spain, Brittany, etc. See Darmesteter, 'Froissart' (1894).

Fromentin, Eugène, ē-zhān frō-mŏṅ-tăṅ, French painter: b. La Rochelle 24 Oct. 1820; d. St. Maurice, near La Rochelle, 27 Aug. 1876. He began life as a law student, but early turned his attention to landscape painting, working in the studio of Louis Sabat. In 1842 he traveled in Algeria, and it was after this journey that under the guidance of Marilhat, the painter of Oriental scenes, he resolved to work a new vein in the same department by painting the North African deserts. In 1847 he exhibited at the Salon for the first time and visited Algeria twice (1848–52). The fruits of these wanderings were not only numerous pictures, but also two literary works descriptive of his travels. These were: 'A Summer in the Sahara' (1856), and 'A Year in the Sahel' (1858), works distinguished by powerful and richly colored style, and poetic imagination. As a painter his aim was to depict the light and atmosphere of the desert with truth and delicacy, yet imparting to it his own subjective interpretation, and he showed a marked taste for studies in gray and violet. The masterly analysis of ancient painting, which appears in his 'Masters of a Former Day' (1876), embodies the results of his travels in Holland and Belgium (1875), where he made a careful study of the Dutch and Flemish masters.

Frommel, frō'mĕl, **Emil,** German theologian: b. Karlsruhe 5 Jan. 1828. He was an army chaplain, and published several theological works of importance. 'Tales For the People' (1873–86), and similar collections of humorous and realistic compositions, will more surely form his memorials in the future.

Fronde, frŏnd (Fr. frōṅd), the name of a political faction which played a conspicuous part in French history during the minority of Louis XIV., and gave rise to the insurrectionary movement known historically as the War of the Fronde. The members of this party obtained the contemptuous name of Frondeurs (slingers), being compared to boys throwing stones from slings, owing to the pertinacious lampoon warfare which they waged against the powerful minister of that day, Cardinal Mazarin, and the Queen Regent, Anne of Austria. Mazarin, as a foreigner and a parvenu, was detested by the French people — both patrician and proletarian — and especially had incurred the opposition of the Parliament of Paris to his measures. In 1648 Mazarin ventured on the bold step of arresting two of the most popular members of the latter body, and on the next day 27 August (*la journée des barricades*) the Parisians rose in arms, dispersed some of the royal troops sent out against them, and barricaded the approaches to the Louvre, compelling the court party to retire to St. Germain, thus leaving Paris in the hands of the insurgents. Upon the Prince de Condé advancing to besiege the capital, the parliament called the citizens to arms, when the Prince de Conti, the Duc de Beaufort, ("Le Roi des Halles," and son of Henry IV.), and numerous others of the great nobles of the kingdom, came forward to head the insurrection. The famous Cardinal de Retz and the Duchesses de Longueville and de Montbazon also joined the popular cause. The Prince de Condé, too, changed sides and went over to the malcontents, with whom the court party shortly afterward patched up a treaty of peace of but brief duration. Fresh contentions arose, and Mazarin caused the arrest of Condé and Conti. This step excited a revolt in the provinces, and Marshal Turenne hastened to the rescue of the Frondeur princes, but was routed in the battle of Rethel (1650). The cardinal, however, enjoyed but a temporary supremacy; the parliament again agitated against him, and procured his banishment from France, leaving the Prince de Condé master of the situation. Subsequently, the contest degenerated into a war of intrigue and is regarded as one of the most useless conflicts ever waged. The court finally agreeing to dismiss Mazarin a general amnesty was proclaimed. Condé attempted to continue the struggle, but was proscribed, and entered the service of Spain, while Mazarin, after a time, returned to Paris, and again obtained the reins of government.

Front Royal, Engagement at. Front Royal, Va., is 12 miles east of Strasburg, and is the key to Luray Valley. On 23 May 1862 it was held by Col. Kenly with 9 companies of the 1st Maryland infantry, 2 companies of the 29th Pennsylvania, a company of the 28th New York, and a section of Knap's battery, under command of Lieut. Atwell, in all about 900 men. Soon after noon of the 23d "Stonewall" Jackson, moving down the Luray Valley to cut off Bank's retreat from Strasburg to Winchester, pushed through the town, driving in Kenly's pickets and advance-guard. Kenly made a stand on a ridge about a mile north of the town, where he was joined by about 100 men of the 5th New York cavalry, but was soon flanked and pushed across both branches of the Shenandoah, and failed to burn the bridges behind him. When across the river he drew up on its north bank and, with artillery and musketry, resisted for some time all efforts to cross; but Jackson's cavalry forded the stream, both above and below the bridges, thus flanking his position, and Kenly fell back toward the cross-road leading to Middletown, closely followed by Confederate cavalry. He had gone four miles when his cavalry rear-guard was stampeded, and his infantry fiercely attacked, the resistance continuing until his force was cut to pieces and captured, with Atwell's two guns and the entire supply-train. Nearly all the New York cavalry escaped. The Union loss was 18 killed, 56 wounded, and 718 captured; the Confederate loss was 11 killed and 15 wounded. Jackson pushed on after Banks, leaving Col. Conner with the 12th Georgia and a battery at Front Royal. On the 30th the 1st Rhode Island cavalry, the advance of McDowell's corps, dashed into the town, surprised Conner, and captured 156 officers and men and one gun, the loss in the cavalry being 8 killed and 5 wounded.

E. A. Carman.

Frontaura, frōn-tow'rä, **Carlos**, Spanish author: b. Madrid, Spain, 4 Sept. 1834. He published: 'The Philanthropist,' a comedy; 'Fortunes and Misfortunes of Rosita,' a novel.

Frontenac, Louis de Buade, loo-ē dė boo-äd frônt'näk, Comte de, French colonial officer: b. France 1620; d. Quebec 28 Nov. 1698. He entered the army in 1635, and at an early age became brigadier. In 1672 he was appointed governor of the French possessions in North America, to be recalled 10 years later, in consequence of endless quarrels with his intendant and the Jesuits. In spite of his violent temper he gained the confidence of the settlers and the respect of the Indians, and in 1689, when to the horror of constant attacks from the Iroquois the misery of a war with England was added, he was again sent out by the king, as the only man who could rouse the colonists to hope and action. During the next nine years he loosed his savage allies on the defenseless villages of New England, repulsed a British attack on Quebec, and so broke the power of the Iroquois that they were never again a terror to the colony. See Parkman, 'Frontenac and New France Under Louis XIV.' (1877); Winsor, 'Cartier to Frontenac' (1894).

Frontier Posts. See Northwest Territory.

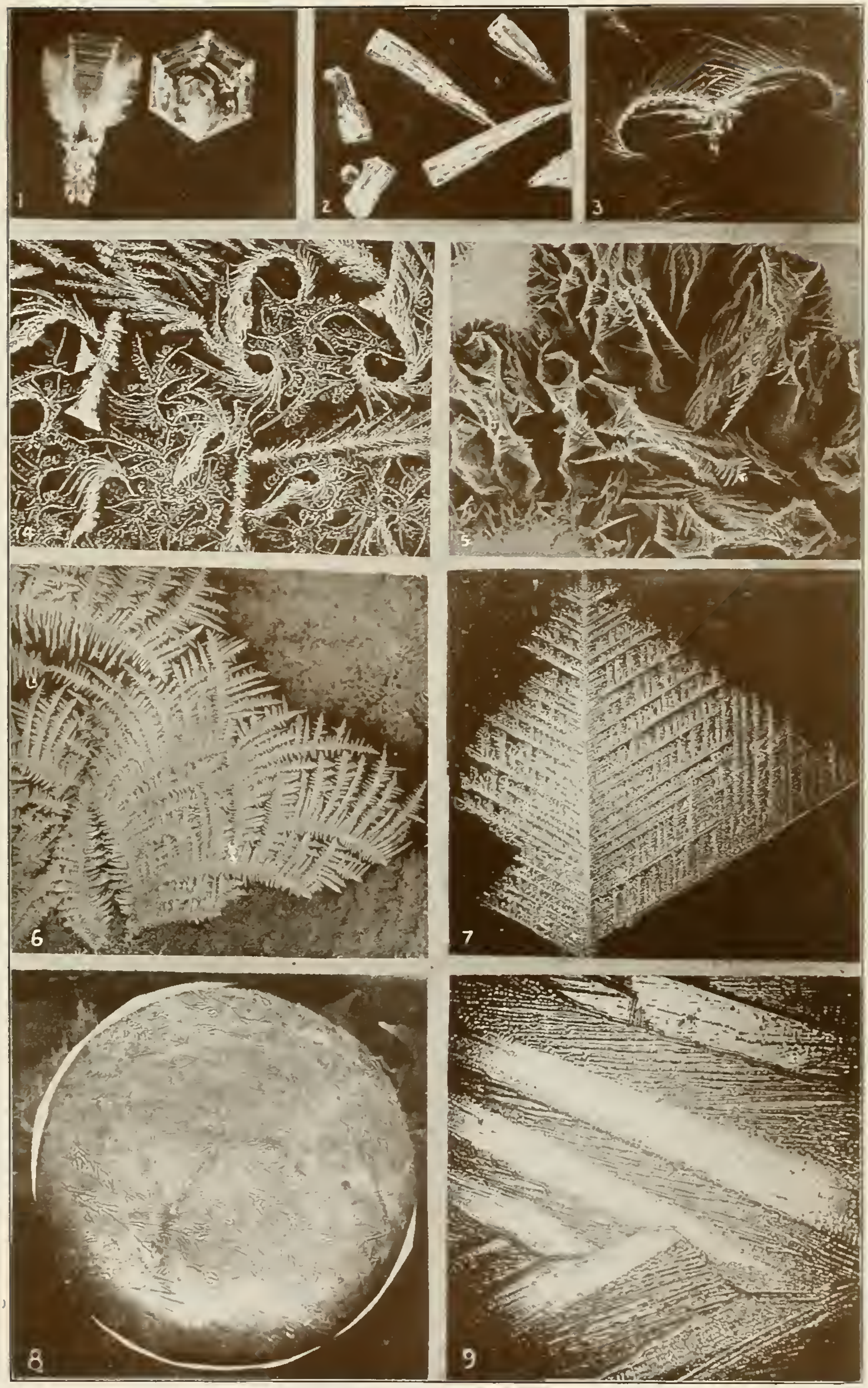
Frontinus, frōn tī'nŭs, **Sextus Julius**, Roman writer, who flourished in the second half of the 1st century after Christ. He was thrice consul, and commanded with reputation in Britain, under Vespasian. He was appointed by Nerva to superintend the aqueducts of Rome, and left an extant work on this subject, 'De Aquis Urbis Romæ,' as well as one dealing with the art of war, 'Strategemata.'

Fron'to, Marcus Cornelius, Roman orator and rhetorician: b. Cirta, a Roman colony in Numidia, about 100 A.D.; d. about 175. He went to Rome during the reign of Hadrian, soon acquired great fame as a speaker and teacher of rhetoric, and was in consequence selected as tutor to M. Annius Verus and L. Commodus, afterward emperors under the names Marcus Aurelius and Lucius Verus. He became a member of the senate, and was a consul in 143 A.D. Till 1814 the only extant writings of Fronto were a worthless tract, 'De Differentiis Vocabulorum' and some fragments; but in that year Angelo Mai recovered many of Fronto's letters from a palimpsest in the Ambrosian library at Milan. These were part of the orator's correspondence with Antoninus Pius, Marcus Aurelius, Lucius Verus, and other distinguished friends, and were published under Mai's editorship in 1815. In 1823 Mai published a new edition of the letters, containing many others which he had discovered in the Vatican library, but the standard edition is that of Naber (Leipsic 1867).

Frost, William Goodell, American educator: b. Le Roy, N. Y., 2 July 1854. He was graduated at Oberlin College in 1876, and afterward studied at Harvard and Göttingen, Germany. He was appointed professor of Greek in Oberlin College in 1879, and president of Berea College 1893. He has published: 'Inductive Studies in Oratory'; 'Greek Primer.'

Frost, the moisture in the atmosphere crystallized or congealed by the cold, upon the earth's surface, or upon various objects and surfaces situated or existing upon it, as grasses, shrubs, trees, window panes, etc. The various phenomena of hoar frost, window frost, etc., grouped under this head, occur over a large portion of the land surface of the earth. In the United States, hoar frosts often occur during the spring and autumn months, over the whole northern portion of the country, and more rarely also in the Southern States, sometimes causing much damage by freezing and injuring the young corn sprouts and early fruits and vegetables. Frosts occur only during calm, cold nights when the temperature falls below 32° F. In the United States the meteorological conditions usually preceding the formation of frosts are northerly winds, accompanied by high barometer, and especially the coincidence of these conditions with the near approach, or passing, of a storm from the west or southwest. The formation of hoar frost depends in some degree upon surface topography and local causes, occurring much more frequently within the deep valleys leading down from mountain heights, than in broader valleys or level regions. In the former, during calm cold nights, the cold air of the hill and mountain tops, by virtue of its greater specific gravity, flows down and mixes with, or flows underneath and replaces, the warmer, lighter air of the valleys, thus furnishing the conditions favorable to frost formation. The cooling of objects by radiation of heat, and by the evaporation of moisture from them, greatly facilitates the formation of frost. Frost crystallizations exhibit a wonderful variety, both of form and structure. The formation of each of the various types seems to depend upon a great number of meteorological and other conditions, some of them obscure. The temperature of the air, its electric condition, humidity, etc., and also the nature of the substances upon which they form, each seem to exert an influence in determining and modifying their form and structure. Two principal types of hoar frost occur,— the columnar, and the tabular. Commonly, both varieties do not occur simultaneously, but on a given night one or the other type will greatly predominate and form the bulk of the crystals. Frost crystallizations in general greatly resemble those of snow, but because their development is usually restricted in one or more directions by the objects or surfaces upon which they form, the resemblance is segmentary, rather than complete. In general, columnar forms vary from similar snow crystallizations, by virtue of their hollow cylindrical, or cup-like character, and by often attaining to much greater dimensions. Sometimes, during extreme cold, such forms attain a length of many inches. Tabular forms rarely attain perfect symmetry, but exhibit within them air tubes and inclusions, assume crystal forms possessing both close and open structure, and develop upon the

WINDOW AND HOAR FROST.



1. Columnar window frost.
2. The same, cup-like.
3, 4, 5, 7. Crystalline window frost.
6. Branching hoar frost.
8, 9. Membranous window frost, highly magnified

same extremely thin plane as do similar snow crystals. As commonly deposited in spring or autumn, they do not usually greatly exceed in size similar snow forms, but during intense and prolonged cold, as in winter, they attain much greater dimensions. A very beautiful effect is sometimes produced by the deposition upon the trees, shrubs, etc., of a heavy coat of hoar frost. Each limb and leaf and delicate twig is transformed and beautified, and presents a white appearance, as though frosted with silver. During zero weather, large and delicately formed branching tabular crystals, and long, icy needles, form in beautiful pendent clusters upon, and depend from, the rafters and timbers of barns, etc., close to where domestic animals are kept; and also upon ferns and similar plants overhanging icy terraces or ice-covered pools. Similar forms also form directly upon or project from icy surfaces. Even the clouds furnish their quota of frost crystallizations. When low-lying clouds enshroud mountain tops covered by forests, they often deposit a portion of their moisture upon the branches of the trees, commonly in the form of long, granular or fibrous needle-shaped crystals. Fogs, when they occur during hoar frost formation, usually deposit moisture upon the forming crystals in granular form. The most beautiful and varied frost crystallizations are those that form upon the window panes of dwelling houses, etc., in arctic or temperate zones. These fairy-like creations, seemingly in imitation of leaves, feathers, ferns, trees, starry firmaments, tropical forest effects, etc., occur as three distinct entities: the granular, the crystalline, and the membraneous. The latter variety forms only in heated rooms, upon window panes covered with an uncongealed film of water, as a dew-like condensation of moisture. It occurs most frequently in the form of long, curving, feather-like forms, or as an exceedingly delicate membranaceous-like network of diverging and coalescing lines. It is due to a process of crystallization that takes place during the conversion of a film of water into ice. The crystalline variety of window frost forms only upon window panes that are free from water in liquid form. Crystals of this class assume branching, star-like forms (often as four- or six-pointed branching stars), curving filaments, fibrous crystallizations, and those resembling sea-moss, long serrated lines, etc. Many of these are very beautiful and interesting. Some of them develop within minute striations in the surface of the glass and will reappear in the same identical positions upon a given pane, with each renewal. When identical meteorological and other conditions recur again and again, the types of frost coexistent with each will, in general, recur simultaneously with them. During zero weather, if conditions are favorable, the formation and growth of these beautiful frost creations takes place very rapidly. A beautiful and absorbingly interesting experiment consists in melting a heavy coat of window frost off a portion of a window pane (by placing an oil lamp close to it). Only the central portion of the pane should be cleared of all moisture; around this a film of water should be left upon the glass. Soon after the lamp is removed the feather-like membraneous frost will form around the outer edges of the film of water, and quickly radiate in beautiful curves toward the centre of the pane. They stop instantly when they reach the clear glass. Soon minute and delicate serrated crystal lines, or tiny crystal stars, appear upon the clear glass space, and slowly develop, and usually coexistent with them, a thin film of granular texture will be laid down upon portions of the clear glass. The latter is not usually deposited in slow progressive order, but in intermittent order. Large spaces of the clear glass are often covered simultaneously, by a succession of auroral-like flashes; each flash, in the twinkling of an eye, spreading a thin granular film upon unoccupied portions of the glass. Singularly enough, the granular deposit does not form near where the true crystalline frost is, the latter repels the former and prevents its formation upon the spaces immediately surrounding it.

The phenomena included under the title frost, as commonly accepted, are understood to include both the processes of freezing and the mechanical effects produced thereby. Considered under this broad definition, frost plays an important part in the economy of nature, both beneficent and otherwise. It enters the crevices and minute cracks in the rocks and rends the rocks apart; and is thus an important agent in aiding and hastening their disintegration, and in converting them and the solid materials of the earth into soil. Its beneficent action in loosening and pulverizing the soil, by entering it and forcing the particles of compacted soil and clods apart through its expansive action upon the particles of moisture disseminated therein, is well known, and is of inestimable value to agriculture and to humanity. The damage sometimes done to vegetation, trees, etc., through the frosts entering them, and rending their fibres, cells, etc., apart, is often very great, and partial failures of crops such as corn, vegetables, fruits, etc., are due to this cause. As any considerable motion of air, the presence of clouds covering the sky, or the placing of a light covering, as of cloth or similar material, over the objects to be protected, greatly reduces or prevents the formation of frost upon them and of injury thereby, artificial preventives are often resorted to. Sometimes smoke-producing fires are built around or within enclosures or fields containing plants, fruits, or vegetables, and light, tent-like coverings are placed over small fruit trees, shrubs, etc., and other tender vegetable or plant growths, and thus the damage by frosts is prevented, or minimized. See also SNOW.

W. A. BENTLEY,
Author of 'Snow and Snow Crystals.'

Frost, Arthur Burdett, American illustrator and author: b. Philadelphia 19 Jan. 1851. He studied under Thomas Eakins in the Academy of Fine Arts, Philadelphia, and coming to New York secured employment on the 'Graphic,' and later entered the studio of Harper and Brothers. In 1877 he went to England, and in 1900 he exhibited at the Paris Exposition. His early work was full of interest and attracted much attention, and his later work showed the spirit of the true artist. He has published: 'Stuff and Nonsense' (1888); 'Bull Calf and Other Tales' (1892); 'Sports and Games in the Open'; and 'Golfers' Alphabet.'

Frost-bird, or **Frost-snipe,** a stilt sandpiper (q.v.).

Frost-bite. See CHILBLAIN; COLD.

Frost-fish, a name given to various fishes, because they appear at the time of early frost, as does the tomcod (q.v.) so called in New England. The frost-fish of New Zealand is one of the scabbard-fishes (q.v.).

Frostburg, Md., a town in Allegany County, picturesquely situated on the Cumberland & P. R.R.; about 2,200 feet above the level of the sea. It has large foundries, planing-mills, and fire-brick works, and an extensive trade in coal. The city controls its own water supply. The government is controlled by a mayor, chosen annually, and a city council, both provided for under the charter of 1870. Pop. (1900) 5,274.

Froth-fly, or **Froth-hopper**. See FROGHOPPER.

Froth'ingham, Arthur Lincoln, American archæologist: b. Boston, Mass., 21 June 1859. He was educated in Rome, Italy, and at Leipsic; lectured on archæology at Johns Hopkins University in 1882–6; and became professor of archæology and the history of art at Princeton University in 1887. He founded the 'American Journal of Archæology' in 1885; and was associate director of the American School of Classical Studies, Rome, in 1895–6. His publications include: 'A History of Sculpture'; 'Mediæval Art Inventories of the Vatican,' and various monographs on Syria.

Frothingham, Ellen, American translator: b. Boston, Mass., 25 March 1835; d. there 11 March 1902. She was a daughter of Rev. N. L. Frothingham (q.v.) and inherited strong literary tastes, particularly in the direction of German literature. Her first published work was a translation of 'Nathan der Weise' (1868), usually ranked as the best English version of Lessing's famous drama. She also published translations of Goethe's 'Hermann und Dorothea' (1870); Lessing's 'Laokoon' (1874); Grillparzer's 'Sappho' (1876); Marie-Herbert's 'Poems of Therese' (1899).

Frothingham, Nathaniel Langdon, American Unitarian clergyman and religous writer: b. Boston, Mass., 23 July 1793; d. there 4 April 1870. He was graduated from Harvard in 1812 and entering the ministry was pastor of the First Church in Boston 1815–50. He was author of: 'Deism or Christianity'; 'Sermons in the Order of a Twelvemonth' (1852); and 'Metrical Pieces' (1855–70). He was one of the earliest American students of German. His writings are marked by grace and refinement.

Frothingham, Octavius Brooks, American clergyman: b. Boston, Mass., 26 Nov. 1822; d. there 27 Nov. 1895. He was a son of N. L. Frothingham (q.v.), and was graduated from Harvard in 1843, and from the Cambridge Divinity School in 1846. His radical views led to the resignation of his pastorate in the North Unitarian Church, Salem, Mass. He was pastor in Jersey City 1855–9; then organized the Third Unitarian Church in New York, where he preached very radical and advanced views till his resignation in 1879. The remainder of his life was devoted to travel and literary pursuits, his home being in Boston. His works were: 'Stories from the Lips of the Teacher'; 'Stories from the Old Testament'; 'The Religion of Humanity'; 'The Cradle of the Christ'; 'Memoir of W. H. Channing'; 'The Safest Creed'; 'Beliefs of the Unbelievers'; 'Creed and Conduct'; 'The Spirit of the New Faith'; 'The Rising and the Setting Faith'; 'Lives of Gerrit Smith, George Ripley, Theodore Parker'; 'Transcendentalism in New England'; 'Recollections and Impressions'; etc.

Frothingham, Richard, American historian: b. Charlestown, Mass., 31 Jan. 1812; d. 1880. He was at various times a member of the State legislature, was mayor of Charlestown 1851–3, and managing editor of the Boston *Post* 1852–65. He published: 'History of Charlestown' (1848); 'History of the Siege of Boston' (1849); 'Life and Times of Gen. Joseph Warren' (1865); 'The Rise of the Republic of the United States' (1871).

Froude, frood, **James Anthony**, English historian: b. Dartington, Devonshire, England, 23 April 1818; d. Salcombe, Devonshire, 20 Oct. 1894. He was the youngest son of Archdeacon R. H. Froude, rector of Dartington, and was educated at Westminster and Oxford. His brother, Hurrell Froude, was one of the leaders in the "Oxford Movement" and both were influenced by Newman, the earliest work of the younger Froude being a contribution to the 'Lives of the Saints,' edited by Newman. He soon emerged from Tractarian influence, however, and for the rest of his life remained indifferent to the Church in which he had been reared. The first two volumes of his history of England appeared in 1856 and at once attracted marked attention, both favorable and adverse, on account of the brilliant style and the audacity of the writer's opinions. The book flatly reversed many historical judgments, and interpreted motives in a manner more common now than then, but very startling to readers in the middle of the 19th century. His attempted vindication of Henry VIII. must be accounted a failure, brilliant and able as it is, and although it is a most striking portrait of Henry that he has painted, it cannot be called a faithful likeness. His treatment of Mary of Scotland is certainly hostile, and has been met with severe criticism. His judgment of Elizabeth, though far from impartial, is more nearly accurate than that of either of the other two personages. He excelled in vigorous, dramatic presentation of men and events, and in the judgment of sober critics appears to have cared much more for picturesque narrative than for absolute historical accuracy. As a historian he will long continue to be read and admired, but his apparent indifference to historical truth at times will not permit of his inclusion in the first rank of historians. He visited the United States in 1872 on a lecture tour, his lectures being afterward published with the title of 'English Misrule in Ireland.' In 1874 he visited South Africa, his impressions being later given to the world in lectures at Edinburgh, and in 1882 made an extended tour through Australia, the West Indies and the United States, the literary outcome of which were: 'Oceana' and 'The English in the West Indies.' He was the friend of Carlyle, whose literary executor he became, and his life of the Sage of Chelsea, his 'Reminiscences of Carlyle' and 'Letters and Memorials of Jane Carlyle' have excited a vast amount of controversy. In 1892 Froude succeeded the historian Freeman as regius professor of history at Oxford, his lectures in that capacity afterward constituting his volume on Erasmus. It may be said that Froude was more distinctly a man of letters than a historian. He is always readable even when one is forced to dissent from him most strongly, but he touched on too many themes to give to the writing of history the devotion toward it so characteristic of such men as the late Samuel Rawson Gardner, Prof. Freeman, or John Richard Green, and he was temperamentally indifferent to the claims of entire truthfulness. He may not have consciously distorted facts, but his selection of certain details and suppression of others for the apparent sake of making the particular hero in question brighter, or the particular villain darker, does not commend itself to the lover of truth for its own sake. His important works include: 'Shadows of the Clouds,' published under the pseudonym "ZETA" (1847); 'The Nemesis of Faith' (1848); 'The Book of Job' (1851); 'The History of England from the Fall of Wolsey to the Death of Elizabeth' (1856–70); 'Short Studies on Great Subjects' (1867); 'Inaugural Address Delivered to the University of St. Andrews' (1869); 'The Cat's Pilgrimage' (1870); 'Short Studies: Second Series' (1871); 'Calvinism' (1871); 'The English in Ireland in the 18th Century' (1872–4); 'Short Studies: Third Series' (1877); 'Life and Times of Thomas Becket' (1878); 'Cæsar: a Sketch' (1879); 'Bunyan' (1880); 'Two Lectures on South Africa' (1880); 'Reminiscences of the High Church Revival' (1881); 'Short Studies: Fourth Series' (1882); 'Reminiscences of Thomas Carlyle' (edited 1881); 'Thomas Carlyle: History of the First Forty Years of his Life' (1882); 'Letters and Memorials of Jane Welsh Carlyle' (edited 1883); 'Thomas Carlyle: History of his Life in London 1831–81' (1884); 'Life of Lord Beaconsfield' (1890); 'The Divorce of Catharine of Aragon' (1891); 'Life and Letters of Erasmus' (1894). The first two volumes named above he attempted to suppress in later life, and succeeded with 'The Shadow of the Clouds,' which cannot now be found anywhere.

Frozen Strait, the passage which connects Repulse Bay and Fox Channel, and separates Melville Peninsula and Southampton Islands. It is from 10 to 20 miles wide and in lat. 65° N. This strait is frozen, as its name indicates, nearly all the year, although some bodies of water farther north are free from ice from two to five months each year.

Fructidor, frük-tē-dōr, signifying the month of fruit and gold, was the name in the French republican calendar of 1792–1806, for the 12th month of the republican year. It commenced on 18 August and ended on 16 September, and was the third summer month.

Fruit, that part of a plant in which the seed or other reproductive element is perfected; in ordinary plants the matured ovary with its pericarp and other parts. This botanical usage is largely extended in popular usage, with the central idea that the fruit is a product of the plant useful to man.

Formation of Fruit.— Starting with those simplest flowers in which all the carpels are separate, we find the stigma and style usually withering back as no longer of service, and the ovary enlarging, as the fertilized ovules grow up into seeds. But in many such simple flowers more ovules are produced than are fertilized, and generally also more fertilized than can be developed up to maturity; hence the reduction of the ovules is exceedingly common, as is simply exemplified in the horse-chestnut.

A second principle of fruit-making is reached through keeping in mind the origin of the ovary from one or more carpellary leaves, of which the individual development has been so greatly checked that they remain closed upon the ovules, and frequently even coalesce with each other from the base upward, so forming a many-celled ovary. Yet the tendency to their individual expansion is not lost; in many monstrosities, and normally a few types, such as the common mignonette, the carpellary leaves early begin to expand, so opening the ovary and exposing the seeds long before ripeness. Far more frequently, however, this final development of the carpellary leaves is delayed until the growth-processes of the seed and fruit have ended, and it is, therefore, accompanied, or even preceded, by their death; the separation often indicating the lines at once of leaf-margin and leaf-fall.

In the best-developed carpellary leaves, such as those of the more floral *Ranunculaceæ*, we naturally find the ovary opening along the line of its united ovule-bearing margins. This is what is termed a follicle.

Since, however, the ovules are on the united margins, the midrib tends to interpose little or no resistance to a tendency to split or tear along its fold. Such "dehiscence by both dorsal and ventral suture" gives us the legume or pod. Another type is the *siliqua* (or when shortened and broadened the *silicula*) of *Cruciferæ*. Here the placental edges of two united carpels develop a transverse septum which divides the fruit; and this is left when the lobes split away, as so familiarly in honesty.

Among united ovaries which readily split open at the united margins (*septicidal*) we may note that of gentian (q.v.), while the more familiar three-celled ovary of a violet, with its parietal placentation, gives a characteristic example of dehiscence along the midribs of the united carpels, so opening the loculi (*loculicidal*). In the five-celled capsule of the geranium (q.v.) the carpellary leaves separate not only at the sides but also at the base, so curling inwards

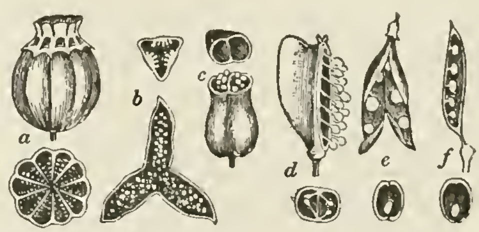


FIG. 1.— *f*, follicle; *e*, legume; *d*. silicula; *c*, capsule of henbane; *b*, of violet; *a*, of poppy.

and projecting the seed. Where, however, the placentæ remain more or less completely upon a central column from which the valves are detached, the dehiscence is said to be septifragal.

In henbane (*Anagallis*), etc., the dehiscence is circular (*circumscissile*). Many-celled capsules are numerous in which the leaf-opening or dehiscence is greatly reduced from completeness; witness the valvular and porous dehiscence of the *Lychnis* and of the poppy respectively. Such cases clearly point us to those of carpels which do not open at all. Such indehiscent fruits, produced from carpels so persistently embryonic, are usually short, few or one-ovuled, and, for the most part, little specialized. Thus the follicle of the *Ranunculaceæ* of more specialized floral character becomes shortened into the one-seeded indehiscent *achene* of the anemone or buttercup. In the achene of the grasses (which similarly represents the capsule of the ancestral lilies) the thin dry pericarp becomes inseparable from the seed-coat (hence the term caryopsis); in many trees (for example, hazel) it becomes hardened and thickened as a nut. In composites, too, the achene is practically a nutlet, although often (on account of its being inferior) superfluously termed a cypsela. Less extremely reduced representatives of the various multicellular ovaries to which such fruits correspond are afforded us by borages or labiates, in which the two-celled ovary of the primitive solanaceous type becomes, as in thorn-apple, etc., subsequently divided into four parts. In *Umbelliferæ* we have another characteristic form of schizocarp, as all such fruits are termed which split up without truly carpellary dehis-

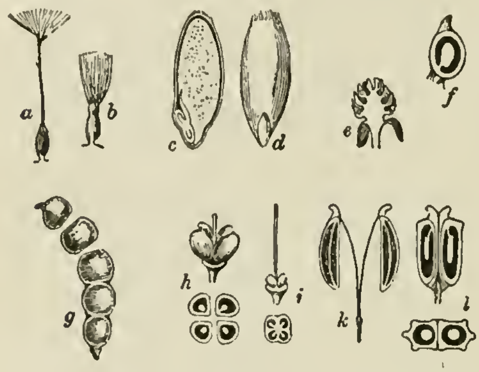


FIG. 2.— *e, f*, achenes of buttercup; *c, d*, caryopsis of oat; *a, b*, achenes with pappus; *g*, "lomentum"; *i, h*, nutlets and ovary of borage; *l, k*, umbelliferous type of schizocarp.

cence, although the tendency to this can be seen still to have some influence. Here the separate portions (or mericarps), each resembling an achene or nut, are two in number, and when ripe swing off upon the ends of a forked carpophore.

So far all our fruits have been dry; but a new physiological "principle of fruit-making" is necessary to comprehend those in which the pericarp is succulent. For, just as the effect of fertilization is seen in many animals to extend beyond the mere ovum to the parent organism, and also in many of the lowest plants, so it is in the case before us. Even in fruits which are dry on ripening we have seen that the ovaries or loculi, on which no demand is made for the growth of fertilized ovules, become reduced or disappear. Sometimes it may be merely the coats of the seed (as in the pomegranate) which undergo the complex histological and chemical changes which we sum up as those of succulence and ripening; at other times largely their placentas, as in the gooseberry and currant. Yet, as in these, the innermost tissue of the ovary may become succulent as well. In the orange also the familiar succulent tissue in which the seeds are immersed are the enlarged succulent cells of the endocarp; the grape, too, gives a characteristic example of soft endocarp. These

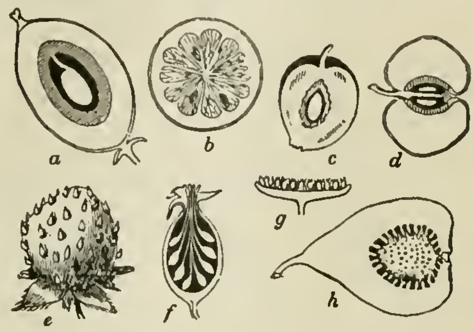


FIG. 3.— *a*, drupe; *b*, orange; *c*, a single drupelet of bramble; *d*, pome; *e*, strawberry; *f*, hip of rose; *g*, capitulum of Dorstenia; *h*, fig.

may all be classed as berries or baccate fruits, for the distinction of the succulent product of an inferior ovary as a berry, from that of a superior one, as a uva or grape, need hardly be allowed to increase our nomenclature. A pepo is merely a berry in which the epicarp is thick and tough (for example, a melon, with which the orange and pomegranate may be reckoned). Where the succulent change, instead of primarily affecting the deeper tissues of the fruit, and so producing a berry, leaves the endocarp hard, we have the drupaceous or stone-fruit. The endocarp here forms a more or less complete "stone" around the kernel or seed, the difference from an ordinary nut being due to the succulence of an outer layer (mesocarp), with a more or less leathery outer skin, the epicarp. The plum, peach, and nectarine are the most obvious examples; but, since we may have many carpels thus transformed, we may have an aggregate fruit or syncarp of tiny drupes. The walnut and even cocoanut are hence not true nuts (see NUT). The immature succulent mesocarp of the former is familiar in pickles, the walnut we crack being merely the stony endocarp (which is exceptionally specialized in being set free by the bursting of the mesocarp on ripening). The familiar cocoanut fibre is the fibro-vascular tissue of the mesocarp, the fruit being thus broadly comparable to a peach which has wizened while still young and stringy. But, as in the kindred grass, the coats of the ovule further unite to the endocarp.

The numerous carpels of the strawberry, although, of course, corresponding to those of the allied raspberry, remain mere nuts; here, however, the subjacent portion of the floral axis or receptacle becomes succulent. In the perigynous or epigynous *Rosaceæ* the same change may take place; hence the rose-hip is a succulent axis, enclosing a multitude of nuts. The apple or "pome" is more akin to the drupe, since the carpels, here deeply sunk in the upgrown floral axis, develop a hard endocarp corresponding to the stone of a drupe.

Fertilization may even be followed by succulent or other thickening of the floral envelopes, or of the floral axis with subjacent bracts — the various cupules, as of acorn, beech, hazel-nut, etc., being of this nature. Or we may have a spurious fruit developed at the expense of an entire inflorescence, as in the pineapple, Dorstenia, and fig.

Chemical Composition of Fruits.— Our knowledge of the chemistry of fruit may be dated from the analyses of Fresenius (1857). But because of the innumerable varieties of almost every cultivated fruit, the effects of different soils and climates upon these, and still more of the fluctuation due to better or worse seasons, the results of any one chemical analysis would tend to convey an idea of undue precision. Thus — for example, while the ratio of sugar to free acid in certain grapes of an ordinary wine-year was found to be 16 to 1, in a very bad year it sank to 12, and in a very good year rose to 24. Hence a broad outline may be of more general use than the statistics of any one analysis.

The percentage of water may be taken as varying from 78 to 80 in the grape and cherry, as from 82 to 85 in plums, peaches, apples, and pears, as 82 to 87 in brambles, currants, etc., and as much as 95 in the watermelon. The proportion of insoluble residue — skin and cellulose, stone and seed — obviously also varies greatly with succulence and ripeness, but may be taken, one fruit with another, at not less than from 4 to 6 per cent. Unripe fruits may contain a notable proportion of starch, but this is fermented on ripening into glucose and other sugars, fruit-sugar, grape-sugar, cane-sugar, or (in *Sorbus*) sorbin. The only fruits which retain starch in important quantity are those of the banana, breadfruit-tree, and baobab; hence the exceptional nutritive value of these. The olive alone yields a notable proportion of oil. The proportion of sugars varies exceedingly, dates, dry figs (48 per cent), and raisins (56 per cent), again very important foods, heading the list. Grapes, of course, stand high, from 12 to 18, indeed sometimes as much as 26 per cent, cherries from 8 to 13, apples 6 to 8, pears 7 to 8, plums 6, red currants 4.75, greengage 3.5, peach and apricot only 1.5. The proportion of pectin bodies is, however, exceedingly notable, especially in fruits such as the three last named. In unripe fruits (as also in roots) we find pectose, a body apparently related to cellulose, but easily transmuted by a natural ferment or by boiling with dilute acid into pectin, $C_4H_6O_4$, and its allies. These are all more or less soluble in water, with which they readily form a jelly (whence the peculiar consistency of our fruit-preserves). The proportion of soluble pectin and gum varies considerably and is of great importance to the blandness and agreeableness of fruit, the harder and more common apples having considerably less than 3 per cent and the best rennets nearly 8. The harsh red currant, indeed, like berries in general, has exceedingly little (0.25 per cent); while the apricot has as much as 9, the greengage 12, and the peach 16 — a circumstance which explains the peculiarly melting quality of these fruits, especially the last-named. The free acid also varies greatly, from 2.4 per cent in the red currant, 1.4 in the raspberry, and nearly as much in the sourest cherries, to 0.5 in sweet cherries and a minimum of 0.1 or less in the sweetest pears. That of apples and of grapes, of course, varies greatly, but both may generally be taken at from 1 to 0.75, while the apricot and peach stand at 0.3 or 0.4. The acid is primarily malic, but citric, acetic, oxalic, tannic, and others may also be present.

The quantity of albuminoids is of course small, in fact, inadequate to render most fruits a staple food. Yet it is by no means inappreciable, ranging from nearly .5 per cent in the majority of fruits to .7 or .8 in the grape (2.7 in raisins), and above 1 in the melon and tomato. Hence to acquire albuminoids equal to those of one egg we must eat 1½ pounds of grapes, 2 pounds strawberries, 2½ pounds apples, or 4 pounds pears. To replace 1 pound starch = 5½ pounds potatoes, we need 5.4 pounds grapes, 6.7 of cherries or apples, or 12.3 of strawberries. See FOOD.

The quality of fruits depends largely upon the proportion of sugar, gum, and pectin to free acid, largely also upon the proportion of soluble to insoluble matters, but in very great measure also upon the aroma. This quality is due to the presence of characteristic ethers, often accompanied by essential oils, although not of course in ponderable percentage. Cultivation and selection operate strongly on all three factors.

Keeping of Fruit.— Many of the finest fruits undergo very speedy decomposition, which, as distinguished from the intrinsic processes of ripening, is due to the attacks of bacteria, molds, or yeasts; and the problem of their preservation is therefore primarily one of preventing these. In damp and stagnant air, especially with considerable or frequent changes of temperature, these fungus pests multiply with special readiness; hence a fruit-room must be cool and shady, yet dry and airy, and the fruit carefully gathered rather before full ripeness, handled so as to avoid in any way bruising or tearing the skin, and laid out and occasionally looked over so that rottenness in one may not affect the rest. Under these conditions apples especially may be kept for many months; indeed many varieties of fruit — for example, winter-pears — require these conditions for satisfactory ripening. On antiseptic principles we see how it is that the dense-skinned and wax-coated grape can be so largely imported in sawdust, or how unripe gooseberries, and even very perishable pears can be kept for months similarly packed in well-sealed jars in a cool place. The process of preserving with sugar in jars promptly covered up is similarly an antiseptic one; but in the systematic application of antiseptic principles we may still look for considerable progress in the preservation and transport of fresh fruit upon a large scale. The method of drying fruit has also been in use from remote times, especially with dates, figs, and raisins.

See CIDER; FRUIT, CULTIVATION OF; FRUIT TRADE, THE AMERICAN; FRUITS, COLD STORAGE OF; GARDEN; and articles on the various fruits, as APPLE, CHERRY, PEACH, etc.

Consult works on fruit-culture by Bailey (1897); Burbidge (1881); Cheal (new ed. 1892); Downing; Du Breuil (1886); Fish (1882); Fuller (1881); Hogg (1885); Roe (1886); Thomson (1881); Wood (1880).

Fruit, Cultivation of, the planting, protecting and ripening of fruit for food. The skilful labor of the cultivator has so greatly improved the original indigenous wild fruit of different zones, that it is worth while to consider from the beginning this gradual process of amelioration. In the tropics, the fruits grow spontaneously with little need for cultivation. The plantain and banana, the guava and sapodilla yield their refreshing fruit without the aid of man. In temperate climates the wild fruits are scarcely edible. Wild cherries, crab-apples, and wild grapes are harsh and sour. By cultivation the crab is changed into the golden pippin, the wild pear into a Bergamotte, and the wild grape into a Concord cluster. There are two or three axioms which underlie all principles of successful fruit culture. The wild fruits if left in their natural state reproduce themselves only. The first step is to domesticate a new generation by sowing their seeds amid new conditions. Take for instance the common wild cherry (*Cerasus avium*). Plant its seed in garden soil and a tree of a different kind appears; each seedling differs from the original plant, and some few will be superior to it. When once this variety appears, selection of the best among many will gradually lead to perfection. This perfection we see in the pears, apples, grapes, and plums of to-day. But only by assiduous care can the present standard be kept up. "There can be no doubt," says Dr. Lindley, "that if the arts of cultivation were abandoned for only a few years, all the annual varieties of plants in our gardens would disappear and be replaced by a few wild forms." Hence the necessity for constant and vigilant cultivation of our present fruits.

Dr. Van Mons, professor at Lourain, was the first to make any great discoveries in ameliorative cultivation. In 1823 his nurseries contained 2,000 seedlings of merit. His theory was that all fine fruits are artificial products. All that wild nature can produce is a healthy, vigorous tree, and a fruit sufficient to protect perfect seeds for continuing the species. The object of cultivation is to enfeeble the tree's excess of vegetation, to diminish the size of the seeds and increase the quantity of flesh or pulp. The older the tree the more likely are its seedlings to return to the wild state. While the seeds of the oldest varieties of good fruit mostly yield inferior sorts, seeds taken from recent varieties of bad fruits, and reproduced uninterruptedly for several generations will certainly produce good fruit. A most important aid in producing the desired varieties is by cross-breeding. This is effected by taking the pollen of one blossom and dusting it upon the pistil of another from which the original stamens have been removed. The development of plums and apples has been much aided by this process, and Mr. Coxe has described an apple which was a cross between a Newton pippin and a russet. It was in appearance half the one and half the other, one end tasting like a pippin, the other like a russet. After a new and choice variety of fruit has been obtained, and of which probably, there is only one tree, it may be propagated by grafting and budding. Grafting is as old as the early Roman Republic; it was also practised by the ancient Greeks. The French orchardists are most expert in it and practice it in more than 50 different ways. The proper time for grafting is in the spring, as soon as the sap stirs, which commences earliest with the cherry and plum, and ends with the apple and pear. Budding differs from a common grafting. Merely a bud, with the smallest possible quantity of the adjoining bark and wood, is inserted in the incised tissues of another tree. All stone fruits are difficult to graft, but can be budded with ease. Fruit trees are also propagated by cuttings, that is, by taking twigs from a good variety and setting them out to take root; or by layers and suckers. A layer is a cutting, part of which is sunk in the ground, while the end is not detached from the parent tree. Suckers are shoots sent up from the root and easily detachable so as to be planted.

The grape vine is almost invariably propagated by cuttings, as are gooseberries and currants. But one of the most important considerations for the fruit cultivator is the soil and its preparation. No good fruit can be produced on dry or barren soil, and fertilizing, watering, and thorough sifting of the orchard or vineyard bed is absolutely necessary for success. Almost equally important is the slope and aspect of the land to be occupied. The warding off of diseases and insect pests from growing fruit also calls for great care on the part of the fruit cultivator.

See Corn-fertilization; Distribution of Plants; Fruit-growing; Fungicide; Fungi; Economical; Grafting and Budding; Implements, Agricultural; Insecticide; Manures and Manuring, Ecology; Mulch; Plant-breeding; Pollination; Pruning; Tillage; Windbreak, and articles on the various fruits.

Consult: Bailey, ‹Principles of Fruit Growing›; ‹Nursery Book›; Barry, ‹Fruit Garden›; Fuller, ‹Propagation of Plants.›

Fruit-bats, the bats of the family *Pteropodidæ*, called also fox-bats or flying-foxes, because of their fox-like heads and faces. They compose one of the two grand subdivisions of bats, the *Megachiroptera* (see Bat), confined to the tropical parts of the Old World. These are the largest of all bats, and differ from the other bats in that they are entirely frugivorous. There are several genera, the most important being the genus *Pteropus*. The best-known species is the Indian fox-bat (*P. medius*), common in India, Ceylon and neighboring islands. As evening falls these bats fly out of the branches, where they have hung, like great black fruits, all day, and start on their nocturnal depredations, which they continue until dawn, when they return to their homes, — thousands sometimes forming a single colony, wrangling and jostling one another for the most desirable places on the limbs. Once settled they hang, head down, until day is over. They are so numerous and so destructive to crops in certain localities that they are hunted vigorously; but, even when they are shot by thousands, the numbers do not seem to be materially decreased. There are certain species that sometimes feed on flowers as well as fruit; but this is not generally the case. The Indian fruit-bat, Lyddeker says, will greedily drink palm-juice from the pots hung on the trees to collect it, and at times, individuals have been found at the foot of the trees quite helpless from intoxication.

The spread of wing is from 4 to 5 feet in the Indian and Malay species; smaller than these are the ugly-faced *Harpyias*, so named because of the supposition that they were the "harpies" of the old mythology.

Fruit-crows, the somewhat crow-like birds of that section of the South American family *Cotingidæ* called *Gymnoderinæ*. This section contains a number of most unusually ornamented birds, such as the bill-bird, and umbrella-bird (qq.v.), and most of them have bare spaces, or wattles, about the head. They are woodland birds whose habits are little known, but they feed mainly on seeds and berries, and make large nests in trees and bushes.

Fruit-fly, any of the flies of the family *Trypetidæ*, whose eggs are laid and maggots are bred in fruit, for example, the apple-maggot (q.v., under APPLE), or in plant-stems. The Mexican orange-worm (see ORANGE INSECT-PESTS) is another well-known species, while the galls so frequently observable upon the golden-rod are the work of a third (*Trypeta solidaginis*). The maggots remain within the fruit or gall during the winter, then, if not already thrown down, creep out, drop to the ground, and transform into pupa and imago. They vary in color from buff to brownish-black, and are frequently beautifully banded or spotted. See also POMACE-FLY.

Fruit growing. Fruit growing as a distinct phase of agriculture is of comparatively recent development in America. The early settlers, who were located chiefly along the Atlantic Coast, in the Lake Region and the Mississippi Valley, found an abundance of wild fruits of many species similar to those known to them in their European homes, and in many cases superior in size, flavor, and quality, to the wild fruits of Europe. This fact encouraged them to introduce the cultivated forms and varieties of the Old World, so that as soon as regular and reliable means of communication were established with the mother countries, seeds, scions, and young trees of the choice varieties of western Europe and the Mediterranean region were secured for testing in practically all of the colonies from the Saint Lawrence Valley southward to Florida. Naturally these early introductions were made in a desultory way and the larger portion of them failed through inability of the types and varieties developed in Europe and western Asia to endure the more intense climatic conditions that prevailed in similar latitudes on the American continent east of the Rocky Mountains. The art of grafting was evidently known to some of the early colonists for as early as 1647 it is recorded that the apple was grafted on wild stocks in Virginia, where in 1686, one orchard of 2,500 apple trees is known to have existed. In 1647 Governor Stuyvesant planted on Manhattan Island a grafted tree of the Summer Bonchretien pear, said to have been imported from Holland. This tree, which is the earliest recorded grafted tree planted by the colonists, stood at what subsequently became the corner of Third avenue and Thirteenth street, New York city, until it was accidentally broken down by a dray in 1866.

The early efforts with orchard fruits were devoted chiefly to the introduction of such as would yield a supply for the family of the owner, rather than to develop a commercial industry. About the only exception to this was the apple, which was planted quite largely in many sections for cider making. This was especially true from Virginia northward, one Massachusetts village, consisting of forty families, having attained the distinction early in the 18th century of producing «near ten thousand barrels of cider.» The early efforts toward the introduction of wine-grapes are related under GRAPE CULTURE.

Bailey states that there are not less than 150 species of native North American fruits fairly well known, of which not more than 40 are of commercial importance. These cover a very wide climatic range, from the hardy plums and apples of the far north to the figs, oranges, and lemons of California, and the oranges, pineapples, mangoes, guavas, and other tropical fruits of Florida. The great diversity of soil and climate render it possible to produce in the United States, Canada, and Mexico, practically all of the important fruits and nuts known to commerce throughout the world, so that America has become in large degree independent of the Old World in the matter of fruit supply. The chief exceptions until recently have been certain sub-tropical fruits and nuts, such as oranges, lemons, dates, figs, almonds, and walnuts, but production of these has shown such rapid increase during the past few years as to largely displace the former imports of these fruits. For convenience in discussion, the various fruits have been grouped by Prof. L. H. Bailey, ‹Principles of Fruit Growing› (1897), into four classes, which may be summarized as follows:

Class I.— Tree-fruits, comprising about 100 species divided into 13 sub-classes.

Class II.— Vine-fruits, comprising the grapes and passi-floris, divided into two sub-classes.

Class III.— Small-fruits, comprising about 20 species, divided into three sub-classes.

Class IV.— Herb-like fruits, comprising about 10 species, divided into four sub-classes.

While the effort to produce a home supply was evident at a very early day, the development of a large commercial fruit industry can hardly be said to date earlier than 1850. Before then plantings of orchard fruits were limited to the needs of the farmer's family or the nearby village or city, except in a few localities where apples and grapes were grown for the manufacture of cider and wine respectively. Each improvement in transportation has been followed by a marked increase in fruit planting and production, frequently at points remote from those where the product is consumed. This is most noticeable in the case of the more perishable fruits, such as the strawberry and peach. The planting of these for the supply of the cities along the Atlantic seaboard has gradually spread southward and westward until there are large shipments of these fruits each year from points as far south as Florida, and as far west as Texas. The fruits grown in the drier climate of the Pacific coast have been found to endure transportation better than those of more humid regions, and their peaches, plums, apricots, cherries, grapes, and pears, as well as the citrous fruits are marketed with little risk in eastern cities. The perfecting of the refrigerator-car service on land has played an important part in this development, and in conjunction with refrigerated compartments on ocean steamers, has resulted in the beginning of what promises to become a very important export trade in such fruits as peaches, pears, plums, and possibly some other perishable fruits that fail to endure the vicissitudes of ordinary transportation.

Types and methods.— The early efforts at commercial fruit culture in America were mainly based upon European varieties, and the methods of culture were such as were followed in the Old World. The unsatisfactory behavior of a large proportion of the imported varieties gradually led to the substitution of seedlings of American origin, which, in the case of most of the important species, have proved much better adapted to American conditions. Prior to the middle of the 19th century most of the American varieties of orchard fruits that came into prominence were accidental seedlings, which were observed to yield fruit of special value, and were, therefore, named and propagated as commercial sorts by their discoverers, for examples, the Baldwin, Ben Davis, and Winesap apples, and the Catawba grape. In recent years attention has been devoted to the breeding of sorts better suited to special conditions or for specific uses, and rapid progress has been made along this line in strawberries, grapes, plums, and peaches. At first these efforts consisted chiefly of the growing of seedlings from seed of choice varieties without effort to control the male parentage, but more recently much definite work has been done in breeding through the cross-pollination of varieties possessing the characters that are desired in the offspring. Notable work in this line has been done by Munson of Texas, Burbank of California, Webber of the United States Department of Agriculture and others. The result of the tendencies above indicated has been to create a distinctive American pomology, consisting largely of Old-World species but mainly of varieties of American origin. In the case of the strawberry, the raspberry, both black and red, the blackberry, dewberry, and gooseberry, the plums of the Mississippi Valley region and the grapes grown east of the Rocky Mountains, the species as well as the varieties are largely of American origin. (Consult Bailey, 'Evolution of Our Native Fruits.')

The gradual change in varieties cultivated has been accompanied by a radical change in methods of culture. With the development and improvement of agricultural implements, hand labor has largely given way to horse-power methods so that a large acreage is now effectively managed with few hands at comparatively small cost, except during the harvesting and marketing of the crop which, with most of the fruits, is still done by hand labor. The prevention of injury by fungous diseases and injurious insects has necessitated the development of economical and effective means of combating these pests. While radically different treatment is needed for different pests, the last decade has witnessed a very general resort to the use of fungicides and insecticides (qq.v.) applied to the trees or plants in the form of sprays.

Methods of cultivation and pruning differ widely for different fruits and in different sections of the country, but in recent years there has been a marked tendency toward clean cultivation of the soil during the early part of the growing season to insure vigorous growth of wood and foliage, followed by the sowing of some leguminous or other cover crop, which is allowed to grow during fall and winter for plowing under the following spring. This practice, where pursued, aids in maintaining the proper proportion of humus in the soil, and when supplemented by applications of phosphoric acid and potash as needed, promotes a healthy and vigorous growth capable of producing normal crops of well-matured fruit. While the pruning of orchard trees to fixed and arbitrary forms is as yet little practiced in America, more attention is paid each year to pruning for specific purposes, such as the stimulation of growth, the setting of fruit buds or the reshaping of the tree or vine. In most sections the practice of heading trees low is on the increase, such trees being found to endure greater climatic extremes without injury, and the accessibility of their most remote branches greatly facilitates their treatment with sprays and the harvesting of their crops.

The necessity for shipping long distances has resulted in the development of methods of marketing fruits which differ widely from those practiced in the Old World. One of the most marked features is the almost universal use of "gift" packages. For most fruits except the cheaper and lower grades of apples and pears, chiefly used for cider making, evaporating, or canning, special light wooden packages are made of convenient size and form in which to pack the fruit for shipment. In most cases these packages go with the fruit, no effort being made to return them to the shipper or use them a second time. It is noticeably true that the highest type of grading and packing fruit for shipment is found in those regions which are remote from the consuming centers of population, and to a considerable extent the same is true of the methods of cultivation, pruning, thinning, and spraying, the heavy expense of long shipment necessitating the production of a more attractive product, which will command a price sufficiently high to leave a profit to the grower. The increasing tendency to plant large areas under single direction and management has had the effect to still further systematize the operations and render the product more uniform in size, quality, and marketability from year to year, while in certain localities, co-operative grading and packing are accomplishing similar results.

Orchard Trees and Products, Census of 1900, Crop of 1899.

	Trees.	Bushels.
Apple	201,794,764	175,397,626
Apricot	5,010,139	2,642,126
Cherry	11,943,287	2,873,499
Peach and nectarine	99,919,428	15,433,623
Pear	17,716,184	6,625,417
Plum and prune	30,780,892	8,764,032
Unclassified orchard fruits	2,215,267	630,321
Cider	1,754,927 bbls.	
Vinegar	392,497 bbls.	
Dried and evaporated fruit	144,804,638 lbs.	
Value of orchard products	$83,751,840	

Magnitude of fruit industry.— Comprehensive and accurate statistics of fruit culture in North America are unfortunately lacking, but enough is known regarding certain fruits to indicate the large and growing importance of the fruit industry as will be noted below under the discussion of the several fruits mentioned. The Twelfth Census (1900) showed totals as above for the United States, while the known facts regarding the annual production and sale of

FRUIT GROWING

1 Napoleon cherry trees in California. 2. A West Virginia peach orchard.

1. Birdseye view of a well-cultivated peach orchard. 2. Strawberry growing in Wisconsin.

young trees by American nurseries indicate that orchard planting continues with little abatement.

Commercial apples.— The apple is both the most widely grown and generally liked of the fruits of North America. It is grown to a greater or less extent in every state and territory of the Union and Province of Canada. The range of the varieties of this fruit as to date of maturity is so great that with proper attention to their selection planters in many sections can have a continuous supply of this fruit from their own orchards during at least ten months of the year. Since the development of commercial cold storage (q.v.) and the improvement of railroad transportation from the South, the supply of American grown apples in wholesome condition in city markets is practically unbroken. (See APPLES; FRUITS, COLD STORAGE OF; FRUIT-TRADE.)

Pear and quince.—While the pear has never attained in America the relative importance that it holds in England, France, and Germany, it succeeds well. The varieties of best quality are chiefly of the European type (*Pyrus communis*) and several of the most important are of European origin, such as Bartlett, Flemish Beauty, Anjou, Angouleme, Clairgeau, Louise Bonne. The pear requires a somewhat richer soil and more cultural attention than the apple, and is subject to a bacterial "blight" which it is difficult to control in regions where the tree makes a strong and rapid growth, as in the South. In such regions this type is rapidly giving away to the Oriental type (*Pyrus sinensis*), the varieties of which are derived primarily from the Chinese sand pear. The most important of these are Kieffer and Le Conte — sorts of indifferent quality but thriving and producing crops under conditions where the better varieties cannot survive. Kieffer has been more largely planted in recent years outside of California than any other sort, and is largely used for canning. It is also well adapted to the export trade. The most important commercial pear districts are in western New York, western Michigan, central California, New Jersey, and the Chesapeake Peninsula. In the latter two regions the Kieffer predominates; in the others, Bartlett is the leading commercial sort. The quince is but sparingly grown in a commercial way, except in a few localities in western New York, New Jersey, Pennsylvania, Michigan, and California.

Stone-fruits.— Among the stone-fruits the peach ranks first in commercial importance, though its climatic range is narrower than that of the several types of plums. The rapid development and magnitude of the American peach industry constitute one of the striking features of our fruit culture. Although prior to 1870 commercial peach orchards were chiefly confined to New Jersey and Delaware, large and successful plantings are now found in all the warmer and moister states, so that total crop failures of this delicious fruit have become practically unknown. Single orchards of 100,000 trees are no longer rare, and in some instances more than 300,000 trees are under one management. The major portion of the crop is grown for marketing in the fresh state or for canning, except in California where large quantities are sundried in addition to these uses. The standard sorts of widest distribution are probably Early and Late Crawford, Elberta, Oldmixon, Stump, and Smock. The varieties of the Peento and South Chinese groups are grown chiefly in Florida, while the Spanish, Chinese Cling, and Persian groups, respectively, are grown to the northward, with the Chili type of the latter group as the most thoroughly tested as to winter hardiness.

The various types of plums are found under successful culture over a wider climatic range than any other tree fruit in America, but are of less commercial and economic importance than the apple or peach. The European types are considerably planted in the northern states, especially New York and Michigan, and constitute a very important feature of the fruit culture of the Pacific Coast. The yield of prunes is increasing rapidly, having averaged more than 120,000,000 pounds per annum, from 1898 to 1902 in California alone. In the colder portions of the North, especially in the Upper Mississippi Valley, hardy varieties of the native *Prunus Americana* have been developed, which are proving of great value. Among these are Wolf, Stoddard, De Soto, Wyant, etc. The Japanese varieties, now widely planted, are proving useful additions to our lists, though in some cases very susceptible to injury by the fruit rot (*Monilia fructigena*).

Cherries are widely planted as door-yard trees, but their commercial culture is comparatively limited in the eastern states. The sweet varieties are grown to some extent in western New York, but only in California and Oregon are they largely grown with profit. The leading varieties are Napoleon, grown on the Pacific Coast as Royal Ann and Black Tartarian. The sour varieties have a wider commercial range, and Early Richmond, Montmorency Ordinaire, and English Morello are the leading sorts.

Apricots are but sparingly grown outside of California, where there is a large production for drying and canning, as well as for shipment in the fresh state.

Small fruits.— The strawberry is widely and largely planted for commercial shipment, and fruit grown in the open air is obtainable in city markets from January to the middle of July. It is grown in all the northern states, and extensively for shipment in the Gulf States, South and North Carolina, Virginia, Tennessee, Arkansas, and Missouri. Varieties are transient and numerous, but all the varieties grown to any extent are of American origin.

The raspberries — red, black, and purple — blackberries, dewberries, currants, and gooseberries are grown in smaller areas, though in certain localities their culture has assumed distinct importance.

The cranberry, which, as a cultivated fruit, is distinctly an American product, is extensively grown in Massachusetts and New Jersey and somewhat in Wisconsin.

Citrous fruits.— The citrous fruits chiefly grown are the orange, including the mandarin or kid-glove type, the lemon, and the pomelo. The citron and the kumquat are now being commercially planted, the former mainly in California, the latter in Florida. The lime is also grown to some extent in the latter state. Prior to the great freeze of 1894-95, orange culture was the most important branch of horticulture in Florida, the annual yield having exceeded 5,000,000 boxes. Since then the yield has been relatively small, though showing marked increase in 1903. The yield of oranges and lemons in California has steadily increased for several years, having averaged more than 5,000,000 boxes per annum for the past five years.

Nuts.— Of the nuts grown in America only the almond, walnut, and pecan have attained much commercial importance, the two former in California, the latter throughout the Gulf States and lower Mississippi Valley. Chestnuts of European and Japanese types are being planted on a somewhat extensive scale in the Eastern States, and appear well adapted to the existing conditions. Cocoanuts are somewhat planted in southern Florida.

Tropical and sub-tropical fruits.— Of these the most important are the fig, olive, and pineapple, all of which have attained commercial prominence. The two former are more largely grown in California, the latter in Florida. The mango and avacado are now being planted in considerable areas in south Florida, and several other species, including the guavas and anonas, to a less extent. William A. Taylor,

Pomologist, U. S. Department of Agriculture.

Fruit-pigeons, a group (*Trevoninæ*) of pigeons of very brilliant and often curious plumage, and frequently of large size, which are scattered from India to the South Sea islands. They spend their lives in the tops of the forest trees and feed wholly upon fruits, which are swallowed whole. There are about 180 species, chiefly of the genera *Carpophaga* and *Ptilopus.*

Fruit Trade, The American. The American fruit trade, which has now attained such proportions that it is entitled to be regarded as an important factor in our national commerce, had practically no existence one hundred years ago. At the beginning of the 19th century, for example, it is doubtful if there was a merchant in the United States who realized any considerable profit from his transactions in fruit. The extent of the trade at that time was represented by a few of the large importing houses, and their interest in this branch of the provision business was confined to the occasional receipt of a cargo of assorted fruits from some Mediterranean port, a few half-casks of dried prunes, currants, raisins, and figs, with, perhaps, some preserved citron. In fact, it was some years after the birth of the last century before even the New York grocers could see any advantage in trading in the native fruits that were frequently brought to the city by the neighboring farmers, and it was not until many years later, or at sometime about 1830, that any of the Metropolitan business men began to give any serious attention to the importation of foreign fruits.

Of course, this does not imply that foreign fruits were not imported from time to time. As early as 1804, a consignment consisting of about 30 bunches of bananas had been brought into the United States by Captain John N. Chester, of the schooner Reynard, but while, during the next 26 years, similar small lots were imported, it was not until 1830 that John Pearsall, a member of the firm of J. & T. Pearsall, decided that it would pay him to negotiate for cargoes of this fruit at regular intervals. He accordingly chartered the schooner Harriet Smith, and, within a few weeks, unloaded the first large cargo of bananas ever brought to New York. It consisted of 1,500 bunches.

The first cargo of oranges arrived at New York, in a sailing ship from Sicily, in 1832. Within a few months a cargo of lemons followed, and, within a comparatively short time, the importations of fruit from the Mediterranean ports became an established branch of our international trade. For fully 30 years these fruits from Italy, especially in the case of lemons and oranges, held full possession of the American market, and sailing ships, which were chartered expressly for that purpose, sped back and forth across the Atlantic to bring these fruits, the demand for which was constantly increasing. In fact, so eager was the competition in those days that entire shiploads were often purchased by importers and dealers before they had been a day at sea, and while the quality and condition of the goods could be nothing more than a matter of speculation.

Prior to 1865, the market for foreign fruit in this country was largely controlled by the great importing houses, most of whom purchased direct from the Italian producer. Among the houses that were most famous some half a century ago, one may mention the names of such firms as Devlin & Rose; Chamberlain, Phelps & Company; James Robinson & Company, and Lawrence, Giles & Company, all of New York; Daniel Draper & Company, and Conant & Company, of Boston; Dix & Williams, of Baltimore, and S. S. Scattergood & Company, and Isaac Jeanes & Company, of Philadelphia. In 1865, however, the Italian fruitgrowers consented to consign their fruit to the American firms, and this method of transacting business continued unchanged until about 1880, when several of the largest Italian fruit houses sent men to this country to represent their interests in the American market, since which time they have quite generally maintained their control over the importations from Sicily and the mainland, the Italian shippers feeling that it is safer to deal directly with a compatriot than indirectly with a stranger. As the result, Italy is still the largest importer of fruit in America. Spain's attempt to introduce her oranges was unsuccessful, and now, with the exception of her lemons and her Malaga and Almeria grapes, she sends but little of her product to this country.

The great changes in the conditions of the American fruit trade have all occurred since 1865. Prior to that time the importer of foreign fruit had little reason to figure upon any great local competition, but, since the close of the Civil War, the development of American resources has completely altered the situation. In the earlier days, New York, New Jersey, and Delaware were practically the only States in which small fruits were raised in any considerable quantities, but, even in such instances, there was nothing like a systematic trade in these products. If the Delaware peach crop failed, there was no other section of the country that could come

1. Dewberry field in Maryland. 2. Gathering peaches in Georgia.

to the rescue, for California at that time was not what she is to-day, one of the most resourceful fruit-growing States in the Union.

The first consignment of fruit from California came by express to New York, in 1867. Although picked green, and brought through with as much care as possible, considering the primitive methods of shipment then in vogue, the condition of the fruit upon its arrival did not compensate for the expense involved in the experiment. Although financially a failure, however, both the shipper and the transportation company had learned something from the experience, with the result that, in November of the following year, a second shipment of pears and grapes was brought through in such good condition that the pears sold at $3.50 to $5 a box, and the grapes, which were principally Tokays, from $10 to $15 for each 40-pound crate. This fruit, which was consigned to N. R. Doe, came from California in four ventilated cars attached to a passenger train, and, although the transportation charges were heavy, the return was sufficient to prove that the experiment could be made a source of great profit. From this beginning the California overland fruit trade has grown steadily until to-day thousands of carloads of such fruits are shipped from that portion of the country every year, of which upward of 2,000 are consigned to New York alone. Including its canned fruits and nuts, the shipments from California, both by sea and rail, showed an aggregate of nearly 520,000 tons in 1900, and this amount, great as it may seem, has been exceeded every year since the last census figures were published.

The development of the Florida fruit trade dates from early in the seventies, and then, as now, oranges were the staple fruit of that State. Of far better quality than the foreign fruit, they speedily attained a degree of popularity that gave them a most important position in the market. For years, therefore, their sway was uncontested, and it was not until the California growers began to develop their orange industry so extensively that the Florida producer commenced to experience the effect of any rivalry.

One apparent result of the growth of the fruit industry of this country has been the creation of a greater demand for fruit in general, a demand which is now so great that even the foreign fruit trade has profited by it. As in the case of the California fruit, this situation is largely due to the condition of American transportation rates. These are so high that, even in the case of Florida fruit, the Sicilian shipper can box, transport, and pay all charges on his product, including the item of customs duties, and still land the fruit at New York at a smaller total expense than any of the local growers can market their output.

That the local fruit is able to hold its own, however, in spite of such handicaps, is indicated by the fact that the shipment of oranges from California and Florida each year closely approximate 9.000.000 boxes. In addition, there are the other fruits from California, the market for which is constantly widening, to say nothing of the millions of pineapples that are sent to the North from Florida every season, and the annual harvest of olives, which is not far short of $300,000 in value. At the same time our importations of fruit are still eight or nine times greater in value than our exports, nor is there many apparent indications that these figures will undergo much change. At present, as in the past, our exports are confined almost exclusively to our shipments of apples, an item in our commerce that has increased so materially that the exports which amounted to scarcely more than $25,000 in value in 1850, have grown to such an extent that they represented more than $3,500,000 in 1905. England is the greatest receiver of this product, and if her demand for apples continues to increase as it has during the past few years it will not be long before it will require no less than 1,500,000 barrels to meet the requirements of the great auction-houses of London, Liverpool, and Glasgow alone.

The wide development of the fruit trade which has been effected during the past 25 or 30 years has naturally resulted in the organization of many associations which have been planned as safeguards for those who are engaged in such commercial enterprises. To-day there are institutions of this character in all the large cities of the country, but those that are best known are the New York Fruit Exchange, which operates on principles similar to those of other great exchanges; the Fruit Buyers' Union, which aims to systematize the methods of the green-fruit import and auction business, and the National League of Commission Merchants, which purposes to obtain uniformity and integrity of method in the commission business. Through the efforts of these organizations, and the local exchanges and associations in other parts of the country, the dealers in fruit are now able to transact a business which aggregates, including both imports and exports, an amount which will exceed $25.000,000 per annum. In addition to this there is the enormous domestic product, which, while it varies from year to year, and has never been reduced to exact statistics, will undoubtedly represent a sum that is equally as great.

Fruits, Cold-storage of, the preservation of fruits, by keeping them in a refrigerator or ice-box of such a temperature as will neither freeze them nor permit the process of ripening to advance. The problem of cold-storage has at length been solved by experiments recently made (1903) by the government expert, W. H. Ragan of the Department of Agriculture, at Washington. It had been generally supposed that cold-storage fruit quickly rotted, on exposure to the ordinary atmosphere of the dwelling-house in summer or winter. It has, however, been discovered that when fruit is put up in a proper condition, and kept subject to a proper temperature, it remains uninjured by storage for some time. Thirty-two degrees is considered suitable temperature for the cold-storage of fruit. Peaches of good color, yet still hard, if fresh from the tree, have been kept in cold-storage for four weeks, and found at the conclusion of that period in fairly marketable condition. They have maintained this condition for at least four days. It is only when they are in bad condition, imperfect and poorly colored, that they spoil on exposure, after resting in cold-storage.

In order to obtain good results the temperature of a cold-storage warehouse should be kept uniform throughout. Freshly plucked fruit is alone suitable for storage, for a delay of a few days, even of a few hours, will result in serious loss. While pears must be gathered as soon as they reach their full size on the tree, apples may best be stored when well matured and highly colored, though still hard. The storing should be made in small packages, certainly of not over 50 pounds; this is especially the case with regard to quickly fermenting fruits, such as pears and peaches. The careful ventilation of the cases, barrels or boxes, which enclose the fruit, is absolutely indispensable. Nothing is more likely to prolong the preservation of fruit in cold-storage than wrapping them individually. Double-wrappings are even better than single. The inner paper should be porous, like blank newspaper tissue, the outer may be paraffin paper.

Fry, Elizabeth Gurney, English philanthropist and prison reformer: b. Earlham, Norfolk, England, 21 May 1780; d. Ramsgate, Kent, 12 Oct. 1845. Brought up a Quaker by her family she did not adapt her mode of life to that prescribed by the more rigid and orthodox of the sect, till 1798, being then induced to do so by the preaching of William Savery, an American Friend traveling in England on a religious mission. This change was consummated by her marriage in 1800 with Joseph Fry, himself a "plain Friend." In 1810 Mrs. Fry became an occasional preacher and thenceforward devoted herself to offices of the purest benevolence and piety. Owing to her unwearied exertions, important reforms were effected in the prison systems, not only of Great Britain, but also in those of France and Germany. See 'Memoirs' by Tompson (1846); Corter (1853).

Fry, James Barnet, American military officer: b. Carrollton, Green County, Ill., 22 Feb. 1827; d. Newport, R. I., 11 July 1894. He was graduated at the United States Military Academy in 1847, and after serving as assistant instructor at West Point, he was assigned to the 3d Artillery, then in Mexico, where he remained till the close of the War. In 1863 he was appointed provost marshal-general of the United States, with headquarters at Washington, D. C.; and in 1864 was promoted brigadier-general. He was brevetted major-general in the regular army, 13 March 1865, for "faithful, meritorious, and distinguished services," and after the War served in the divisions of the Pacific, the South, the Missouri, and the Atlantic, till 1881, when he was retired. He was the author of: 'The History of Brevets'; 'The Army under Buell.'

Fry, William Henry, American composer and journalist: b. Philadelphia August 1815; d. Santa Cruz, W. I., 21 Dec. 1864. He early showed a singular aptitude for music, and in 1835 produced four overtures which were performed by the Philharmonic Society of Philadelphia, who presented the composer with an honorary medal. He next wrote the operas of 'Aurelia' and the 'Bridal of Dunure.' In 1845 he brought out his opera of 'Leonora,' an Italian version of which was performed in 1858 in New York. In 1846 Fry visited Europe as the correspondent of several American newspapers, and after his return in 1852 gave his attention to music, producing several symphonies of merit. In 1855 appeared his next work, a 'Stabat Mater,' brought out at the New York Academy of Music. He subsequently became attached to the editorial staff of the New York *Tribune*, and attained much popularity as a public lecturer.

Frye, William Pierce, American lawyer, legislator, and statesman: b. Lewiston, Me., 2 Sept. 1831. The son of Col. John M. and Alice M. Frye. He was graduated at Bowdoin College in 1850 and after studying law in the office of William Pitt Fessenden, he began the practice of his profession at Rockland, and later at Lewiston. He was elected to the State legislature from the latter city in 1861, 1862, and 1867. In 1864 he was a presidential elector on the Lincoln ticket. After serving a term as mayor of Lewiston, he was elected attorney-general of the State, on the Republican ticket, holding the office from 1868 to 1870. He was elected to Congress from his home district in 1871, and was re-elected no less than five times.

In 1881 he resigned his seat in the House of Representatives to accept the nomination to the United States Senate, filling the vacancy caused by the resignation of James G. Blaine, who entered Garfield's cabinet as secretary of state. Senator Frye was re-elected to the Senate in 1889, 1895, 1901, and 1907; was elected president pro tem. of the Senate in 1896, and has twice acted as permanent presiding officer of that body — after the death of Vice-President Hobart in 1899, and after the elevation of Vice-President Roosevelt to the Presidency in 1901. After the close of the Spanish-American war Senator Frye was a member of the Peace Commission in Paris. He was chairman of the Commerce Committee in the Senate and has exerted a great influence on national legislation. He has been looked upon as one of the great leaders of the Republican party, and has had much to do with framing legislation on the tariff and as regards American shipping. During the exciting days of the Spanish-American war he acted as chairman of the Senate Committee on Foreign Relations. Senator Frye was given the degree of LL.D. by Bowdoin College in 1889, and also by Bates College in 1881.

Fryer, John, American Orientalist: b. Hythe, Kent, England, 6 Aug. 1839. Educated in London, England, he has occupied several educational posts and acted as government translator in China. He was appointed Agassiz professor of Oriental Literature in the University of California in 1892. Among his writings are: 'Educational Directory for China' (1895); 'Translator's Vade-mecum, or Vocabulary of Scientific Terms in Chinese and English.'

Fteley, Alphonse, American civil engineer: b. Paris, France, April 1837; d. Yonkers, N. Y., 6 Aug. 1903. He was educated at the Ecole Polytechnique, Paris, and came to the United States in 1865. He was resident engineer of the Waterworks Bureau of Boston (1873–80); chief assistant city engineer of Boston (1880–4), and subsequently consulting engineer. He was also chief engineer of the New York Aqueduct Commission (1888–1900). In the last named capacity he planned the Croton dam in 1891, and the Jerome Park reservoir in 1894.

Fu-Kien, foo-kē-ĕn', or **Fokien**, a province of China, bounded north by Che-Kiang, northwest and west by Kiang-Si, south by Kwang-Tung, and southeast by the China Sea; area, 38,500 square miles. The coast is deeply indented by bays and studded with islands, including Amoy, Hai-Tan, and others. The island of Formosa formerly belonged to the province. The interior is generally mountainous; but by cultivating not only the plains and slopes, but terracing the hillsides, often to their summits, the far greater part of the surface is turned to good account. The higher mountains are covered with trees, and the cultivated terraces sometimes number 30 to 40. The Min and its tributaries are the most important rivers. The principal products are rice, wheat, barley, tea of superior quality, silk, sugar, indigo, camphor, and tobacco. The minerals include iron and alum, which, with porcelain, various tissues, and the above products, are the chief exports. The capital is Fu-Chau. Amoy, a treaty port, and other important commercial towns are also included in the province. Pop. 25,790,556.

Fu-Shan, foo-shăn', a town of China, in the province of Kwang-Tung, 21 miles southwest of Canton, on one of the branches of the delta of the Si-Kiang. It has manufactures of silk, iron and steel, etc., and carries on some trade. Pop. (1900) 200,000.

Fuà-Fusinato, foo-ä foo-sē-nä'tō, **Erminia**, Italian poet: b. Rovigo, 5 Oct. 1834; d. Rome 27 Sept. 1876. She was married to the poet Arnaldo Fusinato (q.v.) in 1856. Her spirited appeals to national sentiment in 1848 brought her widely into notice. In 1852 was published her 'Verses and Flowers.' She wrote a series of 'Stornelli,' advocating Florence as the national capital instead of Rome. Her complete poetical works, 'Versi,' were published in 1879; her 'Literary Writings' in 1883.

Fuca, Juan de, hoo-ăn' dā foo'kä (originally APOSTOLOS VALERIANOS), Greek navigator: b. Cephalonia; d. Zante 1602. He was for many years in the Spanish naval service. In 1592, when he discovered the sea-passage separating Vancouver Island from Washington, and connecting the Pacific Ocean with the Gulf of Georgia and with Admiralty Inlet and Puget Sound, he thought he had chanced upon a connection between the Atlantic and Pacific oceans. This straight has been called after his name.

Fuca, Strait of. (See JUAN DE FUCA, STRAIT OF.)

Fuchs, fooks, or **Fuchsius, Leonhard**, German botanist: b. Membdingen, Bavaria, 17 Jan. 1501; d. Tübingen, 10 May 1566. He studied the classics under Reuchlin at Ingolstadt, and was graduated Doctor of Medicine in 1524. He afterward turned his attention to botany, of which science he must be looked upon as one of the fathers. In his 'Historia Stirpium' (1542), he gave a clever description of domestic plants, alphabetically arranged, and laid the foundation of a permanent botanical nomenclature. The fuchsia (q.v.) was named after him.

Fuchsia, fū'shĭ-a or fook'sĭ-a, a genus of plants, the type of the tribe *Fuchsieæ*, natural order *Onagraceæ*, named after the botanist Leonhard Fuchs. The genus contains more than 50 known species, chiefly natives of Mexico, Peru, and Chile. Some have been found in New Zealand. The plants are shrubby or arborescent, sometimes climbing; the flowers are pendent, large, and fine, with brilliant and delicate coloring — purple, rose, and white; the calyx is four-cleft, the corolla four-petaled, the fruit four-celled. The leaves are opposite and verticillate. The flowers are both axillar and terminal, usually one flower springing from the axil, more rarely in racemes at the top of the branches. Fuchsias are much cultivated in conservatories, and are favorite house-plants throughout the United States. Some varieties are hardy enough to bear a northern climate. They are propagated with great facility from cuttings, but the berries, which are preserved and eaten in South America, rarely ripen elsewhere.

Fuchsine, fook'sĭn, an aniline dye prepared by the action of arsenic acid, stannic chloride, or other oxidizing agents upon a mixture of aniline and its homologue toluidine, which yields a mass with a bronze or coppery lustre, called rosaniline. This dissolved in water, precipitated with common salt, and the precipitate washed and crystallized from water, forms fuchsine, which in commerce receives various fancy names, as magenta, aniline or new red, roseine, rubine, etc. It is largely used for dyeing purposes, and wines and even confectionery are sometimes colored with it.

Fuchsius. See FUCHS.

Fuchs' Soluble Glass, so named after its inventor, Johann Nepomuk von Fuchs (1774–1856), who discovered the process in 1823, is a silicate of potassium, made by fusing 15 parts quartz sand, 10 of potassic carbonate, and 1 of charcoal. A similar compound is made from 15 parts sand, 8 carbonate of sodium, and 1 of charcoal. The mixture being made, is heated in a crucible until it is liquefied, care being taken that the materials do not remain too long in contact with the crucible, otherwise alumina, etc., may be dissolved, and the product alter its character. After cooling it forms a hard vitreous mass, tolerably permanent in the air, with conchoidal fracture; and varying in color, passing from pale-green into black. It is soluble in water, with alkaline reaction; the solution is not very stable, being apt to deposit silica on standing, and particularly if carbonic acid gas be absorbed. Soluble glass is employed to render wood uninflammable, and along with a solution of calcium to give stonework a waterproof coating. It is also the fixing agent in fresco coloring according to the art of stereochromy.

Fudge Family in Paris. A satire written by Thomas Moore in 1818, the under-bred English in foreign countries being the subject.

Fuego (fwā'gō) **Island.** See FOGO.

Fuel, Comparative Heating Values of. The effective and economical utilization of the inherent heat energy of fuel in the production of light and power is perhaps the most important industrial question of the times. It is one that plays such a necessary part of modern life, and the cost of the fuel used oftentimes forms so great a part of the conduct of an industrial enterprise on an economical basis, that constant efforts are being directed to improve the present imperfect methods of fuel utilization, and approach the limit of theoretical efficiency.

Kinds of Fuel.—Nature furnishes a great variety of fuel in three general forms— the *solid,* such as wood and coal; the *liquid,* such as petroleum and alcohol and the *gaseous,* such as natural gas. The solid forms of fuel are the most common; the liquid contain the largest amount of heat energy; and the gaseous are the most convenient for use. The fact that any kind of gaseous fuel is the most convenient, and in a great many cases, the most effective for use, has been demonstrated principally through the utilization of natural gas; but as the supply of natural gas is gradually failing, and the cost of oil-firing is much higher, the tendency of the times is to perfect methods for the conversion of solid and liquid fuel into gaseous form. These conditions render the methods of firing employed very important.

Methods of Firing.—In general, the economical and effective utilization of a fuel depends upon the completeness of the combustion thereof. In the combustion of solid fuels by ordinary grate or "direct firing" methods the greater part of the heat liberated is lost in the form of gases which are not combustible at the temperatures attained in grate-fired furnaces. On the other hand, when solid fuel is first converted into gas, and the gas thus obtained utilized by "gas firing" methods, the results accomplished more than compensate the 15 or 20 per cent. loss of heat energy sustained by the process of conversion. As generally applied, gas firing results in more complete combustion, and the attainment of higher combustion temperature, and thereby make possible metallurgical operations which are impracticable with direct firing. There is also less loss of heat through the waste products of combustion, and greater efficiency in transfer of heat. Futhermore, by suitable methods, the heat from the hot waste gases can be recovered and returned to the combustion chamber in preheated air, so that the gas and air supply, and therefore the combustion of the fuel, are placed under easy and complete control.

In practice, the theoretical amount of air necessary for combustion is always exceeded. Direct firing requires at least twice the theoretical amount to even approximate complete combustion, especially in the use of soft coals. With the progress of combustion, the fuel bed becomes more compact, so that with a given draught the amount of air penetrating into the bed decreases with the increase of the depth and compactness of the fuel. Under these conditions, a fresh charge of coal requires a greater amount of air to consume its votatile components, and demands it at a time when its passage is most retarded and the combustion rendered more incomplete by the reduction of temperature accompanying volatilization. As the final result is an irregular air demand, the grates have to be arranged to admit the greater excess of air at all times, otherwise large heat losses will occur from the escape of unconsumed gases.

On the other hand, in gas firing, the air supply is always under control, and therefore can be made to closely approximate the theoretical amount, thus reducing the amount of the products of combustion and insuring more complete combustion. The greater amount of heat then liberated is concentrated in lesser volume, and raises the temperature of combustion, so that the oxygen of the air combines more readily with the combustible constituents of the gas. Futhermore, the smaller the excess of air the lesser the dilution of the gaseous mixture by nitrogen and other inert gases which retard combustion.

The products of combustion being of a higher temperature transfer their heat more readily, and being smaller in quantity carry off less heat by way of the chimney. By suitable arrangements, these products may be intercepted and forced to impart a large amount of their heat to the air supply going to the combustion chamber, thus returning a certain amount of heat to the system, which represents a saving in fuel equivalent to the amount of heat so returned.

Therefore, in considering any fuel the primary question does not relate to the calorific value of the fuel so much as to what percentage of the heat energy represented by its calorific value is actually available for conversion into mechanical energy according to the manner of its utilization.

The latest experience shows, that in the case of a modern steam plant, burning coal by direct firing, the economy lies behind the stop valve, yet this fact does not appear to be clearly recognized by engineers in general, or by those who direct their efforts towards reducing the consumption of steam, rather than its economical generation.

According to the best authorities, the mechanical arrangements and conditions most favorable for the most economical utilization of solid fuel are as follows: the height of the chimney should not be less than 120 feet, nor more than 180 feet, giving a natural draught ranging from 0.50 to 0.83 inches of water, with an average temperature of 300° Fahr. For Lancashire boilers (full size) the chimney area should equal 6 square feet per boiler up to a total of four boilers, and 5 square feet per boiler for every additional boiler. The area of the chimney entrance should be 10 per cent. in excess of this amount, and the flue should enter the chimney with a rising slope of 45 degrees. The area through the economizer should be 20 per cent. greater than the flue area, and the economizer walls should be at least 14 inches thick and exceptionally well built, and the combined area of the boiler side flues should not be less than twice that of the main flue.

As the price of fuel is influenced to a great extent by the convenience with which it can be burned, the general tendency is to use a higher priced fuel even though it may have a lower heating value than a cheaper grade. This tendency can be readily overcome and a large reduction made in the fuel bill by the use of high-class mechanical stokers which will burn coal almost impossible to fire by hand.

Comparative Price of Fuel.—The following table shows the relative prices of fuel, either coal or coke, with different percentages of ash, generally used in furnace practice. The percentage of carbon represent those of carbon and hydrogen combined, and the percentage of ash include less than one per cent. of sulphur. This table will be found very useful not only in connection with the use of solid fuel burned by direct firing, but also in considering the results obtainable in high temperature work by gas firing methods where a high percentage of volatile hydrocarbons is very desirable, and a smaller consumption of coal is needed to do a given amount of work. Under the latter condition, when local coals are inferior and cheap, it is often advantageous to bring from a distance higher-priced coals of better quality.

General Descriptions of Fuel.—For various reasons coal is the most important of all fuels, and in many localities constitutes the only one available; but in some places wood, oil, and gas are abundant, and take the place of coal. In certain industrial and manufacturing plants, their waste products, such as straw, tanbark, sawdust and bagasse are used as fuel more economically than coal, owing to their availability. For general purposes, however, coal is the chief fuel, and the available heating value of all other kinds of fuel are invariably expressed in terms of that of coal. The following limited table gives the weight per cord and equivalent coal values of thoroughly air-dried woods:

COMPARATIVE PRICES OF FUEL.

(Containing different percentages of ash and carbon). The values are given in dollars and cents.

PER CENT OF ASH.	PERCENTAGES OF CARBON.																		
	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
2 per cent	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3.54	3.58	3.63	3.68
3 " "	....	....	....	....	....	....	....	....	....	....	....	....	....	3.46	3.49	3.52	3.57	3.61	3.66
4 " "	....	....	....	....	....	....	....	....	....	....	3.33	3.37	3.41	3.44	3.47	3.51	3.56	3.59	3.64
5 " "	....	....	....	....	....	....	....	3.17	3.21	3.25	3.31	3.35	3.39	3.42	3.45	3.50	3.54	3.57	3.61
6 " "	....	....	....	....	3.01	3.06	3.10	3.15	3.19	3.23	3.29	3.33	3.37	3.39	3.43	3.48	3.52	....	....
7 " "	....	....	2.93	2.97	2.99	3.04	3.08	3.13	3.17	3.21	3.26	3.30	3.34	3.36	3.41	....	....	....	....
8 " "	2.83	2.88	2.91	2.95	2.97	3.02	3.06	3.10	3.14	3.18	3.23	3.27	3.32	3.33	....	....	....	....	....
9 " "	2.82	2.86	2.90	2.93	2.96	3.00	3.04	3.08	3.12	3.16	3.20	3.24	3.29	....	....	....	....	....	....
10 " "	2.80	2.84	2.88	2.90	2.94	2.98	3.02	3.06	3.10	3.14	3.18	....	....	....	....	....	....	....	....
11 " "	2.79	2.83	2.87	2.88	2.92	2.96	3.00	3.04	3.08	3.12	....	....	....	....	....	....	....	....	....
12 " "	2.77	2.81	2.85	2.86	2.90	2.94	2.98	3.02	3.06	....	....	....	....	....	....	....	....	....	....
13 " "	2.76	2.79	2.84	2.84	2.88	2.92	....	....	....	....	....	....	....	....	....	....	....	....	....
14 " "	2.74	2.78	2.82	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

Calorific Values of Fuel.—As stated in the foregoing paragraphs, the calorific value of a fuel does not represent its actual available heating power, and likewise neither does its weight per cubic foot, yet for purposes of comparison an accurate knowledge of both of these values of different kinds of fuel is absolutely necessary. For example, engineers who have compared the value of pine and coal, agree upon the ratio of 2½ to 1 as representing the average. In other words, 2½ pounds of wood are equivalent to a pound of coal, and therefore, the weight of wood which must be burned on each square foot of grate surface will equal 2½ times the weight of coal required to give the same amount of heat as would be derived from burning coal. The introduction of the calorific values of the two kinds of fuel into the problem will serve to still further elucidate such comparisons. As the calorific values of different kinds of fuel, and of different varieties of the same kind vary greatly, the approximate heating values of the principal varieties of coal, and some of the other principal kinds of solid fuel, are given in the following table:

CALORIFIC VALUES OF SOLID FUELS.

KIND OF FUEL.	ASH.	CALORIFIC VALUE.
	Per cent.	B.T.U's per lb.
Pennsylvania anthracite coal	3.49	14,199
Pennsylvania anthracite coal	2.90	14,221
Pennsylvania cannel coal	15.02	13,143
Pennsylvania Connellsville coal	6.50	13,638
Pennsylvania semi-bituminous	10.77	13,155
Pennsylvania brown coal	9.50	12,324
Kentucky caking coal	2.75	14,391
Kentucky cannel coal	2.00	15,198
Kentucky lignite coal	7.00	9,326
Indiana caking coal	5.66	14,164
Indiana cannel coal	6.00	13,097
Maryland Cumberland coal	13.98	12,226
Arkansas lignite coal	5.00	9,215
Colorado lignite coal	9.25	13,562
Texas lignite coal	4.50	12,962
Washington lignite coal	3.40	11,551
Pocahontas coal	4.70	14,100
New River coal	4.60	13,900
Peat, Irish, perfectly dried	4.00	10,200
Peat, air-dried, 25 per cent. moisture	4.00	7,400
Wood, perfectly dry	2.00	7,800
Wood, 25 per cent. moisture	. .	5,800
Tan bark, perfectly dry	15.00	6,100
Tan bark, 30 per cent. moisture	....	4,300
Straw, dry	4.00	6,300
Straw, 10 per cent. moisture	4.00	5,450

KIND OF WOOD.	Pounds Per Cord.	Pounds of Coal.
Hickory or Hard Maple	4,500	1,800
White Oak	3,850	1,540
Birch, Red and Black Oak	3,250	1,300
Poplar, Chestnut and Elm	2,350	940
Pine (average)	2,000	800

Varieties of Coal.—The five most important varieties of coal are anthracite, dry bituminous, caking bituminous, cannel, and lignite.

Anthracite coal is found principally in the Alleghany Mountains, and in the Rocky Mountains region in Colorado. It is a hard, lustrous variety and breaks up easily at a high temperature. It consists almost entirely of carbon, with a small percentage of hydrogen, and burns with very little flame and smoke, unless containing an excess of moisture, and gives an intense heat. There is a variety known as semi-anthracite which contains a larger percentage of hydrocarbon, but is not as hard as true anthracite, and burns with a short flame. Owing to its great brittleness, a large part of anthracite gets broken into small pieces; therefore, in order to obtain the best results it should be fired on grates having small air spaces. The various commercial names and sizes of anthracite coal are given in the following table:

ANTHRACITE COAL SIZES.

SIZE NAME.	Through a Round Hole.	Over a Round Hole.
Chestnut	1½ inches diameter.	⅞ inch diameter
Pea	⅞ inch "	9/16 " "
No. 1, Buckwheat	9/16 " "	⅜ " "
No. 2, Buckwheat or Rice	⅜ " "	7/16 " "
No. 3, Buckwheat or Barley	3/16 " "	3/32 " "
Dust	3/32 " "	

Bituminous coal contains about 80 per cent. carbon, and a large amount of hydro-carbon.

The dry variety is found in Maryland and Virginia, and the caking variety chiefly in the Mississippi Valley. Dry bituminous coal burns freely, without caking and with very little smoke, but the caking coals become pasty, or swell and cake when burning. Caking bituminous coals are largely used for making illuminating gas.

Cannel coal, also known as long-flaming bituminous, contains from 65 to 85 per cent. of carbon. It is found in Pennsylvania, Indiana, and Missouri. All varieties of cannel coal have a strong tendency to smoke, and some of them cake when heated.

Lignite, also known as brown coal, contains from 55 to 75 per cent. of carbon. It is found in the Dakotas, Colorado, Texas, Washington, and Alaska. It is a substance intermediate between peat and coal, and contains some moisture and mineral matter. The poorer varieties have a low fuel value.

Peat consists of decayed roots consolidated with earthy matter. It is cut out of bogs and swamps, and then dried. If it is sufficiently compact it is burned without being previously compressed; otherwise, it is pulverized and compressed into briquetes, and sold as an artificial fuel. The amount of ash varies from 5 to 12 per cent.

Coke is a product obtained from bituminous or semi-bituminous coals by driving off their hydro-carbon constituents by means of heat. As the by-products of gas retorts, commercially known as gas-house coke, it has a low fuel value under direct firing methods; but it will make a very hot fire under forced draught.

Charcoal is made by evaporating the volatile constituents of wood, either by partial combustion or by heating in retorts. By partial combustion, 100 pounds of wood will yield 20 pounds of charcoal, and by heating in a retort about 30 pounds. A cord of wood generally yields about 50 bushels of charcoal.

Wood, considered as fuel, is divided into two classes—hard wood and soft wood. The heating value of different kinds of wood for a given weight, is practically the same; or, in other words, one pound of hickory is not worth any more as fuel than one pound of pine, as the chemical composition of different kinds of wood is nearly the same. The following table shows the average chemical composition of fuel woods:

AVERAGE CHEMICAL COMPOSITION OF FUEL WOODS

CONSTITUENT.	Perfectly Dry Wood.	Ordinary Fire Wood.
	Per Cent.	Per Cent.
Carbon	50	37.5
Hydrogen	6	4.5
Oxygen	41	30.75
Nitrogen	1	.75
Ash	2	1.5
Moisture	..	25.0

Kiln-dried wood has a theoretical calorific value of about 7,800 B. T. U.'s per pound, and wood containing 25 per cent. of moisture, a value of only 5,800 B. T. U.'s per pound. Wood contains a great deal of moisture even after being kept for a considerable length of time in a dry place; and after being thoroughly dried it will absorb as much as 20 per cent. of moisture from the atmosphere.

On account of the large per cent. of moisture in peat or turf, wood, sawdust, and tanbark, these substances, like coke and charcoal, are rarely used for steaming or power-producing purposes, but all of them are available as fuel for gas producers, by the use of which the moisture is readily removed from the constituent gases, which can then be used for power-producing purposes by means of gas engines, or be applied to operations requiring high temperatures, such as those of steel works, rolling mills, smelting furnaces, glass works, and chemical works. In fact, the almost exclusive use of gaseous fuels not only derived from the substances stated, but also from the different varieties of coal, in those and many other fields of industry is only a question of a very short time. The reason for this is now clearly emphasized by two cardinal facts—first, that the supply of natural gas is gradually failing, and second, that the most satisfactory method of using the heat from our most reliable source, coal, is to first convert it into gas and ashes. It is interesting to note in this connection, however, that in the gasification of fuels having a high percentage of moisture, high percentages of carbonic acid and hydrogen occur in the gas. This is probably due to the fact that at a temperature of about 1100° Fahr., water vapor oxidizes carbonic oxide to carbonic acid. Therefore, coke and charcoal, which have a low value as a direct-firing fuel, work more favorably in a gas producer, and yield more gas per pound than any other material. The following table gives the approximate yield of gas per pound of different materials:

YIELD OF GAS FROM DIFFERENT FUELS

MATERIAL.	Yield Per Pound.
Coke or charcoal	104 cubic feet.
Anthracite coal	85 " "
Bituminous coal	75 " "
Lignite or Brown coal	55 " "
Peat or Turf	45 " "
Wood	35 " "

Gaseous Fuel.—The principal kinds of gaseous fuel used at the present time for power-producing purposes are natural gas and producer gas. A certain kind of uncarburetted water gas, made by the decomposition of steam in the presence of incandescent-carbon, is also used to a limited extent, but this gas can never play a very important part as a power producer, on account of the large loss of energy sustained in its production.

The weight and heat value of 1,000 cubic feet of the four types of gases used for power producing and illuminating purposes are given by the table on the following page.

The following table shows natural gas to be the highest in the order of heat energy, its calorific power being 50 per cent. greater than that of coal gas. This is due to the high percentage of marsh gas given to natural gas by a natural process which cannot be duplicated artificially. Producer gas has the lowest heat value, yet it is the cheapest artificial fuel gas per unit of heat, as the oxygen for burning the carbon to carbon monoxide is derived principally from the air. It has only one-fifth the heat energy of good illuminating gas per cubic foot, and it is most successfully applied in operations where a considerable body of gas is burned rather than in

AVERAGE VOLUMETRIC ANALYSES.

CONSTITUENTS.	Nat. Gas.	Coal Gas.	Water Gas.	Producer Gas.	
				Anth.	Bitu.
Hydrogen, H	2.18	46.0	45.0	12.0	12.0
Oxygen, O	0.34	0.5	0.5	0.3	0.3
Nitrogen, N	3.61	1.5	2.0	57.0	55.3
Carbon monoxide, CO	0.50	6.0	45.0	27.0	27.0
Carbon dioxide, CO_2	0.26	0.5	4.0	2.5	2.5
Marsh gas, CH_4	92.6	40.0	2.0	1.2	2.5
Olefiant gas, C_2H_4	0.31	4.0	....	....	0.4
Vapor	....	1.5	1.5	....	....
Pounds in 1000 cu. ft	45.6	32.0	45.6	65.6	65.9
B. T. U's in 1000 cu. ft	1,100,000	735,000	322,000	137,455	156,917

very small work, where illuminating gas can be used to greater advantage.

Comparison of Gases on a Coal Basis.—The theoretical heat value of average anthracite coal is about 14,200 B. T. U.'s per pound, or the power to evaporate about 14.7 pounds of water per pound of coal burned. This theoretical evaporation is never attained in practice, however, owing to heat losses sustained in various ways—by improper design of boilers, by radiation, by improper firing, etc., so that a boiler rarely gives an efficiency equivalent to the evaporation of 12 pounds of water per pound of coal, or the utilization of 80 per cent. of the theoretical heat energy of the fuel. The efficiency usually attained is about 10 pounds of water, or about 67 per cent. of the theoretical energy, so that only about 9,500 of the 14,200 heat units in a pound of coal are utilized by the average boiler.

As determined by satisfactory experiments, 7½ cubic feet of natural gas burned will evaporate 10 pounds of water; or in other words, about 8,000 heat units in the form of natural gas are equivalent to a pound of good coal burned. Other authorities give the heat value of 1,000 cubic feet of natural gas as equivalent to that of an amount of coal ranging from 80 to 130 pounds.

Comparison of Illuminating Gas and Producer Gas.—First-class coal gas, or carburetted water gas, made with 4½ gallons of Lima oil per 1,000 feet of gas, contains between 730 and 735 heat units per cubic foot, which gives an equivalency of 19 cubic feet of gas to one pound of anthracite coal, or 1,000 cubic feet equal to 59 pounds of coal.

One pound of anthracite coal, composed of carbon 85 per cent., hydro-carbons 5 per cent., and ash 10 per cent., will make 90 cubic feet of producer gas of the following composition: hydrogen 12 per cent., carbon monoxide 27 per cent., marsh gas 1.2 per cent., carbon dioxide 2.5 per cent., and nitrogen 57 per cent., having a heat value of 137 heat units per cubic foot. This gives an equivalency of about 104 cubic feet of gas to one pound of anthracite coal, or 1,000 cubic feet to about 9.5 pounds of coal.

Comparison of Anthracite Gas and Bituminous Gas.—The following tables show the process of conversion, the resulting products, and the value of heat energy computed therefrom, relative to the two principal varieties of producer gas. A comparison of these figures will show at once the much greater energy, both by weight and volume, in the bituminous gas.

ANTHRACITE GAS.

PROCESS OF CONVERSION.	PRODUCTS.		
	Lbs.	Cubic Feet.	Anal. by Vol.
80 pounds C burned to CO	186.66	2529.24	33.4
5 pounds C burned to CO_2	18.33	157.64	2.0
5 pounds volatile HC, distilled	5.00	116.60	1.6
120 pounds of O are required, of 30 lbs. from H O liberate H	3.7	5712.50	9.4
90 lbs. from air are assoc. with N.	301.05	4064.17	53.6
	514.79	7580.15	100.0

Energy in above gas obtained from 100 pounds of anthracite coal:

186.66 pounds CO	807,304	heat units.
5.00 pounds CH_4	117,500	" "
3.75 pounds H	232,500	" "
	1,157,304	" "
Total energy in gas per pound	2,248	" "
Total energy in gas per cubic foot	152.7	" "
Total energy in 100 lbs. of coal	1,349,500	" "
Efficiency of conversion	.86	per cent

BITUMINOUS GAS

PROCESS OF CONVERSION.	PRODUCTS.		
	Lbs.	Cubic Feet.	Anal. by Vol.
50 pounds C burned to CO	116.66	1580.7	27.8
5 pounds C burned to CO_2	18.33	157.6	2.7
32 pounds volatile HC, distilled	32.00	746.2	13.2
80 pounds O are required, of which 20 lbs. derived from H_2O, liberate H	2.50	475.0	8.3
60 lbs. O from Air are assoc. with N	200.70	2709.4	47.8
	370.19	5668.9	99.8

Energy in above gas obtained from 100 pounds of bituminous coal:

116.66 pounds CO	504,554	heat units.
32.00 pounds volatile HC	640,000	" "
2.50 pounds H	155,000	" "
	1,299,554	
Total energy in gas per pound	3,484	" "
Total energy in gas per cubic foot	229.2	" "
Total energy in 100 lbs. of coal	1,437,500	" "
Efficiency of conversion	.90	per cent.

Fuel Oils.—The various kinds of fuel oils are all derived from petroleum, which is a liquid hydrocarbon composed of carbon, hydrogen, and oxygen in varying proportions: carbon, 82 to 87 per cent.; hydrogen, 11 to 15 per cent.; oxygen, ½ to 6 per cent. The theoretical average calorific value is about 20,860 B. T. U.'s per pound, corresponding to a theoretical evaporation of 21 pounds of water from and at 212° Fahr.

American crude petroleum carries more of the lighter oils than the European or Peruvian, from which a residuum or fuel oil, consisting largely of the heavy oils, is obtained by distillation. In this work steam atomizers give better results than the air spray, the steam required to atomize being about 4 per cent. of the water evaporated.

«Astatki,» «Mazoot,» «distillate,» «petroleum refuse,» «reduced oil,» etc., are some of the commercial terms used to designate the various kinds of fuel oil.

Approximately, one pound of fuel oil is equal to 1.45 pounds of coal. A test at the Minneapolis Water Works showed that for the same duty 224 gallons of oil, weighing 6.875 pounds per gallon, equalled one ton (2,240 lbs.) of Youghiogheny coal.

Fuel oils have both advantages and disadvantages. The heating value of a fuel oil is nearly twice its weight of coal. Its use is not as injurious to the furnace as the use of coal, on account of the smaller percentage of sulphur. With oil, the fire can be controlled by means of a single valve, and when once regulated to produce a certain heat, it can be maintained at that point with very little trouble. The fire can be started easily, and extinguished instantly. The combustion is complete and smokeless, thus making economy and cleanliness important advantages in its use.

The most important disadvantages are the comparatively high price, danger from explosion, loss by evaporation, and unpleasant odor.

The barrel of crude petroleum of commerce is 42 gallons, weighing 6½ pounds per gallon, and it is customary to consider roughly that 3¾ barrels are equivalent to one ton of coal.

Tests on Fuel.—The most important conclusions of the tests on fuel made by the government and by the laboratories of some of the principal universities, are as follows:

1. Samples of coal from 17 states, tested in steam boiler plants indicate that the high steaming quality of many of the American coals may be improved by washing.

2. Most of the American coals and lignites constitute an available source of power by utilization in gas producer plants.

3. Comparative tests made by the government on 14 bituminous coals from nine states, indicate that when these coals are used in a gas producer plant, their power efficiency is 2½ times greater than when they are directly fired in a steam boiler plant.

4. Some of the lignites found in undeveloped but extensive deposits in the Dakotas and Texas, show very high power producing qualities when gasified in the gas producer and used in the gas engine.

5. Some of the American coals, and the stock produced in mining them can be briquetted on a commercial basis.

6. Under these conditions of attainable fuel economy, it is merely a question of time when the gas engine will supersede any possible type of steam motor.

For relavent information consult articles under the titles GAS; GAS ENGINE; GASES, LAWS OF; and GAS PRODUCER, in this Encyclopedia.

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Fuero (from the Latin *forum*), a Spanish word signifying jurisdiction, law, privilege. It is applied to the various written codes and characters of particular districts, towns, etc., and signifies generally those laws, privileges, and immunities founded on usage and sanctioned by the suzerain or supreme authority. Fueros are both civil and ecclesiastical. The earliest, as well as the most universal, is the *fuero juzgo.* This name (a corruption of the Latin *forum judicum*) is given to a 13th century translation of a code of the 17th century. It contains the Gothic laws which, up till this time, gradually superseded the Roman. Each law receives the name of the Gothic sovereign by whom it was promulgated. This code has formed the foundation of Spanish law down even to modern times. The fueros of Leon, known by the name of *fueros bonos,* contain a complete constitution, civil and ecclesiastical, recognize the rights of self-taxation, and of the nobility of all subjects by birth. The constitution of free towns under these fueros is essentially republican, the king having only a right to name the corregidor, who must be confirmed by the junta of the province, an assembly elected by a very liberal suffrage. As the various monarchies became consolidated under a single head, the kings became anxious to evade or withdraw privileges which interfered with the organization of their kingdom, and after 1592 when Philip II. entered Aragon with an army, hanged the grand-justiciary, whose office it was to administer the oath, and abolished the constitution, the fueros as a political institution ceased to exist, although some local and municipal privileges continued to be called by that name. In 1833 a civil war broke out in the Basque provinces, in assertion of the fueros, which were formally recognized in 1844. In 1876, however, the fueros of these northern provinces were superseded by the general laws of the kingdom.

Fuerte Ventura, fwār'tä vĕn-too'rä, one of the Canary Islands, belonging to Spain. It has an area of 650 square miles and numerous extinct volcanoes. Its principal harbor is Cabras on the east coast. Pop. (1900) 11,662.

Fuertes, James Hillhouse, American civil and sanitary engineer: b. Ponce, Porto Rico, 10 Aug. 1863. He was graduated from Cornell University in 1883. He has constructed works for the sewerage, drainage and water supply of various cities in the United States, Canada and Brazil, and is a non-resident lecturer at Cornell. He has published 'Water and Public Health' (1897); 'Water Filtration Works' (1901); etc.

Fuertes, Louis Agassiz, American painter of birds: b. Ithaca, N. Y., 7 Feb. 1874. He was graduated from Cornell University in 1897. He has illustrated 'Birding on a Broncho' (1896); 'Citizen Bird' (1897); 'Song Birds and Water Fowl' (1897); 'Bird Craft' (1897); 'The Woodpeckers' (1901); 'Second Book of Birds' (1901); 'Birds of the Rockies' (1902); 'Handbook of Birds of North America' (1902); 'Coues' Key to North American Birds'; the plates for the 'Report' of the New York State Game, Forest and Fish Commission (1903); 'Upland Game Birds' (1902), and the companion volume, 'Waterfowl' (1903); etc.

Fugger, fook'ĕr or fŭg'gĕr, the name of a wealthy and illustrious German family of Suabia, descended from a weaver, who originally lived in the environs of Augsburg, about 1300. They were at first successful in selling clothes, but afterward extended their dealings, and became merchants, accumulating an immense fortune. Reaching the height of their affluence at the commencement of the 16th century, they rendered considerable services to the Emperors Charles V. and Maximilian, by making them large advances. These princes bestowed titles of nobility on the Fugger family, and they soon became connected with the best blood of Germany. Promoted to the highest dignities of the empire, they did not any the more neglect the pursuits of commerce. Their riches were always forthcoming for the improvement of their birthplace, Augsburg, where they erected some handsome monuments and founded philanthropical institutions. The best known of them are the three brothers, Ulric, James, and George; and afterward Raymond and Antony, both sons of George. Ulric received for his loans to Maximilian the courtship of Kirchberg, and the seigniory of Weissenhorn, which afterward remained in the possession of his family. He was a great encourager of learning. Antony and Raymond bore, to a great extent, the expenses of the expedition of Charles V. against Algeria, obtaining from him the permission to coin money. One day, at an interview with the emperor, Antony, as a mark of his regard and esteem, threw into the fire all the title-deeds and securities which Charles had deposited with him. Toward the close of the 18th century the family withdrew altogether from trade, confining themselves to the management of their landed estates. Count Anselm Maria of Babenhausen, of the Wellenberg line (b. 1776; d. 1821), was raised by the Emperor Francis II. to the dignity of a prince of the empire. The principality of Babenhausen was annexed to Bavaria in 1806, and Leopold Fugger Babenhausen (1827–85), grandson of the first prince, was a hereditary imperial councilor, and lord high-chancelor of Bavaria. He was succeeded by his brother Karl Ludwig Maria Fugger (b. 1829), who in 1891–3 was president of the Bavarian Reichsrat.

Fugio. See CENT.

Fugitive, in law, is a term applied to persons who having violated the laws of a State escape into a foreign territory. As one State cannot pursue criminals into the territories of another, the practice prevails among the more enlightened nations of mutually surrendering such fugitives to the justice of the injured State. This practice is founded on national comity and convenience, or on express compact. The United States recognize the obligation only when it is created by express agreement (see EXTRADITION). As between the States of the American Union, extradition is made compulsory by the Federal Constitution, Art. IV. Sec. 2, which provides that "a person charged in any State with treason, felony, or other crime, who shall fly from justice and be found in another State, shall, on demand of the executive authority of the State from which he fled, be delivered up, to be removed to the State having jurisdiction of the crime." In the several States there are statutory provisions or established usages regulating the procedure in such cases.

Fugitive-slave Laws. In the colonies and under the Confederation, fugitive slaves could only be reclaimed through intercolonial or interstate comity, and in framing the Constitution, one of the chief inducements for the South to join was a fugitive-slave clause. The mandate to deliver them up, however, was only to the States which could not be punished for refusing to comply; and as the free States recognized no obligation of comity on this point, the general government passed the first fugitive-slave law, signed by Washington 12 Feb. 1793. The oral testimony of the alleged owner was all the evidence required, and on this any magistrate, even a town justice, was ordered to surrender the alleged fugitive; $500 fine was imposed for rescue, concealment, or obstruction of arrest. This made kidnapping free blacks a pastime, and it was extensively carried on in the Border States; motions to amend the law and require more evidence were voted down. On the other hand, the Border States complained of increasing escapes, and Congress promptly passed an amendment (30 Jan. 1818), enabling a claimant to make his proof before a judge of his own State, and abolishing the habeas corpus in such cases. The Northern magistrates, however, revolted against the obligation; Pennsylvania passed a law contravening the national act and providing its own methods of reclamation, and made them incumbent on her own magistrates; a Maryland slave-seeker thereupon carried off an alleged slave by force, and on his indictment the Supreme Court decided (Prigg *v.* Pennsylvania) that the execution of Federal laws could not be imposed on State officials. Taney dissented; and on this doubt the Northern States began to pass "personal-liberty laws" to prevent their officials being so employed, or their buildings used as places of detention. This roused the South to demand an effective fugitive-slave law as the price of remaining in the Union; and that of 1850 (see COMPROMISE OF 1850), the death-knell of the Northern-Southern Whig party, was passed, placing the whole course of reclamation in Federal hands. The entire machinery of the United States, from courts to army, was made part of a grand system for this one purpose, and new officials were appointed for it; marshals were liable to $1,000 fine, plus the value of the slave, if he escaped or even was forcibly rescued, and bystanders were held guilty of treason for refusing to assist; the owner's oath was full evidence, that of the alleged fugitive was not to be received, and the habeas corpus was rendered null; obstruction, rescue, or concealment, were punishable by six months' imprisonment and $2,000 damages and fine; if the claimant "apprehended" a rescue, the marshal was to take the fugitive to the claimant's State himself before surrendering him; lastly, an affidavit and general description made in the claimant's own State was to be valid for a reclamation in any other. This atrocious act was met by more stringent personal-liberty laws, which made it hard for the alleged owner or his United States agents to find any State soil to stand on in executing the writs or holding the fugitive; and in 1859 Wisconsin openly threatened to secede if the mandates were executed on her soil. Its political result was an undreamt-of boomerang, each seizure rousing a glare of public notice and hatred, often inflamed still more by the incidents — as riot and bloodshed, the murder of her child by a mother to save it from slavery (see GARNER CASE), the prosecution for treason of two Quakers who refused to join the hunt (see CHRISTIANA CASE), the seizure of long-time free black citizens of towns, etc. The

Free-Soil party demanded its repeal; the Republican party inherited and pressed the claim; and the success of the latter in 1860 was taken by the South as notice that the next administration would repeal it.

Fugue, fūg, a musical term derived from the Latin word *fuga*, — a flight, and signifying a polyphonic composition constructed on one or more short subjects or themes, which are harmonized according to the laws of counterpoint, and introduced from time to time with various contrapuntal devices. The interest in these frequently heard themes is sustained by diminishing the interval of time at which they follow each other, and monotony is avoided by the occasional use of episodes, or passages open to free treatment. The chief elements of a fugue are: (1) the subject; (2) the counter-subject, or contrapuntal harmonization of the answer by the part which has finished the enunciation of the subject; (3) the answer; (4) episodes; (5) the stretto; and (6) the pedal point.

There are three kinds of fugue, the simple, containing one subject; the double, consisting of two subjects, occasionally intermingled and moving together, and the counter fugue, in which the subjects move in a direction contrary to each other. In all the fugues the parts *fly*, as it were, after each other, whence the name. The great masters of fugal form are Johann Sebastian Bach and Handel.

Fuller, Anna, American novelist: b. Cambridge, Mass., 9 Nov. 1853. Her works are: 'Pratt Portraits; Sketched in a New England Suburb' (1892); 'A Literary Courtship' (1893); 'Peak and Prairie' (1894); 'A Venetian June' (1896); 'One of the Pilgrims' (1898); 'Katherine Day' (1901); 'A Bookful of Girls' (1904).

Fuller, Arthur Buckminster, American Unitarian clergyman: b. Cambridgeport, Mass., 1822; d. at the battle of Fredericksburg, Va., 13 Dec. 1862. He was graduated from Harvard in 1843, studied in the Harvard Divinity School, and held pastorates in Manchester, N. H., and Boston and Watertown, Mass. In the Civil War he was chaplain to a Massachusetts regiment. He edited several works of his sister, Sarah Margaret Fuller d'Ossoli (q.v.).

Fuller, George, American artist: b. Deerfield, Mass., 1822; d. Boston 21 March 1884. As early as 1857 his work attracted attention, and during the last years of his life his pictures were warmly admired by many for their richness of tone and peculiar handling, though they never appealed to the popular taste. His best-known works are: 'The Romany Girl' (1879); 'She was a Witch' (1879); 'Winifred Dysart' (1881); 'A Turkey Pasture in Kentucky'; 'Fedalma' (1884).

Fuller, Henry Blake, American author: b. Chicago, Ill., 9 Jan. 1857. He was intended for a mercantile career, but entered literature with 'The Chevalier of Pensieri-Vani' (1891), and 'The Châtelaine of La Trinité' (1892). He next wrote: 'The Cliff Dwellers' (1893), and 'With the Procession' (1895), novels of Chicago life; 'The Puppet-Booth' (1896), dramatic sketches; 'From the Other Side' (1898), short stories; 'The Last Refuge' (1900); 'Under the Skylights.'

Fuller, Melville Weston, eminent American jurist and one of the chief justices of the Supreme Court of the United States. He was born in Augusta, Me., 11 Feb. 1833; graduated at Bowdoin College (A.M.) in 1853, and attended a course of lectures at the Harvard Law School (LL.D.), and was admitted to the bar in his native city in 1855. He began the practice of law, meanwhile becoming the associate editor of the 'Age,' a Democratic newspaper. In 1856 he was elected city attorney and president of the common council. He resigned these offices and removed to Chicago, where he established an extensive law practice.

In 1862 he became a member of the Illinois State Constitutional Convention, and in the following year was elected from Cook County to the lower house of the State legislature. He rose rapidly in State and national politics, and from 1864 to 1880 was regularly a delegate from Illinois to the Democratic national conventions. In 1876 he placed Thomas A. Hendricks in nomination and was himself seriously considered as a candidate for presidential nomination in 1880. The same year he practically retired from politics, but gained additional fame as a lawyer during the next few years. In the famous lake-front case in Chicago he was counsel for the municipality, and in the Cheney ecclesiastical case, he defended Rev. C. E. Cheney, a Protestant Episcopal clergyman, rector of Christ Church, Chicago, against an action brought by an ecclesiastic council.

In April 1888 President Cleveland appointed him chief justice of the United States Supreme Court to succeed R. M. Waite (q.v.), deceased. He was confirmed 20 July 1888, taking the oath of office 8 October. About this time Bowdoin, Harvard College, and the Northwestern University conferred degrees upon him. In the Supreme Court he soon became a prominent figure, and he was largely responsible for the expansion of Federal power, by means of the decision asserting the implied authority of the executive to protect the Federal judge on occasion when there is just reason to believe that, while in the exercise of official duties, they are exposed to personal danger. This was especially applicable to the case of one Nagle, an Arizona cowboy, who was made a United States marshal to protect the person of Chief Justice Field, and who while performing this duty, shot and killed Judge Terry, of California.

In 1899 Justice Fuller was a member of the Arbitration Commission convened at Paris for the adjustment of the Venezuela boundary question.

Fuller, Sarah Margaret. See Ossoli, Sarah Margaret, Marchioness d'.

Fuller, Thomas, English historian and Anglican: b. Aldwinkle, Northamptonshire, June 1608; d. London 16 Aug. 1661. He was graduated from Queen's College, Cambridge. In 1630 took orders and was appointed perpetual curate of St. Benet's parish, Cambridge, and became very popular as a preacher. In 1631 he became prebend in the cathedral of Salisbury. The same year he published a poem entitled 'David's hainous Sin, heartie Repentance, and heavie Punishment.' He gave up his Cambridge curacy in 1633, and next year became rector of Broadwindsor, Dorsetshire. His 'History of the Holy Warre' appeared 1639, soon after the

MELVILLE WESTON FULLER.
CHIEF JUSTICE OF THE UNITED STATES SUPREME COURT, 1888.

publication of which he removed to London, and was chosen lecturer at the Savoy Church in the Strand. In 1642 he published his 'Holy and Profane State' (folio). In 1650 he published 'Pisgah Sight of Palestine and the Confines thereof, with the History of the Old and New Testament acted thereon' (folio), and in 1650 appeared his 'Abel Redivivus,' consisting of lives of religious reformers, martyrs, divines, etc. In 1655 he published the 'Church History of Britain, from the Birth of Jesus Christ to the Year 1648'; to which was subjoined the 'History of the University of Cambridge since the Conquest,' and the 'History of Waltham Abbey.' The year after his death was published his principal literary work, the 'Worthies of England' — a production valuable alike for the solid information it affords relative to the provincial history of the country and for the profusion of biographical anecdote and acute observation on men and manners. Consult 'Life' by Bailey (1874).

Fuller-Maitland, John Alexander, English musical critic: b. 1856. He was graduated from Trinity College, Cambridge, in 1879, and in 1889 became musical critic on the staff of the London *Times*. He contributed to Sir George Grove's 'Dictionary of Music and Musicians,' the appendix to which he edited; translated (with C. Bell 1884) Spetta's 'Johann Sebastian Bach,' wrote a standard 'Life of Robert Schumann' (1884), and further published: 'Masters of German Music' (1894); 'The Musician's Pilgrimage' (1899).

Fullerites, a religious sect near Athol, Mass., known as Fullerites or Howlandites, established 15 Sept. 1855, by Frederick T. Howland, a Quaker, of New Bedford, Mass. Among early converts was Leonard C. Fuller, the present head of the community. Their religious belief resembles somewhat that of the Adventists, but differs in the vital point that the reign of Christ, under the expected new dispensation, is to be spiritual and not personal as held by the Adventists. They believe the judgment day has already begun; the earth is not to be destroyed, but changed; they entirely renounce spiritualism. The community live chiefly upon farinaceous food; they drink principally water and sometimes herb tea. They live on the apostolic plan of having all property in common. They dress very plainly and no jewelry is worn. Sabbath is observed from 6 P.M. Friday until 6 P.M. Saturday. They own a farm of 210 acres.

Fullers' Earth, a pulverulent material formerly much used for fulling cloth and wool, but now more generally employed as a filtering material for the clarification of oils. It is not a substance of definite composition, but consists essentially of clay, mixed with sufficient finely divided silicious matter to destroy its plasticity. The production in the United States in 1902 was $98,144, chiefly from Florida. It also occurs in Georgia, Arkansas, and other States.

Fullerton, George Stuart, American professor of philosophy: b. Fathegarh, India, 18 Aug. 1859. He was graduated from the University of Pennsylvania and in 1887 he was appointed professor of philosophy in the same institution. He is the author of: 'Preliminary Report of Seybert Commission on Spiritualism' (1887); 'The Conception of the Infinite' (1887); 'A Plain Argument for God' (1889); 'The Philosophy of Spinoza' (1894); 'On Spinozistic Immortality' (1899).

Fullerton, Lady Georgiana Charlotte Gower, English novelist: b. Tixall Hall, Staffordshire, England, 23 Sept. 1812; d. Bournemouth, Hampshire, 19 Jan. 1885. She was married to Alexander George Fullerton in 1833, and followed him into the Roman Catholic Church in 1846. Her first novel, 'Ellen Middleton' (1844), was followed by 'Grantley Manor' (1847). Her later stories, after her conversion to the Catholic faith are in a mild way "stories with a purpose," the purpose being to develop the influence of religious belief on life and character; among them are: 'Lady Bird' (1852); 'Too Strange Not to be True' (1864); 'Mrs. Gerald's Niece' (1871); 'A Will and a Way' (1881). She wrote also 'The Gold-Digger, and Other Verses' (1872). See Craven, 'Life of Lady Georgiana Fullerton,' translated from the French by H. J. Coleridge (1888).

Fulling, the act of cleansing, scouring, and pressing woven woolen goods, etc., to render them stronger, firmer, and closer; called also milling, because these cloths are usually scoured by a water-mill. The principal parts of a fulling-mill are the wheel, with its trundle, which gives motion to the tree or spindle, whose teeth communicate that motion to the pestles or stampers, which fall into troughs, wherein the cloth is put, with fullers' earth, to be scoured and thickened by this process of beating it. The operation takes from 48 to 65 hours, and results usually in considerable shrinkage in length and width; it obviates the tendency to unravel and renders the threads of the cloth so firm and close as to be almost imperceptible.

Fulmar, fŭl'mar, an Arctic petrel (*Fulmarus glacialis*), which breeds on rocky coasts of the North Atlantic in enormous colonies, and comes southward in winter. It is about the size of a large duck. The head and neck are pure white; the back and long wings of a pearly gray; breast, belly, and under surface white; bill large, strong and yellow; legs and toes brownish. The young are brownish gray. In the Hebrides, and especially in St. Kilda, where these birds reside in incredible numbers, they are of great value to the people. The fulmars breed on the faces of the highest precipices, on which every grassy shelf over a few inches in extent is covered with their nests, which are slightly excavated in the turf and lined with dry grass and withered tufts of sea-pink. One egg is deposited at a time, which the cliffmen obtain by descending with ropes from the summit of the cliffs. The birds, when seized, vomit a quantity of clear amber-colored oil of a disagreeable odor, which is one of the most valuable products of St. Kilda. The old birds feed the very young with it. The fulmar feeds on animal substances, chiefly fat. It flies buoyantly and rapidly, and withstands heavy gales, skimming the surface of the water. When a whale is caught, though few of the fulmars should be present, they assemble in thousands as soon as the cutting up is commenced; hence the whalers call them "whale-birds" or "mollymauks." They follow in the greasy track of a ship, coming within a few yards of the men engaged in cutting, and devour the morsels of fat voraciously and in great quantity.

Various other large oceanic petrels are called fulmars, as the "Cape pigeon" (*Daption capensis*), giant petrel, "nelly" or "bonebreaker" (*Ossifraga gigantea*) of the Indian and Antarctic seas, and several species in the North and South Pacific. See PETREL.

Fulminates, fŭl'mĭ nāts, compounds of fulminic acid, all of which are violently explosive. The most important of these is mercuric fulminate, which is formed by dissolving 10 parts by weight of mercury in 120 parts of nitric acid (specific gravity 1.4) and, when cooled, pouring this solution into 110 parts of 95 per cent grain alcohol. At the normal temperature a reaction sets in which becomes quite turbulent, dense white fumes being given off and then red fumes, and after this, the mercuric fulminate separates out as a gray, crystalline powder. It has the formula of $HgO_2N_2C_2$, and belongs to the class of chemical substances known as oximes. Its specific gravity is 4.42. When dry, mercuric fulminate explodes violently if struck or compressed or rubbed between hard surfaces, when heated to 186° C., when touched with strong sulphuric or nitric acids, or when in contact with sparks from flint and steel or electric sparks. In all these cases the body undergoes a detonating explosion, and its principal use is to produce detonation in high explosives, though it is also used in percussion caps and primers to ignite gunpowder and other low explosives. Mercuric fulminate should be stored and transported only in the moist condition, yet even in this condition it can be exploded by the explosion of dry fulminate in contact with it. Certain amines like fulminating silver, gold, mercury and copper are frequently confounded with the fulminates because they are also explosive. The best known of these is Berthollet's fulminating silver, which was used in the bomb which killed the Czar of Russia. This body is made by treating freshly precipitated silver oxide with ammonia water. It separates out as a black, crystalline mass, which explodes on the slightest concussion when dry and may even be exploded by rubbing when moist, so that it requires the greatest caution in handling. It has been repeatedly formed accidentally in the ammoniacal silver solutions used in silvering mirrors and in the silver baths used in the wet processes of photography and has given rise to serious explosions. See EXPLOSIVES.

Fulmina'tion, a term used in chemistry to denote the sudden decomposition of a body by heat or percussion, accompanied by a flash of light and a loud report, and differs therefore but little from detonation; except that the latter refers more to the sound, and the former to the flash. See DETONATION; EXPLOSIVES; FULMINATES.

Fulminic Acid. See FULMINATES.

Fulton, Robert, American inventor: b. Little Britain, Lancaster County, Pa., 1765; d. New York 24 Feb. 1815. Early in life he manifested a taste for painting, and purposing to adopt it as a profession, went to England to study under Benjamin West. In that country, however, he became acquainted with the Duke of Bridgewater, the founder of the canal system of Great Britain, who induced Fulton to abandon art, and take to the study of mechanical science. This nobleman was at the time engaged in a scheme of steam navigation, which he imparted to Fulton. The latter visiting Birmingham was brought into communication with the celebrated James Watt, who had just succeeded in his great improvement of the steam-engine, with the construction of which Fulton made himself thoroughly familiar during his stay. About this time he invented a machine for spinning flax, and another for making ropes, for which he obtained patents in England. In 1796 he published a 'Treatise on the Improvement of Canal Navigation.' From 1797 to 1804 he resided in Paris with Joel Barlow, the American representative at the French court. During this period he invented a submarine or plunging boat, called a "torpedo," designed to be used in naval warfare. He invited the attention of the French government to his invention, and Bonaparte, then first consul, appointed Volney, La Place, and Monge as a commission to examine it. Several experiments were made in 1801 in the harbor of Brest. He could easily descend to any depth, or rise to the surface; and where there was no strong current, the boat was quite obedient to her helm while under water. On one occasion, he remained in the torpedo several feet below the surface for more than four hours; but the motion of the boat while submerged was very slow, and it was clearly unequal to the stemming of a strong current. The French government declined to patronize the project, and Fulton accepted an invitation from the English ministry, who also appointed a commission to test the merits of his torpedo. He appears, however, to have received but little encouragement, and in 1806 returned to the United States. Having been supplied with the necessary funds by Robert Livingston (q.v.), who had been American ambassador at Paris, Fulton had the satisfaction of proving, in 1807, that steam could be applied to the propulsion of vessels with entire success. His achievement excited universal admiration, and from that time steamboats were rapidly multiplied on the waters of the United States. His first steamboat, called the Clermont (of 140 feet keel and 16½ feet beam), made a progress on the Hudson of five miles an hour. His second large boat on the Hudson was the Car of Neptune, and was built in 1807. He afterward built other steam vessels, one of them a frigate, which bore his name. His reputation became established, and his fortune was rapidly increasing, when his patent for steam vessels was disputed, and his opponents were in a considerable degree successful. Though an amiable, social, and liberal man, the anxiety and fretfulness occasioned by the lawsuits about his patent rights, together with his enthusiasm, which led him to expose himself too much while directing his workmen, impaired his constitution, and he died at the early age of 49. He was buried in Trinity churchyard, New York, and in 1901 a monument to his memory was placed there by the American Society of Mechanical Engineers. His name is perpetuated in the immediate locality by Fulton Street, Fulton Market and Fulton Ferry. Consult: Colden, 'Life of Fulton' (1817); Preble, 'History of Steam Navigation' (1883).

Fulton, Ill., city in Whiteside County, on the Mississippi River, and on the Chicago, M. & St. P., the Chicago, B. & N. and the Chicago & N. W. R.R.'s; 36 miles northeast of Rock

ROBERT FULTON.

Island. The Northwestern College of Illinois was opened here in 1865, and other prominent educational institutions are located in this vicinity. There are extensive lumber manufactories, clay-mills, sewer-pipe works, stove and metal foundries, and there is a large trade here in grain, lumber, and produce. The municipality is governed by a mayor and council elected every two years by popular vote. Pop. (1900) 2,685.

Fulton, Mo., city and county-seat of Callaway County, on the Chicago & A. R.R., 125 miles west of St. Louis. Here are located the State Institution for the Deaf and Dumb, State Lunatic Asylum No. 1, Westminster College (Presbyterian), founded 1852; the Woods College of the Christian Church of Missouri, and the Synodical College and Conservatory of Music. Fulton is noted for its fire-brick and pottery works, the city having an extensive supply of coal and fire-clay. The town was settled in 1821, and was incorporated as a city in 1859. The charter has never been changed since that date. The mayor and council are elected annually. The city owns and operates its electric light and water plants. Pop. (1900) 4,883.

Fulton, N. Y., city in Oswego County, on the Oswego River and the Oswego Canal, and on the New York C., New York, O. & W., and Delaware & L. R.R.'s, 25 miles northwest of Syracuse. It has a public library, city hall, opera house and other public buildings. It is the centre of the cheese trade of northern New York, and there are manufactures here of paper, woolen goods, flour, fire-arms, tools, water-motors, cutlery, paper-mill machinery, condensed milk, canned goods, etc. Fulton was settled in 1791 and was originally incorporated as a village in 1835. The villages of Fulton and Oswego Falls, with an aggregate population of 8,206, were consolidated and chartered as a city in April 1902. A mayor and common council govern the city, being elected every two years by popular vote. The municipality owns and operates the waterworks.

Fulvia, fŭl'vĭ-a, Roman matron: d. about 40 B.C. After being twice married she became the wife of Mark Antony. Antony divorced her to marry Cleopatra, upon which she attempted to persuade Augustus to take up arms against her husband. When this scheme did not succeed she retired into the East, where Antony received her with great coldness. This broke her heart, and she soon after died.

Fumiga'tion, an attempt at disinfection by gaseous agents. Fumigation is probably a very unsatisfactory mode of bringing about disinfection. The agents that are used most effectively are chlorine gas, sulphur dioxide, and formaldehyde. It has been distinctly demonstrated that chlorine gas as a disinfecting agent is untrustworthy, and that its application is attended with many disadvantages. Sulphur dioxide, in the absence of moisture, gives practically no results, and even when aqueous vapor is generated in a room previous to the use of the gas its bactericidal action is very slight. Moreover, sulphur dioxide in the presence of moisture in the air tarnishes brass and silver, gilt frames, etc., and corrodes fabrics and other stuffs. It is not a satisfactory disinfectant. Formaldehyde gas has been used since 1890 for fumigation. The vapor is extremely pungent, and it has a strong affinity for all organic substances. Its practical value as a disinfectant has been demonstrated to be above that of any other gaseous substance. It cannot, however, be said to give absolute results, and although its power of penetration is greater than in that of any of the others mentioned it is still only a surface disinfectant. The interior of a heap of clothing, for instance, if exposed to the gas, is not affected at all by it. Formaldehyde gas as a fumigant is not sufficiently strong to kill many household pests. This casts suspicion on its value as a room disinfectant. Moreover, it is very costly. In general it may be gathered that gaseous disinfection by fumigants is somewhat of a farce; and although formaldehyde gas approaches more closely the requirements of the ideal, it is far from being perfect. The best disinfectant for rooms is unquestionably sunlight. Short of this, thorough cleansing, rubbing down the walls, etc., should be carried out. As noted in the article on disinfection, it is the effort of hygienists to particularize on the type of disease agents which they desire to eradicate. The general modes of disinfection heretofore much in vogue were largely founded on a lack of knowledge of what the infecting agents have been. See BACTERICIDE; DISINFECTANTS.

Fu'mitory ("smoke of the earth"), a name commonly given to species of the genus *Fumaria.* It is a native European weed which has been naturalized in America. The climbing fumitory or mountain-fringe of the United States grows well under cultivation. To the family *Fumariaceæ* belongs the genus *Corydalis,* found throughout most of the north temperate zone.

Funchal, foon-shäl, Madeira, the capital and seaport of the island in the centre of a large bay on the south coast of Madeira. It is irregularly built; the streets are narrow, winding, ill-paved, and dirty. An old castle, which commands the roads, stands on the top of a steep, black rock, called Loo Rock, surrounded by the sea at high water. The entire produce of the island, consisting mostly of wine and fruit, is exported from Funchal. Pop. (1901) 19,600, among whom are many English, French, Portuguese, and mulatto and negro freedmen. See MADEIRA.

Funck-Brentano, funk brōn-tä-nō, **Théophile,** French philosophical and critical writer: b. Luxembourg 20 Aug. 1830. He became professor at the School of Political Sciences in Paris in 1873. His thorough studies in law and medicine have imparted to his philosophical writings an exactitude of thought and inspired a special stress on method, very apparent in such works of his as: 'New Thoughts and Maxims' (1858); 'Exact Thought in Philosophy' (1869); 'Greek Sophists and Contemporary English Sophists' (1879); and others. As a critic he is esteemed for the happy presentation and careful elaboration of his thought.

Function, (1) In biology, the action proper to tissues, organs, or groups of organs in plant and animal life. The function of respiration is the joint action of lungs and skin; digestion is a very compound function, to which organs and groups of organs contribute. The actions are capable of being grouped in subordination to three leading phenomena of every living thing—namely, sustentation, reproduction, and relation. To the first belong digestion and all the other functions which contribute to the vegetative life; the processes of the second are, as examples of cell transformation, so far identical with those of the other two, but the results are different; the cell changes of the nervous system which regulates the relations of living things, are again identical with those of the other two sets of phenomena. Functional diseases are those due to organs perfect in structure but not performing their functions properly; as opposed to organic or structural diseases, due to defect of structure.

Organs often have more than one function—a *primary*, or that for which it is principally intended, and a *secondary*, some subsidiary purpose which it performs. It sometimes happens that important changes take place in the course of the evolution of a type, or the development of an individual, whereby the primary function disappears and some secondary use becomes pre-eminent or exclusive. Thus "a brilliant speculation," says Carpenter, "has indicated pairs of tracheal gills on the meso- and metathorax as the possible origin of insect wings. The primeval insects forsook, so it is thought, the water for the land; and the plates, becoming useless for breathing, were enlarged and finally changed into organs of flight." Another strong and familiar example is the case so often presented among crustaceans where the mouth parts are largely structures ("foot-jaws") originally ambulatory, but now entirely devoted to the seizing and mastication of food. Change of function results in change of structure. Consult Darwin, 'Origin of Species' (6th ed., London 1882); A. Dohrn, 'Der Ursprung der Wirbelthiere und das Princip des Functionwechsels' (Leipzig 1875); A. M. Marshall, 'Biological Lectures and Addresses' (London 1894); Saint George Mivart, 'Genesis of Species' (New York 1871). See also FUNCTIONALISM.

(2) In mathematics, one quantity is said to be a function of another, or of several others, when its value depends on those of the latter. Thus the area of a triangle is a function of its three sides, and $y=a+bx+cx^2$ is a function of a, b, c, and x. Functions receive distinctive names according to the nature of the dependence above referred to. Thus the function above written is said to be an algebraical function of x, since y is obtainable from x by the performance of a limited and definite number of algebraical operations. Log x, sin x, a^x, on the other hand, are said to be transcendental functions of x, and for obvious reasons receive the distinctive names of logarithmic, trigonometrical, and exponential functions. The term function in its mathematical sense was due to Leibnitz (1692), but in its present sense was first defined by Johann Bernoulli (1718). Lagrange first used the term "theory of functions" in his 'Théorie des fonctions analytiques' (Paris 1797). The object of the theory is the study of functions of one or more variables, in which either the variables or the coefficients, or both, are complex numbers. Lagrange (1772, 1797, 1806) may be said to have been the real founder of this general theory but others before him—Newton, Leibnitz, Bernoulli, Clairaut (1734), D'Alembert (1747), and Euler (1753)—had already worked in its direction. Landen (1775) is usually credited with founding the theory of elliptic functions, though this theory had been suggested by Jakob Bernoulli (1691); Maclaurin (1742), and D'Alembert (1746). The real development of the theory, however, is due to Legendre, who after great labor produced his 'Traité des fonctions elliptiques et des intégrales Euleriennes' (1825-8). Abel, Jacobi, and Cayley also contributed much to this theory. The present form of the general theory of functions is based largely on the works of Cauchy, Riemann, and Weierstrass. For a list of the special functions consult: Müller, 'Mathematische Terminologie,' in 'Bibliotheca Mathematica' (Leipzig 1901), a work in which are given about 200 functions. Brill and Noether, in 'Die Entwickelung der Theorie der algebraischen Functionem in älterer und neuerer Zeit,' in 'Jahresbericht der deutschen Mathematiker Vereingung' (Vol. II, Berlin 1894), give a valuable history of the development of functions. Consult also: Forsyth, 'Theory of Functions' (Cambridge 1893); Harkness and Morley, 'Theory of Functions' (New York 1893); and Merriman and Woodward, 'Higher Mathematics' (New York 1896), in all of which will be found the historical development, bibliography and full discussion of the theory of functions. See also articles in this encyclopedia: COMPLEX VARIABLE, THEORY OF THE FUNCTIONS OF A; REAL VARIABLE, THEORY OF THE FUNCTIONS OF A; MATHEMATICS; TRIGONOMETRY; etc., to which extended bibliographies are appended.

Functionalism (in psychology and philosophy). Functionalism is a term employed by modern writers both in philosophy and psychology. It occurs more commonly in psychological writers and it will be convenient to designate first the meaning which they assign to it. Functional psychology can be considered as dealing with three fairly distinct problems which we may discuss separately.

First: One of the fundamental problems which psychologists undertake to solve consists in the determination of the number and character of the various materials sensory, ideational, etc., which the mind employs, *e. g.*, the varieties of color, tone, taste, etc. Their effort is directed to analyzing and describing both the elementary and the complex *contents* of consciousness. This field of endeavor is ordinarily entitled structural psychology. As contrasted with this, functional psychology undertakes to discern and portray the typical *operations* of the mind with especial reference to the *actual* life conditions under which consciousness occurs. In describing sensation, for example, it would find its sphere of interest in determining the character of the various sense activities like vision and hearing, as differing in their *modus operandi* from one another and from other mental processes such as thinking and willing.

This branch of functional psychology is found in all important psychological writers from Aristotle to the present day. It is not, however, until the present generation that any essential distinction has been recognized along this line between structural and functional psychology. Indeed, as compared with the remaining forms of functional psychology, the distinction is relatively unimportant. It represents nevertheless a difference in emphasis which is significant. The functionalist is peculiarly resolute in his purpose to describe mental life as it is in the moment of experience. The analyses offered by the structuralist are perhaps apt to dwell too impartially upon details which may be evident to later introspective examination without having constituted noticeable features of the conscious state itself when it was in progress.

Substantially identical with this first conception of functional psychology, but phrasing itself somewhat differently, is the view which regards the functional problem as concerned with discovering *how* and *why* conscious processes are what they are. The structuralist is supposed to be occupied with the problem of determining *what* the conscious elements are and how they are combined. In general it will be seen that functionalism as thus described is roughly analogous to a physiology of mind, whereas structuralism is analogous to a mental anatomy.

Second: A broader conception of functional psychology and one more frequently characteristic of contemporary writers takes its rise from the prevailing interest in the larger formulae of biology and particularly the evolutionary hypotheses within whose majestic sweep is nowadays included the history of the whole stellar universe. From this point of view functional psychology finds its peculiar problem in mental activity as part of a larger stream of biological forces. The psychologist of this stripe is wont to take his cue from the basal conception of the evolutionary movement, *i. e.*, that for the most part organic life possesses its present characteristics by virtue of the efficiency with which they serve to meet the conditions laid down by the environment. With this conception before him he attempts to gain some understanding of the manner in which the psychical contributes to the furtherance of organic activities—not alone the psychical in its entirety, but much more the psychical in its particularities, mind as feeling, mind as judging, as willing, etc. He seeks to discover the exact nature of the accommodatory service represented by the various great modes of conscious expression.

Animal psychology affords a concrete example of the effort to discover these particularistic features of the adaptive service rendered by consciousness to organisms. Modern investigations in this field have thrown a flood of light upon such problems as the mechanism of instincts, the methods of animal topographical orientation, the scope and character of the several sense processes, etc. In a similar manner the studies of human genetic psychology, particularly that branch entitled child study, have contributed to our knowledge of the service rendered to the growing mind by its several different functions, such, for example, as the various sensations, the emotions, etc. Pathological psychology has also contributed in no small measure to our knowledge of the part played by particular portions of our consciousness in the development and organization of our mental life as a whole.

In this connection it is interesting to remark that not a few modern writers hold the view that every accommodation by an organism to a *novel* situation requires and involves consciousness. Such a view rests on the conviction that consciousness is not only of service from time to time in assisting organic adaptation to environment, but also that it is the absolute pre-condition of accommodation to situations which are new.

This broad biological ideal of functional psychology may be considered as issuing in the attempt to discover the fundamental utilities of consciousness. The problem from this point of view has not as yet been satisfactorily solved. It is possible to regard the three great familiar divisions of mental life, *i. e.*, knowing, feeling, and willing, as constituting these basal utilities. There are, however, many subordinate categories which are equally significant; *e. g.*, attending and judging. Moreover, from the strictly utilitarian standpoint it may be urged as practicable to reduce all these manifestations of utility to the basal one, selective accommodation; that is to say, it is because consciousness by its selective action leads to movements which result in the attaining of certain ends, that mind possesses value.

Third: It is sometimes asserted that functional psychology is in reality a form of psychophysics. This means that it finds its major interest in determining the relations to one another of the physical and mental portions of the organism. To be sure all psychology must necessarily entertain some doctrine regarding these relations, but functional psychology is occasionally identified with a peculiar attitude toward this problem which may be described as follows:

The distinction between the mind and the body is not regarded as founded primarily on a difference between two kinds of existence, one physical and the other mental. The two are rather thought of as different modes in which organic life expresses itself, now the one and now the other being more in evidence. Conscious processes are thought of as present whenever novel situations are to be dealt with and the fundamental business of consciousness is conceived to be that of building up efficient habits, or co-ordinations, to meet the necessities of these situations. The purely physical or physiological processes are on the other hand regarded as finding their peculiar sphere of action wherever old and well-formed habits are capable of meeting the requirements of the temporary environment. From this point of view mind and body are not so much two distinct entities as they are stages or aspects of the general process of vital accommodation to environment.

These three conceptions of functional psychology which have been described are obviously supplementary to one another. It is clearly impracticable to carry out a functional psychology which should deal with the problem of mind conceived as engaged in mediating between the environment and the needs of the organism without having some doctrine to offer concerning the connection of the mind and the body, for by common agreement consciousness makes itself effective through the muscular movements to which it leads. Some notion, therefore, of this connection must be involved. Moreover, it is equally certain that no effort to handle either of these problems can go far without some theory as to the basal character of the various mental operations themselves. The three positions must accordingly be regarded as complementary to one another. Their apparent divergence arises chiefly from emphasizing different aspects of a common problem.

The term functionalism, as has been already intimated, is less frequent in philosophy than in psychology. When used, however, it is generally employed as substantially identical with such terms as pragmatism and humanism. It does not represent a definite group of opinions and beliefs, but rather a certain attitude toward philosophical problems. This attitude may be illustrated by the comments in an earlier paragraph upon functional psychology conceived as concerned with the mind-body problem. In general, philosophical functionalism undertakes to discern the exact circumstances out of which the various problems of philosophy have grown, not only in the historical sense in which these problems are connected with the systems of particular movements or philosophers, but in the much more genetic sense in which they may be shown to come to light in the reflective processes of any human being. In a way, therefore, it might be designated a genetic philosophy.

In its purposes at least a philosophy of this kind is peculiarly vital, for it attempts to see the practical living significance of philosophical problems and it finds its solutions in the actual outcome in human life of the multifold factors with which metaphysical speculation finds itself confronted.

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Fundamental Note, Tone, or Bass. (1) The lowest or gravest note that a string or pipe sounds in generating a series of harmonics. The fundamental note of a stretched string is sounded when the string vibrates as a whole. The fundamental note of an open organ-pipe is sounded when there is one node at the middle of the pipe. In a closed organ-pipe the closed end or stopper acts as the node when sounding the fundamental note.

(2) The fundamental note also signifies the root of a chord, irrespective of the inversions of the chord; thus in the common chord of C, C E G, C is the fundamental note and remains so in the inversions E G C, G C E, E and G being called the bass notes.

Fundamental Units is the term employed in physics for units which constitute the foundation of calculations with regard to other quantities; units used for measuring others. Fundamental units are three, namely, a definite length, a definite mass, and a definite interval of time.

Funded Debt. See DEBT, NATIONAL.

Fundi, or **Fundungi,** a kind of grain *Paspalum exile*, allied to the millets, which is cultivated to a considerable extent in the western part of Africa. It is wholesome and nutritious and is much used by the natives of western Africa as a food.

Funding, in finance, the conversion of floating debt into an interest-bearing obligation with a definite period, on which bonds can be issued. One such operation if of special interest in United States history, as part of the operations by which Hamilton, as leader of the Federalists (q.v.), and then secretary of the treasury, succeeded in setting the government on a firm foundation. The Act of 4 Aug. 1790 funded not only the foreign and domestic debt in full, but the State debts incurred in carrying on the Revolutionary War; the bonds were at 6 per cent., but those for the domestic debt did not bear interest till 1800.

Funds, Public. See DEBT, NATIONAL.

Fundy, Bay of, a huge arm of the Atlantic Ocean extending into the land between New Brunswick and Nova Scotia, and the State of Maine, and terminating in two smaller bays, Chignecto Bay and the Basin of Minas. Its length up to Chignecto Bay is 140 miles, and its extreme breadth 45 miles. It is noted for its high tides, which are influenced by the Gulf Stream, and rise about 30 feet at St. John and 60 feet at the head of Chignecto Bay, rushing into the latter with remarkable force. At Bay Verte, 14 miles distant, the tide rises little more than 4 or 5 feet. Along its northwest side the Bay of Fundy receives the St. John, the largest river in New Brunswick, and also the St. Croix. The tides in the Fundy are perilous to navigation and produce dangerous bores, especially in the upper reaches of the Bay. At low tide there is a long expanse of mud flats, at times over 2 miles in length, and the inreaching estuaries are completely drained. At the entrance to the Bay of Fundy are the Grand Manan and other islands. See TIDES.

Fu'nen, an island of the Danish archipelago, separated from Jutland by the strait called Little Belt; area 1,123 square miles; pop. (1901) 279,501. Its shores are deeply indented; its interior is undulating, and there are numerous lakes, streams, and marshes. The largest stream is the Odense, 36 miles long. It trades principally with Sweden and Norway. It forms with other islands a province of Denmark (q.v.). Chief towns: Odense, Svendborg, and Nyborg.

Funeral Rites, the last religious and ceremonial tribute of friendship and love paid to the remains of the dead. Among the Hindus the corpse is perfumed and adorned with flowers; it is then burned; after many ceremonies the bones are deposited in a casket and buried, but afterward disinterred and thrown into the Ganges. A second series of obsequies commences after the period of mourning has expired, and this is followed by commemorative rites. The voluntary immolation (*suttee*) of the widow of the deceased, now abolished, was the most remarkable part of the ceremony. The Mohammedans bury their dead. The interment takes place as soon as possible, in obedience to the command of the prophet: "Make haste to bury the dead, that, if he have done well, he may go forthwith into blessedness; if evil, into hell-fire." No signs of excessive grief, no tears nor lamentations, are allowed, as it is the duty of a good Mussulman to acquiesce without a murmur in the will of God. On arriving at the burial place the body is committed to the earth with the face turned toward Mecca. Monuments are forbidden by the law, but they are constantly erected. The Egyptians, it is well known, embalmed their dead. Among the Jews the next of kin closed the eyes of the deceased; the corpse was then washed, and, in the case of persons of some consequence at any rate, laid for a time in spices or anointed with spices, swathed in linen bandages, and deposited in the tomb. The mourning customs of the Jews may be collected from various passages of the Scriptures. They went bareheaded and barefoot, covered their mouths and kept silence, put on sackcloth and sat in ashes; funeral songs were sung by persons hired for the purpose. Splendid monuments were sometimes hewn out of the solid rock, with numerous niches: as each niche was filled, its entrance was stopped up by a large stone rolled against it. In the religious creed of the Greeks and Romans sepulture was an act of piety to the dead; without it the spirit had to wander 100 years on the banks of the gloomy Styx. The last breath was generally caught by a near relative, who opened his mouth to receive it; the body was washed and crowned with flowers, a cake of flour and honey placed in the hand, as a bribe for Cerberus, and an obolus in the mouth, as a fee for Charon. Interment and burning were practised indifferently. In interment the body was placed with the face upward and the head toward the west. In burning the pile varied in form and material: it was lighted by the nearest relative; perfumes and wine were poured on it, and the richest clothes of the dead were burned with him. The ashes were then collected and deposited in an urn. This description applies to the Greeks and Romans, whose rites were nearly identical.

In the Roman Catholic Church the body is washed immediately after death, a crucifix is placed in the hands, and a vessel of holy-water at the feet, with which the visitants sprinkle it. The Ritual prescribes that the corpse be borne in procession from the house in which it lies to the church, attended by the parish priest with acolytes and servitors all in cassock and surplice, and one of them bearing the processional cross in the van. Before the procession moves, the priest first sprinkles the coffin with holy-water and recites the *De Profundis* and the *Miserere* while the procession is in movement. Taken into the church, the coffin is laid on trestles in the middle of the nave, the feet to the east or the sanctuary, if the deceased was a layman, the head to the sanctuary if he was a priest; lighted candles surround the coffin. Then follows the Office for the Dead, and after that the Mass for the Dead. After the Mass the priest, attended by the acolytes, pronounces the Absolution and certain prayers, meanwhile sprinkling the coffin with holy-water and fumigating it with frankincense. The procession is now reformed and the body borne to the place of burial. There the *Benedictus* is sung or recited, followed by the Antiphon, *Ego sum resurrectio et vita* ("I am the resurrection and the life"); the corpse is again sprinkled, a final prayer is pronounced, and the body is laid in the grave or tomb. In the funerals of children, the vestments of the clergy are white instead of black, joyous psalms are chanted or recited, there are antiphons of praise and thanksgiving instead of petitions for mercy and forgiveness; and the church bell is not tolled.

In the Greek Church there are distinct services for laymen, monks, and priests severally. The officiant holds a short service at the house of the defunct; service is held at the church, to which the body has been brought, and then at the grave, where the priest takes a shovel and sprinkles dust cross-wise on the body. Finally, before the grave is closed, he casts wax or ashes from his censer upon the coffin. The English Church, followed very closely by the Protestant Episcopal Church in the United States, uses the order for the Burial of the Dead in the Book of Common Prayer. It is a stately and somewhat elaborate service, which is frequently used in part by other Protestant bodies. The first section of the service is recited in church, to which the body has been brought, or at the house of the defunct. It consists of anthem, psalms and a lesson. The second section, sometimes called the committal, is recited at the grave, where dust is scattered on the coffin as it has been lowered.

Fungi, fŭn'jī (singular *Fungus,* Latin name for mushroom), the general name applied to a multitude of lower plants of quite diverse structure, but which agree in not containing chlorophyll, the green coloring matter of the vegetable kingdom. Formerly the fungi were regarded as constituting a natural group (class or order) of plants, but are now recognized by modern botanists as belonging to many natural groups of plants.

The peculiarities of fungi are physiological; they result from their food habits, and are not primarily structural and of profound significance. When we enumerate the physiological changes involved in the change of a plant from an independent life to one of parasitism or saprophytism, we have considered all of the essential differences between the fungi and the green plants from which they have been derived. We may say then, that a fungus is a lower plant which has suffered certain physiological changes on account of the fact that it has become parasitic or saprophytic.

Before going farther it is necessary to define certain terms which must be used in any discussion of the fungi. A plant is a *parasite* when it lives upon or in another living plant, absorbing food from it, and living at its expense. The mere fact of growing upon another plant does not make the first parasitic, for there are many small plants which merely find lodgment upon larger species, not, however, absorbing anything from the plants on which they are lodged. When it is necessary to distinguish such plants, they are called *epiphytes.* In the case of parasites the plant upon which they live is spoken of as the *host.* When a plant lives upon a plant which is no longer living, it is called a *saprophyte.* Thus the toadstools which grow so freely on manure and other decaying vegetable matter are saprophytes. It is sometimes necessary to have a term to apply to plants which are neither parasitic nor saprophytic, and then we use the word *holophyte.* Thus all common green plants are holophytes. When it is desired to contrast holophytes with both parasites and saprophytes, we can use the term *hysterophyte* for the parasitic and saprophytic plants.

Applying the terms we have now defined, we may say that all fungi are hysterophytes, some living parasitically upon their hosts, others living saprophytically.

All holophytes are green in color, and the significance of this is purely physiological. Green plants absorb the gas carbon dioxide, and in green cells this is combined with some of the elements in the ever-present moisture of the plant into a chemical compound allied to starch and sugar, and characterized by consisting of nearly equal amounts of carbon and oxygen, combined with nearly double the amount of hydrogen.

Such compounds are known as carbohydrates and they are made by all holophytes, and then used in the processes of assimilation and growth. It has been demonstrated that plants which are not green cannot make the carbohydrates, and since all plants need these compounds for building up their tissues, it follows that colorless plants must obtain them by taking them from living or dead green plants. Last, it should be borne in mind that even green plants cannot make the carbohydrates in darkness. For this work they need light and in fact the greatest importance of light to a plant is in connection with this process of making carbohydrates. Accordingly plants which are not green, and which as a consequence do not make carbohydrates, often grow in darkness or in feeble light. This is quite characteristic of the fungi, great numbers of which grow as well in darkness as in light, or in some cases grow even much better in the darkness than they do in the light.

The fungi are very numerous, some recent estimates placing the number of species as high as 250,000, of which not more than one third have as yet been described. They occur wherever there is organic matter of any kind upon which they can subsist. Wherever there are living plants or animals there are fungi which obtain food either from the living cells of their hosts, or the dead and cast-off cells and tissues. Some species occur in the lower layers of the air, in all exposed waters, and in the soil. They are the most numerous of living things when we consider individuals alone. They range in size from extremely small to many centimetres in length. The smallest are far too minute to be seen by the naked eye, some being visible only by the aid of the most powerful microscopes. Of some of the smallest species it would require 25,000 to 30,000 placed side by side to measure one inch. On the other hand there are toadstools a foot or so in height and diameter, and puff-balls two to three feet in diameter have been recorded.

The fungi as thus described are found in three of the grand divisions (branches) of the vegetable kingdom.

Branch Protophyta. The Protophytes.— Here are gathered a thousand or so species of microscopic aquatic plants in which the cells have a very low organization. No distinct nucleus is present, and the coloring matter in the typical plants pervades the whole cell, and is of a bluish or brownish-green color instead of a bright green as in higher plants. They reproduce by simple fission, and by the production of spores. There is no hint of any sexual reproductive process. They occur in ponds, pools and streams, to which they give a greenish color by their great numbers. In decaying they usually give off a fetid odor.

While the typical Protophytes are greenish — and are known as green slimes — many have become parasitic or saprophytic, and have lost their green color. These colorless species are known as Bacteria, and are the lowest of the fungi.

Bacteria (Fig. 1) are then to be regarded as colorless green slimes, their lack of color being due to their parasitic or saprophytic habits. Some species are minute rounded cells of remarkable minuteness. To these the generic name *Micrococcus* has been given, and many species have been recognized by botanists.

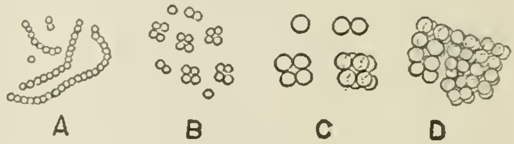


Fig. 1.— Bacteria. A, *Streptococcus pyogenes;* B, *Micracoccus tetragenus;* C D, *Sarcina lutea.* All highly magnified.

Other genera with spherical cells are *Streptococcus, Staphylococcus, Sarcina,* etc. Other bacteria consist of cylindrical cells which tend to adhere end to end in filaments or rods. In the genera *Bacillus* and *Bacterium* the rods are straight or little curved, and short or of moderate length, while in *Vibrio* and *Spirillum* the rods are more or less spirally curved. In still other genera, as *Crenothrix, Leptothrix,* etc., the rods are elongated. See Bacteria.

Branch Phycophyta. The Phycophytes.—These plants, of which there are probably nearly 10,000 species, may very properly be called the seaweeds, since they are typically aquatic, living in the salt and fresh waters of the earth. Typically they are bright green, and the cells of which they are composed have well-formed nuclei. However, the chlorophyll is confined to definite portions of the protoplasm, and is not diffused throughout the cell. Some of the lower species are spherical, rounded cells, but for the most part they consist of filaments of cylindrical cells, or in some instances they are masses of cells constituting leafy-stemmed plants. They reproduce by fission as in the Protophytes, but in addition all, or nearly all, Phycophytes reproduce sexually also. In the simplest cases of sexuality, two equal and similar cells detached from older plants fuse into a new and larger cell, and then this new cell grows into a new plant. Sometimes the new cell becomes covered with a

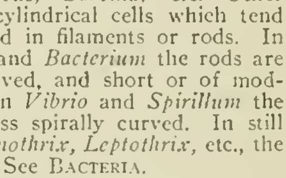


Fig. 2.— A, *Olpidium brassicæ,* one of the simplest of the fungi (*Synchytriaceæ*), parasitic in cells of a crucifer; B, three zoospores. Highly magnified.

1. Tasty Fungus (Lactarius deliciosus).
2. Morchelle (Morchella esculenta).
3. Yellow Cockscomb (Clavaria flava).
4. Early Toadstool (Helvella esculenta).
5. Cantarelle (Cantharellus ciberius).
6 Truffles (Tuber melanosporum .
7. Stubble Fungus (Hydnum repandum.).
8. Butterfly Fungus (Boletus granulatus).
9. Stone-Mushroom (Boletus edulis).
10. Masseron (Agaricus prunulus).
11. Parasol-Mushroom (Agaricus procerus).
12. Champignon, or Cultivated Mushroom Agaricus campestris)
13. Hooded Toadstool (Boletus scaber.

thick wall, and for a time ceases activity as a "resting spore," before it develops into a new plant.

While most Phycophytes are green plants, several hundred species have become parasitic or saprophytic in habit (Figs. 2 and 3) and have therefore lost their color, and become fungi. Among these are the following families, namely:

Fig. 4

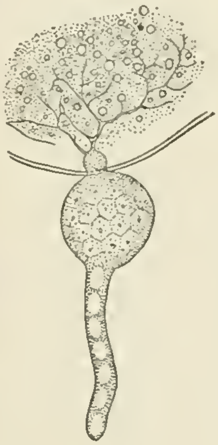


Fig. 3

Fig. 3.— *Rhizidiomyces apophysatus*, another of the lower fungi (*Chytridiaceæ*); the root-like organs are parasitic in a cell of a water mould. Highly magnified.

Fig. 4.— *Saprolegnia thureti*; A, fly with attacking filaments; B, end of a filament forming zoospores. C, zoospores escaping. A, natural size; B and C, highly magnified.

Water Moulds (*Saprolegniaceæ*) which are minute filamentous, colorless plants living in the water on living and dead plants and animals. (Fig 4.) Each plant is a more or less branched thread, some portion of which penetrates the host and thus obtains food, while the other part is external and bears the reproductive organs. The filaments are cylindrical, and are peculiar in having few cross partitions. They are to be regarded as composed of many cells which have not separated themselves by partitions. The nuclei are numerous, and very small.

The more common mode of reproduction is as follows: A terminal portion of a branch forms a partition at some distance from the extremity and the protoplasm in this segment becomes denser, and a little later divides into a great number of small cells, each of which remains naked (that is, no cell wall is formed around it), and soon escapes by a rupture of the end of the segment. (Fig. 4.) These escaped cells are known as zoospores, since they have a very active swimming motion, very like that of some of the lower microscopic animals. The similarity to the lower animals is shown still more by the identity in their locomotive organs, which consists of one or two slender protoplasmic whips (cilia) by whose rapid lashing the zoospores are propelled. After a short period of activity they come to rest, when they cover

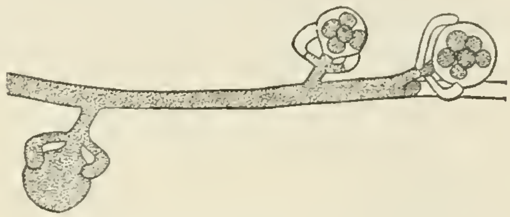


Fig. 5.— *Achlya racemosa*, showing antherids and oögones. Highly magnified.

themselves with a cell wall, and begin to elongate into a filament like that of the plant from which they came. Reproduction by means of zoospores is very rapid, since they are formed in such great numbers when conditions are favorable.

The sexual organs, which are rather rarely formed, consist first of an enlarged and rounded end segment in which the protoplasm is quite dense. From the sides of the branch below the end segment (or from elsewhere on the body of the plant) slender branches grow up and in turn their ends become cut off by cross partitions. (Fig. 5.) The first end segments (the rounded ones) are oögones, or in plainer words they are egg-organs, and in them one or more eggs are produced. The second segments (slender) are male organs called antherids, and the protoplasm they contain has the function of the spermatozoids of many plants (and animals). At the proper time the antherids puncture the egg-organs, and by the inflow of the contents of the former the eggs are fertilized. Later these eggs may germinate and produce new plants like those on which they were borne.

Downy Mildews (*Peronosporaceæ*) are much like the water moulds, but instead of being aquatic, they live in the tissues of land plants. Like the water moulds they are composed of branching, non-septate filaments. The main body of the plant grows in the intercellular spaces of the host, where there is nearly as much moisture as under aquatic conditions. (Fig. 6.)

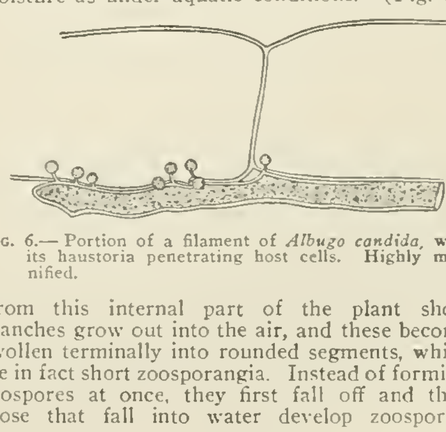


Fig. 6.— Portion of a filament of *Albugo candida*, with its haustoria penetrating host cells. Highly magnified.

From this internal part of the plant short branches grow out into the air, and these become swollen terminally into rounded segments, which are in fact short zoosporangia. Instead of forming zoospores at once, they first fall off and then those that fall into water develop zoospores, much as in the water moulds. As these structures are very minute, a droplet on a leaf is large enough for the germination of hundreds of the detached zoosporangia. Here again, the zoospores, after coming to rest, develop into new plants, which at once penetrate the host. In some species the zoosporangia grow at once into a filament, without forming zoospores.

The sexual organs of downy mildews are much like those of water moulds, the differences being quite immaterial for the present discussion. (Fig. 7.)

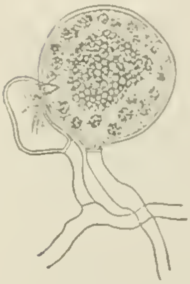


FIG. 7

FIG. 8

FIG. 7.— *Peronospora alsinearum*, showing antherid penetrating the egg-cell. Highly magnified.
FIG. 8.— *Mucor stolonifer*. Highly magnified.

It is evident from a comparison of the structure and reproductive organs of water moulds and downy mildews, that the latter are derived from the former. Just as the water moulds have been derived from the green plants of the green felt family (*Vaucheriaceæ*) by the adoption of parasitic and saprophytic habits, so by the change from strictly aquatic conditions to those found in the intercellular spaces of land plants, water moulds have been changed to downy mildews. Every difference between the two families may be accounted for by this difference in the environment of the plants.

Black Moulds (*Mucoraceæ*) show an additional modification of the water mould type. They are non-aquatic, mostly saprophytes, a few only being parasites. They live for the most part on dead organic matter, animal or vegetable, which is still moist, and but few species can live in the water. The commonest species live on the starchy and sugary substances in pantries, cellars, and other places where these substances are found in the presence of sufficient moisture. Organic substances which are dry are not attacked by black moulds.

Each black mould plant is a branching tubular filament, which has few cross partitions. One part of the plant usually grows in the substance of the organic matter, and another grows upward into the air. (Fig. 8.) The former absorbs food matter, while the latter bears reproductive organs, as in the water moulds. The ends of the aërial branches enlarge as in the two preceding families, but instead of forming zoospores, the protoplasm in the terminal segments forms many small spores, each covered with a cell wall. These spores are the homologues of the zoospores in previous families, but as the plants are not aquatic, these zoospores have ceased to be aquatic also. With a good cell wall to protect their protoplasm, they may be blown about in the air without drying up. It is in this way, in fact, that black moulds are propagated, the air currents carrying the spores sometimes for long distances, and when they fall upon organic matter under favorable conditions they quickly give rise to a new crop of mould plants. On the filaments which penetrate the nutrient substance, or grow over its surface, are to be found (rarely, however, in the common species) sexual organs somewhat resembling those of the two preceding families. (Fig. 9.)

Insect Fungi (*Entomophthoraceæ*) are somewhat similar to black moulds, but are parasitic in the body tissues of insects, and accordingly show considerable structural modifications. (See below.) Fig. 10.

Branch Carpophyta. The Carpophytes.— The plants which constitute this immense group are of much higher structure than those in the two preceding branches. They are still typically aquatic, and so are seaweeds, but this name is not as commonly applied to them as to the Phycophytes. The typical species are green plants, but in one group (the red seaweeds) the chlorophyll is hidden by a red or purple coloring matter. The plant-body is usually composed of an axis, on which are symmetrically arranged branches or leaves. The lower end of the axis is supplied with root-like organs by which it is attached to the soil or other support, and the plant commonly stands upright. Some species show a wonderful beauty of form and color, and on this account are greatly prized by amateur botanists, who collect and preserve them under the name of sea mosses.

All Carpophytes reproduce by two common methods. In the first, certain end cells separate from special branches, and float away to germinate and grow directly into plants like those from which they came. In the second method of reproduction an egg-organ, much like that of

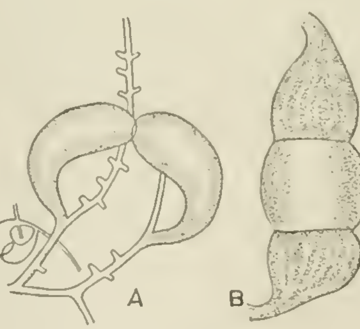


FIG. 9.— *Mucor fusiger;* A, young sexual organs; B, after fertilization. Highly magnified.

the Phycophytes, is fertilized by spermatozoids from an antherid which, again, does not differ in any essential respect from that of the Phycophytes. However, the result of the fertilization is the formation of a more or less compound body which the botanist recognizes as a primitive kind of "fruit." Hence, the aquatic Carpophytes are sometimes known as "Fruit Tangles." In these fruits are spores, and these on escaping and germinating give rise to new plants.

POISONOUS FUNGI

1. Golden Cantarelle (Cantharellus aurantiacus)
2. Puffball (Scleroderma aurantiacum)
3. Green Toadstool (Russula furcata)
4. Devil's Toadstool (Russula emetica)
5. Poisonous Toadstool (Lactarius terminosus)
6. Bulbous-leafed Mushroom (Agaricus phalloides)
7. Thickfoot (Boletes pachypus)
8. Satanic Fungus (Boletus satanas)
9. Antler-Fungus (Calocera viscosa)
10. Fly-Fungus (Agaricus muscarius)
11. Sulphur-Head (Agaricus fascicularis)
12. Witch-Fungus (Boletus luridus)

The chlorophyll-bearing Carpophytes comprise nearly 2,500 species, and are widely distributed in the salt and fresh waters of the globe. From these have sprung an enormous host of parasitic and saprophytic species, which are colorless, and constitute the great bulk of the fungi of the world, aggregating fully 100 times as many species as those from which they sprang.

In changing from the holophytic structure and habits of their ancestral types, these hysterophytes (fungi) have suffered much degeneration of the vegetative plant-body, while the reproductive apparatus has been relatively enlarged and multiplied. This is in accordance with the well-known law that since hysterophytes do not make carbohydrates they have little need of large vegetative bodies, and further, that since they are dependent upon particular hosts or organic matter for their food, they must provide more lavishly for propagation. Many of these fungi are little more than absorbing and reproducing organisms, the vegetative plant-body having almost entirely disappeared through disuse. These fungi are readily separable into two great classes, by characters derived from their reproductive apparatus. The first of these classes is known as the Sac Fungi, and the second as the Club Fungi.

Fig. 10

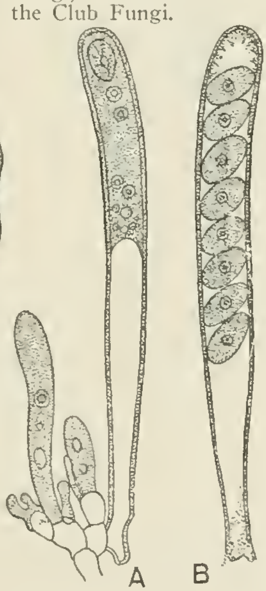


Fig. 11

Fig. 10.— *Empusa muscæ;* filaments from body of fly. Highly magnified.

Fig. 11.— A, several spore-sacs (*asci*) in different stages of development; B, a mature spore-sac. Highly magnified.

Sac Fungi (*Class Ascomycetæ*).— The distinguishing mark of the plants of this class is that the spores which occur in their fruits develop in certain end cells and remain enclosed within the cell wall until matured. (Fig. 11.) These spore-containing cells have been aptly likened to sacs (Latin, *asci;* singular, *ascus*) and from this we derive the name of the class.

There are more species of sac fungi than of all other kinds. They range in size from very minute to many inches in extent. They include some of the most harmfully parasitic plants as well as many which live saprophytically upon refuse organic matter. Among the many families (more than 40) in this class, the following may be noticed:

Powdery Mildews (*Erysiphaceæ*) are to be regarded as primitive sac fungi, but little removed from their aquatic ancestors. The plant body consists of branching filaments which creep over the surfaces of their hosts, from which they obtain food by means of root-like absorbing organs, which penetrate the host cells. Certain branches form spores by the simple process of separating their terminal cells in succession and this is done so abundantly that the spores form powdery masses on the surface of the hosts. These spores float away on wind currents, and those that germinate on similar hosts give rise to new plants.

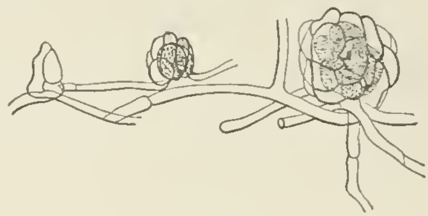


Fig. 12

Fig. 12.— Sexual organs of *Erysiphe* and formation of fruit. Highly magnified.

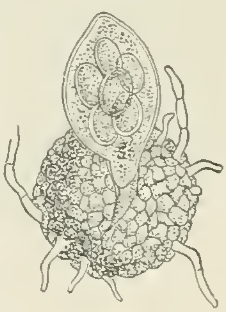


Fig. 13

Fig. 13.— Mature fruit of powdery mildew, with escaping spore-sac. Highly magnified.

The sexual organs (egg-cells and antherids) occur on the creeping filaments, and are short lateral branches, the former somewhat thicker than the slender antherids. (Fig. 12.) The two come in contact with one another, and the protoplasmic contents of the antherid pass into the egg-cell fertilizing it. As a result the egg-cell sends out one or more branches, the end cells of which develop into *asci,* while from below the egg-cell there grows up a cellular, globular covering, constituting the outer wall of the fruit, and enclosing the *asci.* The spores in the *asci* when set free by the rupture of fruit and *ascus* walls, germinate and on similar hosts give rise to new plants. These fruits are usually blackish and may be seen by the naked eye as minute globular bodies on the mass of filaments. (Fig. 13.)

Truffles (*Tuberaceæ*) are evidently related to the powdery mildews, but their life history is not so well known. They are saprophytic, living on the decaying organic matter in the soil in forests. Little is known as to their early life, and the formation of their non-sexual spores, but these are thought to be somewhat like those of the powdery mildews. Their fruits are formed under ground, and may be compared to a mass of compound fruits of the powdery mildews. The sexual organs, which probably precede the development of the fruits, have not yet been discovered. The fruits of the common truffles of Europe are from one to two inches in diameter, and warty and dark colored externally. (Fig. 14.) Internally they consist of a soft, whitish tissue, in which are numerous cavities, each containing several *asci*. Practically nothing is known as to their propagation. A few little known species occur in America, but in Europe they are common. See TRUFFLE.

Black Fungi (*Sphæriaceæ*) are typically parasites which grow in the tissues of higher plants, and whose small black fruits are formed on the surface of the host. Here again we are evidently dealing with plants related to the powdery mildews, but with an increased parasitism. They are known to form non-sexual spores much as in the powdery mildews. Their fruits also resemble the fruits of the powdery mildews, and probably result from a fertilization, but thus far the sexual organs have evaded discovery. (Fig. 15.)

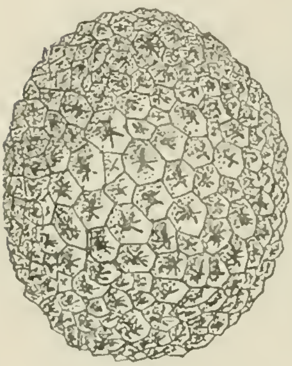


FIG. 14

FIG. 15

FIG. 14.— Truffle; fruit, natural size.
FIG. 15.— *Nectria cinnabarina;* A, bark with enlarged fruits; B, spore-sacs. Highly magnified.

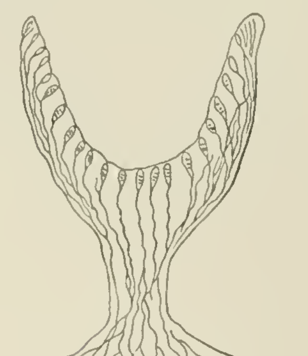


FIG. 16.— Diagrammatic vertical section of a cup fungus.

Cup Fungi (*Pezizaceæ*) are typically saprophytes (Figs. 16 and 17), growing in the tissues of decaying plants, as rotten logs, sticks, etc. In these fungi the plant is filamentous and grows through the decaying tissues as slender white, branching, threads. Non-sexual spores resembling those of the powdery mildews are known for some species. Sexual organs, consisting of a globular egg-cell, and a slender antherid, are found on

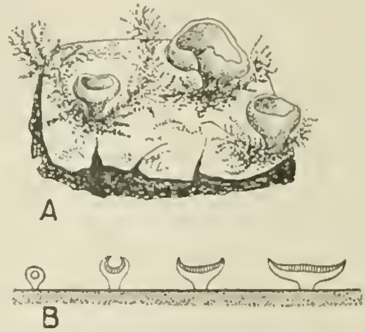


FIG. 17.— *Humaria rutilans;* A, three fruits, natural size; B, vertical sections of fruits of different ages.

the creeping filaments. (Fig. 19.) Fertilization takes place as in powdery mildews, with a similar result, the fruits, however, being at length cup-shaped instead of globular. In many species the fruits (Fig. 17) are globular when young, but as they mature they open out into cup-shaped structures (Fig. 17), in the con-

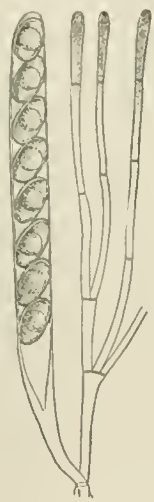


FIG. 18

FIG. 19

FIG. 18.— *Humaria rutilans;* spore-sac, and three paraphyses. Highly magnified.
FIG. 19.— Egg-cells and antherids of a cup fungus. Highly magnified.

cave surface of which are found many *asci* (Fig. 18.) It will readily be seen that were these cup-fruits to remain closed, their structure would be closely similar to that of the fruits of the powdery mildews. However, the fruits of the cup fungi are often of considerable size, sometimes being as large as an inch or more in diameter.

Lichens (see article LICHENS) are now regarded as nearly related to the cup fungi and black fungi. (Fig. 20.) In all essentials they agree with those fungi, but they are usually treated separately on account of the peculiar parasitism and

FUNGI.—MUSHROOMS AND THEIR AFFINITIES.

Fig. 1 Vertical Section through Fungus. 2 Under surface of Pileus or Cap. 3 Reproductive Organs. 4 Amadou or German Tinder. 5 Edible Cantharellus. 6 Common Mushroom. 7 Smaller Fasciculate Agaric. 8 Sweet-smelling Hydnum. 9 Imperial Mushroom. 10 Goat's beard or Yellow Clavaria. 11 Fly-blown Mushroom. 12 Socket Peziza. 13 Bell-shaped Bird's-nest. 14 Dry-rot Fungus. 15 Umbellate Polyporus. 16 Hypoxylon polymorphum. 17 Longitudinal Section of do. 18 Truffle. 19 Delicious Agaric. 20 Edible Boletus. 21 Edible Helvella. 22 Round-headed Morel. 23 Latticed Stinkhorn. 24 Warty Puff-ball. 25, 26 Hysterium of the Ash. 27–29 Brown Pulvinate Sphæria.

symbiosis which they exhibit. There are several families of the lichen-forming fungi, aggregating between 2,500 and 3,000 species.

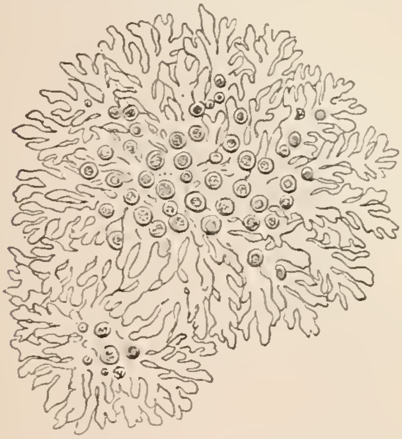


FIG. 20.— *Physcia stellaris*, a common lichen. Natural size.

Yeasts (*Saccharomycetaceæ*) are here briefly referred to in order to call attention to the excessive degradation which they have suffered. Although they consist of single cells, or short chains, they are now regarded as greatly reduced sac fungi. They grow in the watery solutions of sugars, starches, and other carbohydrates, and one result of their activity is the formation of alcohol, while at the same time carbon dioxide is set free. It is for the alcohol that yeasts are used in breweries and distilleries, and it is for the escaping carbon dioxide gas that they are used in the making of bread. See YEAST.

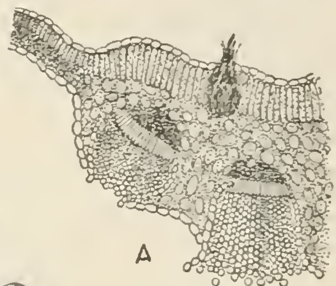
Rusts (*Uredinaceæ*) are minute plants, parasitic in the tissues of higher plants. (Fig 21.)

FIG. 21.— *Puccinia caricis*, a common rust on sedges.

They consist of branching filaments which grow through and live upon the host tissues. Certain branches cluster together and form rows of spores by terminal abstriction (*æcidiospores*) (Fig. 22 A) and later others form single terminal spores (*uredospores*) (Fig. 22 B), and still later other branches form one, two, or several thick walled spores in terminal *asci* (*teleutospores*). (Fig. 22 B.) These all begin within the host tissues, but they eventually break through the epidermis into the air. Lastly, when the teleutospores germinate each produces a short filament (promycelium) on which four minute spores (*sporidia*) develop. There are thus four kinds of spores in a typical rust plant, and these have been taken to characterize as many stages in the plant's life history, namely: 1. Cluster-cup stage (*æcidiospores*); 2. Red Rust (*uredospores*); 3. Black Rust (*teleutospores*); 4. Promycelium (*sporidia*). In most rusts these stages occur on the same host in the order given, but in some the first stage occurs on one host, and the remaining stages on another. The latter is the case with a rust of wheat, in which the cluster-cups occur on Barberry leaves, and the æcidiospores then germinate upon and infect the leaves of the wheat, on which the red rust, black rust and promycelium then follow in succession. No sexual organs have as yet been discovered, but analogy would suggest that they are to be looked for before the development of the teleutospores.

In this account the rusts are considered to be reduced sac fungi, of the cup fungus type, the degeneration being due to their excessive parasitism.

Smuts (*Ustilaginaceæ*) are still more parasitic than the rusts, and as a consequence have suf-



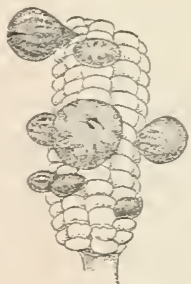


FIG. 23.— Portion of an ear of maize with eight of its kernels attacked by *Ustilago maydis*.

FIG. 22.— *Puccinia graminis*, a common rust of wheat. A, Cluster-cup stag on Barberry leaf; B, three uredospores and one teleutospore from a leaf of wheat. Magnified.

fered still greater degeneration. (Fig. 23.) They grow wholly within their hosts, and do not even bring their spores to the surface. They consist of branching filaments which penetrate the tissues of their hosts, and at last form spores homologous with the teleutospores of the rusts. The latter in germinating produce sporidia. Comparing the rusts with the smuts we note that while there are four stages in the former, there are but two in the latter, the first and second having apparently disappeared.

Imperfect Fungi.—At this point should be mentioned the so-called imperfect fungi, an immense aggregation of many thousand species (12,000 or more) of which we know but one stage (apparently the first) and so are unable to assign them to their proper place in the system. They are minute and mostly parasitic plants, occurring in the tissues of higher plants, and sending their spore-bearing branches out into the air. Some plants formerly placed here have been found to be early stages of certain sac fungi (black fungi, or their relatives) and it is suspected that most, if not all, of them will eventually be so disposed. At present they are grouped under three general kinds, as follows:

Spot Fungi (*Sphæropsideæ*), which produce whitish or discolored spots, and later develop closed, spheroidal cases, containing free spores. *Septoria* and *Phyllosticta* are common genera.

Black-dot Fungi (*Melanconieæ*) are like the spot fungi, but there are no spore cases, the spores developing in masses beneath the epidermis which they eventually rupture. *Gloeosporium* is a common genus.

Moulds (*Hyphomyceteæ*) produce their spores on branches which grow out through the stomata of the host. Here we find the parasitic species of *Ramularia*, *Cercospora*, etc., and the mostly saprophytic species of *Monilia*, *Botrytis*, etc.

Club Fungi (*Class Basidiomyceteæ*).— The distinguishing mark of the club fungi (often spoken of as the higher fungi) is that the spores which develop in certain end cells in their fruits do not remain inside of these cells, but push out into the ends of terminal or lateral protuberances and so come to appear to be external. (Fig. 24.)

Fig. 24.— Spore-clubs in different stages of development; A, when very young; B, with the spore-branches beginning to form at the summit; C, showing the spore-branches with nearly mature spores at their ends. All highly magnified.

These club-shaped, spore-bearing cells are technically known as *basidia* (singular, *basidium*), whence the scientific name of the class. The spore-clubs (*basidia*) of this class are regarded in this discussion as the homologues of the spore-sacs (*asci*) of the preceding class.

Between 10,000 and 12,000 species of fungi of this class are known. Many attain to considerable dimensions, especially their fruits. They are typically saprophytic, but it is now known that many of them are more or less parasitic, also, when the opportunity offers.

About 10 families are commonly recognized, four of which, only, will be noticed here.

Puff-balls (*Lycoperdaceæ*) are saprophytes whose branching filaments penetrate decaying wood or earth rich in organic matter, and finally produce globular fruits which rise above the surface. (Fig. 25.) These fruits are filled with tortuous canals whose walls are studded with spore-clubs (basidia) on which the spores are produced. At maturity the interior tissues of the fruits deliquesce, setting free the spores, which escape into the air a little later as a dusty cloud, by the rupture of the fruit-wall. From these spores new plants are produced, but we do not know the whole life history of these common fungi. Although the sexual organs should precede the formation of the fruits, they have not yet been observed

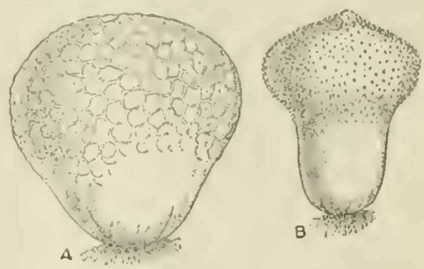


Fig. 25.— Two species of puff-balls; A, *Lycoperdon cœlatum;* B, *Lycoperdon gemmatum.*

Stink-horns (*Phallaceæ*) are closely related to the puff-balls, which they closely resemble in all stages excepting the last. Here the spore-bearing portion of the globular fruit is confined to a vertical, circular layer of tissue about midway between the centre and the circumference. At maturity the spore-bearing tissues deliquesce and at the same time the tissues below rapidly elongate, bursting the fruit-wall and carrying up the spores into the air. (Fig. 26.) These fruits

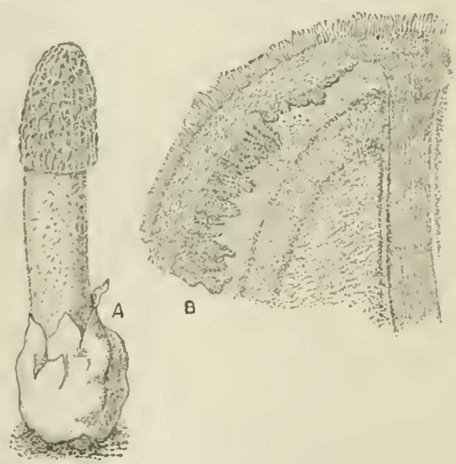


Fig. 26.— A, a stink-horn (*Ithyphallus impudicus*) after the rupture of the volva; B, highly magnified section of the spore-bearing layer.

have very bad odors, which attract insects, and it is thought that these help to distribute the spores. Stink-horns are from an inch or two to six or more inches in height, and grow commonly in lawns and pastures, where their presence is indicated by their intolerable odor.

Toadstools (*Agaricaceæ*) are fungi of the puff-ball kind, consisting of white, branching filaments which creep through the nutrient substance or the host tissues. Most species are saprophytes, but some are parasites. When the fruits are young they resemble those of puff-balls, but as they grow older a circular layer of spore-bearing tissue develops, and this, by the rapid growth of lower lying tissues, is carried up on a stalk, very much as is done in the stink-horns. (Fig. 27.) Here, however, the stalk is

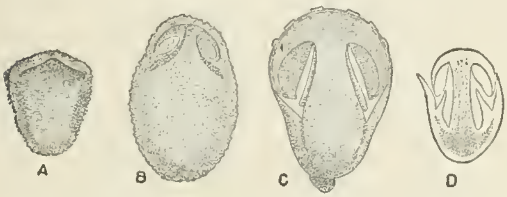


FIG. 27.— Development of a toadstool (*Amanita muscaria*) shown in vertical section. A, very young stage; B and C, later stages; D, after the bursting of the volva.

formed earlier, and the spores are usually developed after the rupture of the fruit-wall.

A typical toadstool fruit has the following structure: There is first at the bottom the cup-shaped remnant of the original fruit-wall (technically, the *volva*); from this rises the cylindrical stem (*stipe*), terminating in an expanded cap (*pileus*). The stem and cap together resemble on expanded umbrella, or a one-legged stool (Fig. 28), from which latter fact the common name "toadstool" was doubtless suggested. The lower surface of the cap is folded into many vertical radiating plates, called gills (*lamellæ*), and these are studded with the spore-clubs, bearing the spores. This gill portion corresponds to the circular spore-bearing layer of the stink-horns, and the gills themselves are to be regarded as devices for increasing the number of spores, by an enlargement of the surface studded with spore-clubs.

FIG. 28.— Two fruits of *Armillaria mellea* attached to the filamentous plant; several young fruits at the left. Considerably reduced.

While in typical toadstools the cap is rounded and centrally attached to the stem, in some species its growth is not uniform, and the stalk is excentric, or even lateral. Lastly, let it be remembered that the toadstool which we see is not the plant itself (that is below the surface) but it is the fruit of the plant which develops in order that it may produce spores.

Pore Fungi (*Polyporaceæ*) are so named because the spore-bearing structure on the under side of the cap of the fruit consists of a mass of small vertical pores, instead of plates, and by this character they may be readily recognized. In typical pore fungi the general structure and development are similar to those of the toadstools, the change from gills to pores being the only important difference. Here, however, many of the species instead of growing into regular umbrella-shaped fruits, have the stalk more or less laterally placed. In others, again, the lateral stalk is very short, and from this the step is a very short one to its complete suppression, when the cap is sessile marginally, as in the bracket fungi, which are so common on decaying logs and other forms of timber.

Some pore fungi are fleshy, but for the most part they are hard and tough, often resisting

FIG. 29.— *Agaricus campestris*, the cultivated mushroom, showing several stages of development.

decay for many years. Some of the species are perennial, adding successive layers of pore tissue to their fruits for some years.

ECONOMIC RELATIONS OF FUNGI.

The economic relations of the fungi are of great importance. Some are edible, and furnish wholesome food to man and other animals, some are used in the arts, some yield medicines, some are the cause of disease in man and other animals, and some again attack and destroy other plants, including many of the cultivated plants of our farms and gardens.

Edible Fungi.—Here perhaps we should include those bacteria which have to do with the flavor of butter and cheese, and those moulds whose presence in cheese adds to its edibility. Of far greater importance, however, are those species which are eaten for the nutriment which they contain. Truffles are collected in Europe, and sold in the markets. Dogs and pigs are trained to search for them, the attendant bagging the truffle when found by the keen scent of the animal. The Morels are sac fungi related closely to the cup fungi; each Morel (fruit) is a hollow-stalked body two to five inches high, with a crinkled and pitted conical cap in whose surface are imbedded the spore-sacs. They grow in fields and thickets, and when fresh are wholesome. Morels are often called mushrooms, although this name should be restricted to the next group.

Mushrooms (Fig. 29) are of the toadstool kind, and popularly any species which is edible is called a mushroom, while those which are poisonous are called toadstools. Many species are collected from the forests and fields by experts who have learned to distinguish them from the poisonous ones, but by far the most commonly used species is the common mushroom (*Agaricus campestris*) which is cultivated by gardeners for this purpose. See MUSHROOMS.

Medicinal Fungi. — The most important species is the Ergot (*Claviceps purpurea*), one of the sac fungi, which is parasitic in the heads of rye.

Pathogenic Fungi (on Animals).—Many bacteria are the direct cause of diseases of animals, including man. See BACTERIA.

Some of the water moulds cause a serious disease of fishes, especially of young fishes in "hatcheries." Occasionally an epidemic, known as the "Salmon Disease," has been known to occur in the streams of Great Britain. Investigation has shown it to be due to a certain species of water mould.

The insect fungi (*Entomophthoraceæ*) annually destroy immense numbers of flies, locusts, caterpillar larvæ, etc. The common house fly is attacked by *Empusa muscæ* in summer and autumn. Every infected insect fastens itself by means of its tongue to some object, and soon perishes miserably, its body walls being pierced by innumerable spore-bearing branches. In the autumn myriads of locusts ("grasshoppers") are destroyed by *Empusa grylli*. When attacked by the fungus the locust climbs a grass or weed stem around which it finally clasps its legs and dies firmly attached. Many other insects, including mosquitoes, are destroyed by these beneficial fungi. Thus far all attempts to artificially apply these fungi in combating insects have been unsuccessful.

Pathogenic Fungi (on Plants). See DISEASES OF PLANTS.

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University of Nebraska.

Fungicides, fŭn'jĭ-sīd, any agent used to prevent the growth of fungi or their spores. The most important uses of fungicides are in agriculture and horticulture for controlling the fungi that attack crops. These may be divided into two general classes: (1) Fungi which burrow among the tissues of the host plants and expose little more than their fruiting organs to the air. (2) Fungi which expose almost all of their vegetative parts to the air, only the holdfast, absorbing organs (*haustoria*) entering the tissues of the host. From the nature of their growth it is easily seen that members of the second group may be attacked at any time, but that since the vegetative parts of members of the first group are protected by the tissues of the host they cannot be reached effectively by any fungicide without injuring the host. Controlling agencies in such cases must therefore be preventive.

For the control of the exposed fungi the chief agent is sulphur in out-door practice, applied as a powder, which is dusted upon the foliage, preferably with a powder gun. In the greenhouse it is more frequently evaporated, by strewing powdered sulphur upon the heating pipes or upon burlap suspended in warm parts of the greenhouse. This is a slow way, and is mainly preventive. When a considerable quantity must be evaporated in a short time the sulphur is gently heated over an oil stove. It is imperative that the sulphur be kept from igniting, because the fumes are destructive to host as well as fungus. For cleansing a greenhouse of objectionable fungi when the plants are out, the sulphur may be burned and all reachable parts sprayed liberally with Bordeaux mixture.

Various compounds of copper are used as preventives of the attacks of internal feeding fungi and as remedies for the exposed. Chief of these salts is copper sulphate, which may be applied in a pure solution only to dormant wood, walls, etc. It is used at the rate of one pound to the gallon, and will, at this strength, destroy lichens and algæ as well as fungi. For use upon foliage and other actively growing parts it must be mixed with some substance which will counteract its causticity. Lime is most frequently used, and the compound is called Bordeaux mixture from the French city where its usefulness was accidentally discovered about 1882. It is made as follows: A known number of pounds of copper sulphate are dissolved in an equal number of gallons of water, contained in a wooden tank or barrel, the salt being suspended at the surface of the water to ensure quick solution. In another receptacle a known number of pounds of lime, as free from magnesium as possible, are slaked with a little water, and when slaking is complete, enough more water is added to make the proportion one pound of lime to a gallon of water. When needed for use six gallons of the copper sulphate solution and four or five of the lime solution are separately diluted with enough water to make a combined total of 50 gallons. The two diluted solutions are then thoroughly mixed, and afterward tested with ferrocyanide of potash to make sure that there is no uncombined copper sulphate. A brownish discoloration indicates that more lime must be added to neutralize the free copper salt. The mixture is then ready for general use, but for peaches, plums, cherries, and some other plants, another 25 gallons of water must be added because of the susceptibility of the foliage to injury. The stock solution of copper may be kept for weeks, but the lime solution should stand for only a few days and the completed mixture for only a few hours, because the particles tend to flocculate and settle, a process which impairs the usefulness of the mixture.

Copper sulphate is often used as *eau celeste*, a solution of one pound of the salt to two gallons of water plus three half-pints of standard ammonia, and then diluted with water to make 25 gallons. Since the strength of the ammonia varies, this solution often burns the foliage, there being insufficient ammonia to neutralize the free copper sulphate. This fungicide and ammoniacal solution of copper carbonate are used when a non-staining solution is needed, as in spraying ornamental plants and fruit which is nearing maturity. The latter solution is made by dissolving one ounce of copper carbonate in one pint of ammonia and mixing with 10 gallons of water.

The seeds of various cereals are often dipped in hot water formalin solution and copper sulphate solution to destroy fungous spores, and hot water is also used to some extent for destroying exposed fungi, spores, etc.

All solutions must be applied as a mist-like spray, to ensure which a nozzle with a small aperture is essential. The first application to fruit trees should be before the buds begin to swell. This may be a stronger solution than those used after growth starts. The second should be given when the buds begin to swell, the third when the blossoms have fallen. No spray should be given during the blossoming period.

Consult: Lodeman, 'The Spraying of Plants' (1890); Prillieu, 'Maladie des plantes agricoles' (1895); Massee, 'Text-book of Plant Diseases' (New York 1899); various bulletins of the United States Department of Agriculture and of many of the State Agricultural Experiment Stations.

Fungus, fŭn'gŭs. See FUNGI.

Fungus-eaters. The fungi enter largely into the food of the lower animals, and somewhat into the fare of the higher forms. The moulds, slimes, and various aquatic forms are devoured by echinoderms and mollusks, both bivalves and univalves, who take in the minute floating forms, or their spores, or eat the fixed growths from stones and other resting places, and by vegetable-eating fishes and crustacea. Pond-snails will keep the glass sides of an aquarium clean of vegetable growths, a large part of which is fungoid. Worms, slugs, and insects in great variety feed upon the vast array of fungi not aquatic. Beetles are especially fond of the larger forms — the toadstools and tree-borne polypores. A large Javan beetle, known from its shape as the "fiddle-beetle" (*Mormolyce phylloides*), spends its life within and about certain fungi growing on tree-trunks. A whole family of small flies (*Mycetophilidæ*) breed in fungi, including the cultivated mushroom, beds of which are often largely damaged by the work of their maggots bred there; hence the group is termed "fungus-gnats." In the United States the woodland toadstools are eagerly fed upon when ripe in August and September, not only by great numbers of insects, slugs and snails, but by salamanders, tortoises (especially), and by all sorts of squirrels; but they seem to be rarely if ever eaten by birds. For the edibility of fungi by man, see MUSHROOM.

Fungus-gnat. See FUNGUS-EATERS; GNATS.

Funk, fŭnk, **Isaac Kauffman**, American publisher: b. Clifton, Ohio, 10 Sept. 1839. He was graduated at Wittenberg College, Ohio, and after several pastorates, the last of which was in Brooklyn, N. Y., began a publishing business in 1872; founded and published the 'Metropolitan Pulpit' (now the 'Homiletic Review') in 1876, and the 'Literary Digest' in 1890. He has published also the 'Standard Dictionary' of which he was editor-in-chief (1890–4). He is an earnest Prohibitionist, and in 1884 founded the 'Voice,' a prohibition journal, and has been the Prohibition candidate for mayor of New York. In 1901 he began the publication of the important 'Jewish Encyclopedia.'

Funnel-marks, painted designs on the funnels of ocean steamships to designate the ownership of the vessel. American line steamships are thus designated by a black funnel, white band, with black top; Anchor line, black funnel; Cunard line, red funnel, with black rings and black top; French line, red funnel with black top; White Star line, cream funnel with black top; Wilson line, red with black top; North German Lloyd line, cream funnel; Red Star, black funnel, white band, black top; Netherlands line, black, with white band and green borders; Hamburg-American line, buff for express steamers, black for regular steamers; Scandinavian-American line, yellow, with white band and blue star, and black top; Bristol line, black, white band in centre, blue star in centre of white band.

Funston, Frederick, American military officer: b. New Carlisle, Ohio, 9 Nov. 1865. He was educated at the State University, Kansas, and was a commissioner of the Department of Agriculture to explore Alaska 1893–4. He served in the insurgent army in Cuba in 1896–7, and, receiving in 1898 a commission as colonel of the Twentieth Kansas Volunteers, went to the Philippines, where he became brigadier-general of volunteers the next year. In March 1901, he commanded an expedition which succeeded in capturing the Filipino leader, Aguinaldo, and was appointed brigadier-general in the United States army in the same month.

Fur-bearing Animals. In the broader sense any animal which yields a pelt used in the preparation of marketable furs. In a narrower, more zoological sense, the term is restricted to that family of carnivora, the *Mustelidæ*, which contains the weasels, martens, sables, badgers, skunks, wolverines, otters, and sea-otters. The family is not a large one, but is of great economic importance, and many of its genera and species are of very wide distribution, mostly in northern regions. Two groups, the Arctic sea-otter and the skunks, are exclusively American. All are small animals; fierce, and voracious, living in burrows, or holes in trees or rocks, and active in winter. They belong in the arctoid division of carnivores, are most nearly related on the one hand to the bears and on the other to the dogs. For further particulars see FUR-TRADE; and the names of prominent species, as: BADGER; FERRET; MARTEN; OTTER; POLECAT; SABLE; SEA-OTTER; SKUNK; WEASEL; WOLVERINE; etc. Consult: Elliott Coues, 'North American Mustelidæ' (Washington 1877).

Fur Seal, the fur-bear or northern fur-seal (*Otaria*, or *Callorhinus, ursina*), whose pelts form the seal-skins of commerce. (See FUR TRADE.) There is also a southern fur-seal (*O. nigrescens*), dwelling along the southern coast of South America. See SEAL.

Fur Trade, The. The history of the fur trade is so closely interwoven with the early history of America that it is extremely difficult to narrate one without reference to the other. Among all the industries that helped to make this country one of the great commercial nations of the world there was none that exerted such an important influence upon the early prosperity of the colonies as that which was represented by those who took the pelts of animals and prepared them for manufacture into various articles for the use of mankind. It was the rich peltries of North America that were the magnet that attracted the hardy French and British adventurers to the shores of the new world, and it was their brawn that blazed the trail through the wilderness that the more timid agriculturalist might have the courage to follow in their footsteps. In the early days of this country's history it was the hunter and the trapper who explored the unknown regions. To obtain the furs that represented one of the great sources of wealth in the new country they journeyed into the most distant and inaccessible parts of the land, and that they might have havens of safety in which to store their pelts, and, incidentally, rest secure from the attack of savage foe, they established the small settlements, so many of which have since grown into prosperous communities. It was the fur trader, therefore, who was the real pioneer in North America. Always in advance of civilization, his labors in leading the way for the settlement of the country provided a means of advancement that would have been much delayed if it had not been for these preparatory efforts. The Canadian provinces, for example, owed practically all their primary prosperity to their fur trade. In those days there were no mines to stimulate the immigration into that country, and the French pioneers who first made it their home soon discovered that there could be no more profitable source of income than that which was afforded by the possibility of trading in furs, for in Canada, as throughout the English colonies further south, the native Indians were so ignorant of the value of the pelts which they gathered that they were willing to dispose of them upon terms that permitted an enormous profit to the successful trader in such articles.

During the early days in the history of the fur industry in North America there was practically no limit to the percentage of profit that could be made in buying furs. To become a successful trader in pelts the one thing that was necessary was to import a large quantity of cheap and practically worthless trinkets from Europe. For these the Indians would exchange the most valuable peltries without hesitation. In fact, the conditions under which the fur trade with the natives was conducted soon became such a serious scandal that reformatory measures were absolutely necessary, the better class of traders becoming unwilling to sanction the unmitigated dishonesty and unbridled licentiousness of the class of men who were known as *coureurs des bois*, or rangers of the woods. It was to suppress this class that the licensing system was introduced, and, although this too soon became subject to abuse, for a time at least it tended to free the traffic from its most scandalous conditions.

It was during these early days that the feuds between the British merchants of New York and the Canadian traders became a serious factor in the industry. There can be little doubt that the former set out deliberately to encroach upon the business of the fur interests of Canada, and the trouble regarding the infringement of territorial rights had become a most serious situation when the Hudson's Bay Company was formed, in 1670. This company, which was chartered by Charles II., had the exclusive privilege of planting trading stations on the shores of Hudson Bay, and all its tributaries, and when, about a century later, France lost possession of her Canadian colonies, the Britons assumed almost exclusive control over the great fur trade of America. Prior to the beginning of the 19th century this trade was chiefly monopolized by the powerful trading companies.

First in the field, of course, was the Dutch East India Company, with its prosperous trading-posts at New Amsterdam (now New York), Beaverwyck (now Albany), as well as at several points on the Delaware and on the Maine coast. Next came the extensive Hudson Bay Company, which practically monopolized the trade in furs for 200 years, or until the Northwestern Company entered the field and established a somewhat successful rivalry, although its efforts were confined almost entirely to the Pacific coast.

It was in 1808 that John Jacob Astor formed the American Fur Company, establishing a line of trading-posts that extended across the continent, with a depot for furs at the mouth of the Columbia river, from which point he intended to ship direct to China and India. The name of the concern was afterwards changed to the Pacific Fur Company, and Mr. Astor saw his enterprise on the high road to success, when, in 1813, he was treacherously sold out to the Northwest Company by his resident partner, the latter claiming that, as the United States was then at war with Great Britain, the British soldiers would have taken the establishment by force if he had not made other disposition of it. After this incident, Mr. Astor confined his operations to the district east of the Rocky Mountains, where he, with his partner and successor, Ramsay Crooks, transacted a profitable business in furs for many years. The Russian-American Fur Company, which had its main trading post at Sitka, Alaska, with many subordinate posts on the Yukon, carried on an immense traffic in such lines until 1867, when all its rights and properties were transferred to the United States with the purchase of Alaska.

It was somewhat prior to 1809 that John Jacob Astor conceived his great project to make the American fur trade independent of the Hudson's Bay Company. As his scheme was partly based upon the fact that such an enterprise would have a strong tendency to spread the civilization of the East into the far western country, he asked the aid of Congress in carrying it into execution. Briefly described, Mr. Astor's idea was to establish a connected chain of trading posts from the Great Lakes to the Pacific Ocean, with a central depot for packing and shipment at the mouth of the Columbia river; to acquire one of the Sandwich Islands as a provision station, and to establish a line of vessels to sail from the west coast of North America to the most important ports in India and China. Washington Irving, in his "Astoria," presents a graphic description of this gigantic enterprise which met with such a strange disaster when Astoria, the town founded at the mouth of the Columbia river in 1811, was so unnecessarily abandoned during the War of 1812. The balance of Mr. Astor's career, however, was quite as remarkable. Year after year his fur business was extended until its operations surpassed those of any house that had hitherto been established. In addition to its immense American business a gigantic export trade was carried on with many countries, and, when the founder of the company died, he left a fortune that was estimated at $20,000,000. William Backhouse Astor, his son, was interested with him in the fur trade, and when, in 1827, the house of John Jacob Astor & Son was merged in the American Fur Company, he became its president.

The first great establishment founded in St. Louis — one of the principal depots of the fur trade from the middle of the 18th century until 1859 — was that of Laclede, Maxon & Company, in 1763. In the early days of this house the brothers Auguste and Pierre Chouteau were connected with it, and the establishment, which was extremely successful, employed a large number of trappers and voyageurs. In 1808, the Chouteau brothers and a number of their associates in the older firm, withdrew to form the Missouri Fur Company. This prospered until about 1813, when, because of the war with Great Britain, it was dissolved. During the next few years several of its members transacted business independently, but, in 1827, the Rocky Mountain Fur Company of St. Louis was formed to send trappers to the Pacific coast. At this time the perils of the work were so great that fully 40 out of every 100 persons employed in it perished, and yet the life of adventures offered so many fascinations that there was no lack of hardy men eager to take the places of the slain. After several years of varying success the company was dissolved. In 1834, however, Pierre Chouteau, Jr., who had been educated in the fur trade by his father, organized the house of Pierre Chouteau, Jr. & Company, a firm name which was practically a household word among hunters and trappers from the Mississippi and the Lakes to the Pacific during the next 25 years. In 1859, the business was sold to Martin Bates and Francis Bates of St. Louis and New York.

The year 1859 saw the American fur trade more widely diffused than ever before. The passage of the industry into the hands of individuals had commenced to be apparent as early as 1821, and while, by the middle of the century the aggregate amount collected each year was much greater than it had been 40 years previously, the opportunities for making great fortunes in the trade had gone. A writer in 'Silliman's Journal' (1834) gives an interesting description of the situation of the fur trade at that time. He says:

"The Northwest Company did not long enjoy the sway they had acquired over the trading regions of the Columbia. A competition, ruinous in its expenses, which had long existed between them and the Hudson's Bay Company ended in their downfall and the ruin of most of the partners. The relict of the company became merged in the rival association, and the whole business was conducted under the name of the Hudson's Bay Company. This coalition took place in 1821. Almost all the American furs which do not belong to the Hudson's Bay Company find their way to New York and are either distributed thence for home consumption or sent to foreign markets. The Hudson's Bay Company ship their furs from their factories of York Fort and from Moose River, on Hudson Bay; their collection from Grand River, etc., they ship from Canada; and the collection from Canada goes to London. None of their furs come to the United States, except through the Indian market. The export trade of furs from the United States is chiefly to London. A quantity of beaver, otter, etc., is brought annually from Santa Fe. Dressed furs for edgings, linings, caps, muffs, etc., such as squirrel, genet, fitchskins, and blue rabbit, are received from the north of Europe; also cony and hare's fur; but the largest importations are from London, where is concentrated nearly the whole of the North American fur trade."

It was as early as 1834 that those who were interested in this industry began to fear that the American fur trade had commenced to decline and, even at that time, it was quite freely predicted that its downfall would be rapid. By this period there were practically no new lands to be explored. The hunters and trappers in the employ of the great fur trading companies had gone everywhere and had slaughtered so indiscriminately that it seemed almost impossible that the fur-bearing animals should not be exterminated. While in some few cases this prediction has been proved to be only too true in a majority of instances the fear has been shown to be without foundation, for many of the fur-bearing animals, especially the small mammals, actually increased in number. They seemed to thrive better in the neighborhood of small settlements, where they were able to feed upon the farmers' crops. Some of the larger species, like the bear or the beaver, were much reduced in number, although even they did not meet so sad a fate as that of the buffalo, which has now been reduced to a few herds which are being cared for in southern Canada and in the Yellowstone Park. Up to 1875 these animals existed in countless herds on the western plains, where they were of incalculable value, to the Indian as well as to the white man, not only on account of the fact that their skins represented one of the most important commodities in the fur trade, but for the reason that they supplied both the white adventurer and the Red-skin native with food and clothing. Soon after 1870, however, the popular demand for this fur became so great that it is estimated that not less than 4,500,000 of these animals were recklessly killed, merely for the sake of their hides, between the years 1871 and 1874, and it is this ruthless extinction of the buffalo that is responsible for the conditions which now compel the United States Government to supply the Indians with regular meat rations. Of the millions of buffaloes that roamed the plain before the fur companies commenced their campaign of slaughter only a few hundred still remain, and they are so safely guarded that it is hoped that the species may be preserved from absolute extinction.

The table on following page presents a list of the principal fur animals of America, with such descriptive facts concerning them as can be tabulated, and the uses to which their skins are applied.

Among all these fur-bearing creatures the seal is of paramount interest to the trade owing partly to the great demand for such skins and partly to the efforts that are being made to prevent this valuable mammal from following the buffalo into comparative oblivion. There are many varieties of seals, but the four which are most extensively used by the trade are the Alaskan, Victoria or Northwest coast, Copper Island, and Lobos Island. Of these the most extensive fishery is the Alaskan. It was a material element in determining the value of the Alaskan province when it was purchased from Russia at a heavy cost by the United States, and it was one of the principal inducements upon which the purchase was made. That those who engineered the purchase of this territory were not mistaken in their valuation of the seal fisheries has been shown by the fact

PRINCIPAL AMERICAN FUR ANIMALS.

Common name	Scientific name	Habitat	Color	Uses
Beaver	Castor fibre.......	N. America, N. Europe, Asia	Chestnut brown..	Muffs, trimmings, robes.
Silver fox...	Canis vulpes......	Northern latitudes..........	Silver gray......	Muffs, trimmings, boas, robes.
Cross fox....	Canis vulpes......	Northern latitudes..........	Silver gray......	Muffs, trimmings, boas, robes.
Red fox.....	Canis vulpes......	Northern latitudes..........	Red	Muffs, trimmings, boas, robes.
Arctic fox...	Canis vulpes......	Northern latitudes..........	White	Muffs, trimmings, boas, robes.
Blue fox.....	Canis vulpes......	Alaska, Greenland..........	Slate or purple..	Muffs, trimmings, boas, robes.
Gray fox.....	Canis vulpes......	Virgina	Gray	Muffs, trimmings, boas, robes.
Raccoon	Procyon lotor.....	N. America................	Grayish yellow...	Robes, rugs, gloves.
Wolverine ...	Gulo luscus.......	N. America, Europe, Asia..	Dark brown.....	Robes, muffs, trimmings.
Fisher	Mustela pennanti..	N. America................	Dark brown.....	Muffs, boas.
Mink	Mustela vison.....	High latitudes..............	Dark brown.....	Muffs, boas, capes.
Lynx	Felis Canadensis...	N. America, Europe........	Silver gray......	Robes, muffs, boas, collars.
Wildcat	Felis rufa.........	N. America................	Yellowish brown.	Robes.
Skunk	Mephitis mephitica.	N. America................	White and black.	Muffs, collars
Black bear...	Ursus Americanus.	Northern latitudes..........	Black	Rugs, robes.
Cin'am'n bear	Ursus cinnamonum	Northern latitudes..........	Dark brown.....	Rugs, robes.
Grizzly bear..	Ursus ferox........	Northern latitudes..........	Brown	Rugs, robes.
Polar bear...	Ursus maritimus...	High latitudes..............	White	Rugs, robes.
Isabella bear.	....	Northern latitudes..........	....	Ladies' goods.
Badger	Taxidea Americana	N. W. America............	Sandy gray......	Painters' brushes, muffs, boas.
Sea-otter	Enhydris lutris....	N. Pacific.................	Dark brown.....	Coats, muffs, collars, caps.
Otter	Lutra Canadensis..	N. America, Europe........	Chestnut	Muffs, collars.
Fur-seal	Callorhinus ursinus	Alaska, Shetland...........	Yellowish gray...	Mantles, cloaks.
American wolf	Lupus Occidentalis.	N. America................	Black, gray, white	Robes, rugs.
Prairie-wolf .	Lupus latrans.....	N. America................	Dark gray.......	Robes, rugs.
Panther	Felis concolor.....	All America................	Light dun.......	Robes, rugs.
Musk-ox	Ovibos moschatus..	Upper Canada.............	Dark brown.....	Sleigh-robes.
Buffalo	Bison Americanus.	N. W. America............	Drab brown.....	Robes, coats.
Marten	Mustela Canadensis	N. America................	Light brown.....	Coat lining, capes.

that since Alaska became the property of the United States this industry has afforded a very considerable source of revenue to the Government through the lease of the seal fishing privileges, while the furtherance of this industry has not only engaged a large amount of American capital but has provided employment for a large number of American people.

From the early part of the 19th century until 1862 the seal fisheries were leased by the Russian Government to the Russian-American Company, a corporation composed of several wealthy Siberian merchants, but when the United States assumed control of the Alaskan territory these rights reverted to this Government. Even at this early date the question of the possible extinction of the seal had been seriously agitated, and it was not long after American acquisition of the territory that Congress passed a law forbidding the killing of seal upon the islands of St. Paul and St. George except during the months of June, July, September, and October. The laws further prohibited the killing of females, or males under one year of age, and it forbade the use of firearms; the taking of seal in adjacent waters, or on places where they were accustomed to haul up to remain, and limited for a term of twenty years the number to be killed on these islands to 100,000 annually, reserving the right to further restrict the number if at any time it appeared necessary or advisable to do so in order to prevent the serious reduction of the species.

The Alaskan Commercial Company obtained its lease of the seal fisheries in 1870. It continued for a term of 20 years, and gave the corporation the right to take seal, under the regular Government restrictions, in return for a rental of $50,000 per annum, and a further tax of $2 for each seal thus taken. The headquarters of this corporation were in San Francisco, John F. Miller, afterwards senator from California, being its first president. He was soon succeeded by Lewis Gerstle, one of the original stockholders, and the affairs of the company were principally directed by Messrs. Gerstle, Sloss, Niebaum, and Neumann on the Pacific coast, by Mr. Hutchinson at Washington, and by Sir Curtis Lampson (since deceased) at London. As the Government became pretty well persuaded that the amount of revenue received from the fur-seal fisheries had not corresponded with the number of seals taken, the lease was not renewed, but instead, when it expired, 1 May 1890, a lease was granted to the North American Commercial Company for the ensuing twenty years. This lease, which expires 1 May 1910, gave them the exclusive right to take seals in Alaskan territory for an annual rental of $60,000 and a tax of $2 per head upon all seals taken, and an additional bonus of $7.62½ on each skin. Even under such new conditions matters did not turn out satisfactorily, however, and the United States Government finally brought suit against the North American Commercial Company to recover $214,293.37, a sum alleged to be due on the company's contract since April, 1895. The case was fought through the lower courts and was finally settled in the Supreme Court of the United States. This suit has been regarded as one of the utmost importance and is reported in full in the 171 U. S. p. 137. The action, as brought by the Government, was to recover the annual rental of $60,000, as well as the tax and the bonus on each skin. The court found that there was no abatement on account of the tax or bonus, but held that the rental should be reduced in proportion as the whole number of skins allowed to be taken in any one year bore to the maximum allowed by law. As the result, instead of paying a stipulated rental of $60,000 per year, the North American Commercial Company now pays a fixed rental of 60 cents for each skin taken, which, with the tax and bonus, makes a total payment to the Government of $10.22½ per skin taken and shipped.

During the past few years the Government has restricted the lessees of the seal fisheries to a limited catch per year. The following table shows the maximum limit of seals allowed to be killed and the total number taken and shipped from 1859 to 1905 inclusive:

RESTRICTION AND SHIPMENT OF FUR SEALS.

Year	Allowed to be killed	Shipped
1895	15,000	15,000
1896	30,000	19,200
1897	20,000	16,818
1898	30,000	18,032
1899	30,000	16,812
1900	30,000	22,470
1901	30,000	22,672
1902	30,000	22,368
1903	30,000	19,292
1904	15,000	13,128
1905	15,000	14,368

In fact, as the matter now stands, the Government annually fixes a maximum and minimum number of seals that may be killed, and before the opening of the season the approximate number to be taken is fixed upon by the agent stationed at the Alaska fisheries.

The first seals to arrive at the Pribylov Islands each season are the bulls, each one of which immediately proceeds to locate the "homestead" that he and his future harem are to occupy. This "homestead" is about 10 feet square, and, as there is considerable space to be filled, the competition in the beginning — from the 1st to the 5th of May — is not very great. A few days later, however, the breeding grounds become so crowded that late comers find no place to locate their "homestead," with the result that the most terrific combats ensue, some of which are attended with mutilation if not, as is quite frequently the case, by death. The bulls who do not succeed in obtaining a place, or who are unable to oust others from their stronghold, are compelled to live apart from their companions. They are mainly old bulls who have been weakened by age, or young bulls, less than five years of age. The "whites" call them "bachelor seals," while the Aleuts know them as "holluschickie," and they usually number from one-third to one-half of the entire herd.

It is from these bachelor seals that the lessees of the islands are permitted to take the skins that are shipped in batches of 200 to 300 casks to London that they may be sold at auction, the great fur sales being held in that city. Each cask contains from 40 to 45 skins, which are rolled up separately, tied with cord, and packed in salt.

Nearly all the vessels that are employed in the seal fishery are the property of Canadians, but are manned by Indians, the latter making the most successful hunters, and their operations are conducted as follows: When a herd is discovered the natives launch their canoe and steal cautiously towards it. If the animals are asleep, every effort is made to approach them without waking them, for, in that manner, they may easily be speared, when they are almost invariably captured, whereas, when they are shot, they are so liable to sink to the bottom before the canoes can reach them that many valuable skins are lost.

The Victoria seals are captured at an earlier date than the Alaskan seals, and they are chiefly females and old bulls. The Copper Island seals are taken on "Copper Island," one of the islands of the Aleutian group, which is still the property of Russia. Their fur is inferior to Alaskan seal, however, in spite of the fact that it is generally believed that it is the same animal but taken at a different season of the year. It is lighter in color, being of a dark brown hue, and is generally inferior in quality. At the same time from 40,000 to 50,000 of these skins are taken annually.

According to the decision of the Bering Sea Court of Arbitration, announced at Paris, 15 August 1893, a close season was established to begin 1 May and to continue until 31 July, these restrictions to apply both in the north Pacific Ocean and in Bering Sea. A protected zone was also established extending for 60 miles around the islands, Pelagic sealing being allowed in Bering Sea, outside that zone, from 1 August. The use of firearms in sealing was forbidden.

In spite of all the precautionary measures that were adopted it is generally conceded that the Paris Court of Arbitration was a failure, at least so far as the prevention of the extinction of the seals was concerned. In 1901, Governor Sheakley, in a report submitted to the secretary of the interior, insisted that the extinction of the fur-bearing animals in Alaska was almost inevitable. Speaking of the rapidly diminishing seals, he said that the official inspection of skins taken by the pelagic sealers during the previous year showed anywhere from 55 to 80 per cent of female skins, a condition which merely confirmed previous investigations upon that subject, and he explained that so long as buckshot was being picked from the hides of young males killed in the Pribylov Islands, and maimed and wounded seals still limped about the hauling grounds, to say nothing of the fact that female skins predominated in the pelagic catches that arrived in London, it was unnecessary to make any further investigation as to the cause of the demolition of the seals. In his opinion, there was nothing that could be done at the islands to better the situation, for the rehabilitation of the rookeries would be an easy matter if adequate protection could be afforded the females. In 1902, Henry W. Elliott, the Government's fur expert, sounded a similar warning by assuring the Government that better protection was needed than that which was afforded by the finding of the Paris tribunal, and, about two years later, 9 March 1904, he again appeared before Congress to announce that his worst fears were about to be realized as the killings on the islands had run down to the very dregs of the young male life which the law permitted to be killed. In his 1905 report the secretary of commerce and labor considered this subject quite fully, and recommended that strong efforts be made to secure the necessary international regulations to put a stop to pelagic sealing. It was also shown by figures that, as the result of this wanton destruction of seal life, the herd on the Pribylov Islands had been reduced from approximately 2,000,000 animals in 1885, to about

200,000 in 1905, while the ravages of these pelagic sealers had reduced the number of skins taken from 100,000 in 1885, to less than 15,000 during 1905.

It is not for seal-skins alone that the American fur trade is indebted to Alaska, however, for that territory helps to supply the world with many other pelts including those of the sea and land otter, the brown and black bear, the beaver, fox, mink, marten, lynx, wolf, muskrat, and wolverine. An industry pursued incidentally with that of sealing on the Pribylov Islands is that of raising the blue fox for its pelt. This foxing industry, which is conducted by the agents of the lessee, permits of the killing of the fox under proper restrictions, the catch during the winter of 1904 amounting in all the islands to 289 blue fox skins and 13 white fox skins. Efforts have also been made by the agents of the department of commerce and labor, by the careful selection of the best animals for breeders and an insistance upon an adequate quantity of fox food to be furnished by the lessee, to induce an increased birth rate among these animals. What makes this experiment particularly interesting is that the proceeds from the sale of these skins are applied to the support of the native inhabitants of the islands, their services being required in the taking and curing of all kinds of pelts.

The manufacturing of skins into articles of commerce is not only an industry in itself but one that requires considerable knowledge and experience, as both the durability and the appearance of most furs depend much upon the mode in which they are cured, dried, and made up. To prepare most skins for packing and transportation — after they have been stripped from the animal — they are first carefully cleaned of fat and flesh, and are then dried in a cool, dry place. When thoroughly dry they are ready for shipment. This methid, of course, does not apply to the seal-skin, the manner of packing them in salt having already been described.

To present anything like definite figures regarding the consumption of furs is an extremely difficult matter as the demand for the many varieties vary from year to year owing to the fickleness of fashion. It is also due to fashion's foibles that some of the animals having the most beautiful skins are not exterminated, for when the demand for a certain variety of fur ceases for a season or two, with it ceases the destruction of the animals, which leaves them a period of safety in which they may recover their normal status as to numbers.

The American fur industry, like most other business and professions, is divided into departments and few firms now carry on all the branches of the business, as it was formerly done, under one roof. The taxidermist, for example, has one of the collateral branches of the fur trade. The manufacturing furriers and fur dealers represent an enormous investment of capital, especially those who are large exporters and importers of furs, for, in spite of the fact that London and Leipsic still have a firm hold upon the international trade, there are many fur houses in this country that conduct constantly increasing operations with the foreign markets owing to the superiority of American manufactures in furs. In addition to these, however, there are many other branches that are more or less directly connected with the fur industry. Among them one may mention the manufacturers of hats and caps, jobbers of furs, dealers in hatters' furs, proprietors of skunk and other fur farms, fur sewing machine houses, and firms making machinery and materials for the use of furriers, such as muff-blocks, head-forms, skulls, and down muff-beds. According to the 1900 census the aggregate number of establishments handling fur goods in the United States was placed at 994, but these firms paid $5,315,584 in wages to 9,709 employees. The cost of materials used during the census year amounted to $15,742,508, while the value of the product manufactured, including the receipts for custom work and repairing, amounted to more than $27,735,264. The total domestic exports of furs and fur skins during the year 1905, amounted to $6,599,222, while the imports of furs and fur skins, undressed, during 1905, were $10,502,907 The following table gives the value of the imports and exports of furs and the manufacturers of furs in this country from 1880 to 1905, inclusive:

FURS AND MANUFACTURES OF FURS.

Year	Imports	Exports
1880	$ 6,424,112	$5,404,418
1885	5,257,547	4,153,287
1890	7,553,816	4,661,034
1891	9,828,849	3,236,705
1892	10,197,131	3,586,339
1893	10,567,807	3,699,579
1894	7,620,284	4,238,600
1895	10,322,157	3,923,130
1896	9,303,398	3,800,168
1897	6,015,104	3,284,349
1898	7,881,172	2,986,970
1899	10,861,262	3,092,846
1900	12,060,124	4,503,968
1901	11,019,658	4,404,448
1902	15,623,601	5,030,204
1903	15,301,912	6,181,115
1904	14,763,002	5,422,945
1905	18,306,302	6,599,222

Furies, Eumenides, or Erinyes, called by the Romans FURIÆ and DIRÆ, were Greek mythological divinities, the avengers of murder, perjury, and filial ingratitude. They sprang from the drops of blood which fell from Uranus when he was mutilated by his son Kronos or Saturn. Others make them the daughters of Acheron and Night, and of Pluto and Proserpine. Later mythologists reckon three of them, and call them Alecto the unresting, Megæra the jealous, and Tisiphone the avenger. They were supposed to be the ministers of the gods, and to execute their irrevocable decrees; their sphere of action consequently was both in the infernal regions, to punish condemned souls, and on the earth to rack the guilty conscience and chastise by mental torments. Æschylus, in the celebrated tragedy of the Eumenides, introduced 50 furies, and with them Horror, Terror, Paleness, Rage, and Death, upon the stage. These terrible beings were described as clothed in black robes, with serpents instead of hair, with fingers like claws, a whip of scorpions in one hand and a burning torch in the other, an outstretched tongue, and eyes dripping with gore. They were suckers of the blood of men; when they were enraged, a venom oozed from them that spread like a leprosy-spot wherever it fell, and made the ground barren. They were regarded with great dread, and the Athenians hardly dared to speak their names, but called them the *venerable goddesses*, by a similar euphemism the name Eumenides, signifying the soothed or well-pleased goddesses, being introduced. They dwelt in the cave called after them, at the northeast corner of the Areopagus at Athens, below the seats of the judges. Erinyes, the more ancient name, signifies the hunters or persecutors of the criminal, or the angry goddesses. The sculptors represented them as beautiful hunting nymphs, whose character was indicated only by the sternness of their expression, by the torch, dagger, and other similar emblems.

Furman University, a coeducational institution in Greenville, S. C.; founded in 1854 under the auspices of the Baptist Church. Reported in 1905: Professors and instructors, 12; students, 204; volumes in the library, 4,000; productive funds, $90,000; grounds and buildings valued at $80,000; benefactions, $20,000; income, about $40,000; president, E. M. Poteat, D.D., LL.D.

Furnace, a structure wherein a vehement fire and heat may be made and maintained, as for melting ores or metals, heating the boiler of a steam-engine, warming a house, baking pottery or bread, and other such purposes. Furnaces are constructed in a great variety of ways, according to the different purposes to which they are applied. In constructing furnaces the following objects are kept in view: (1) To obtain the greatest quantity of heat from a given quantity of fuel. (See FUEL.) (2) To prevent the dissipation of the heat after it is produced. (3) To concentrate the heat and direct it as much as possible to the substances to be acted on. (4) To be able to regulate at pleasure the necessary degree of heat (see HEAT) and have it wholly under the operator's management. An air furnace is one in which the flames are urged only by the natural draught; a blast furnace, one in which the heat is intensified by the injection of a strong current of air by artificial means; a reverbatory furnace, one in which the flames in passing to the chimney are thrown down by a low-arched roof on the objects which it is intended to expose to their action.

Those furnaces in which gaseous fuel is burned form a class of considerable importance. The gas to be consumed and the air to be used in the combustion are introduced into the combustion-chamber by separate pipes or openings, preferably in parallel streams near to each other, or in opposite directions along one channel so as to mingle before entering the chamber. The fuel may be either some naturally occurring gas, or one specially manufactured for the purpose, or the by-product of some other industrial process, for example, the waste gases of the blast furnace. Four methods of preparing fuel gases are distinguished: dry distillation, as in the case of coal-gas; preparation from oils; the producer method; and the water-gas method. Producer-gas was first introduced by Siemens. Regenerators are furnaces in which the gaseous fuel and the air to be mixed with it are heated before combustion with a view to increasing the working temperature of the furnace. The advantages of gas furnaces may be briefly summarized thus: no ashes or slag, high temperature, certainty of action and capability of exact regulation, simplification of working power, comparative cheapness, and economy. The electric current has been successfully utilized in the production of heat for chemical and metallurgical operations, and in this way temperatures otherwise unattainable have been reached. See ELECTRIC FURNACE; GAS; GAS, NATURAL.

Furnaces, Electric. See ELECTRIC FURNACES.

Furnaces, Metallurgical. See METALLURGY.

Furneaux (fėr nō') **Islands,** a group in the South Pacific off Tasmania, to which colony they belong. The total area is about 1,050 square miles. The principal islands are Flinders, Cape Barren, and Clarke. The inhabitants number about 700, and earn their livelihood by seal-fishing, the capture of sea-fowl, etc. The islands were discovered in 1773 by Tobias Furneaux (q.v.).

Fur'ness, Horace Howard, American Shakespearian scholar and editor; son of William Henry Furness (1802-96) (q.v.): b. Philadelphia 2 Nov. 1833. He was graduated at Harvard in 1854; studied law, and was admitted to the bar in 1859. The honorary degree of Ph.D. was conferred on him by the University of Göttingen in recognition of his services to Shakespearian literature. He is the editor of the exhaustive 'New Variorum Edition' of Shakespeare, the successive volumes of which appearing since 1871, include: 'Romeo and Juliet' (1871); 'Macbeth' (1873); 'Hamlet' (2 vols. 1877); 'Lear' (1880); 'Othello' (1886); 'Merchant of Venice' (1888); 'As You Like It' (1890); 'Tempest' (1892); 'Midsummer Night's Dream' (1895); 'Winter's Tale' (1898); 'Twelfth Night' (1901).

Furness, William Henry, American clergyman and author: b. Boston, Mass., 20 April 1802; d. Philadelphia 30 Jan. 1896. He was educated at Harvard; studied theology at Cambridge, Mass., and was pastor of the First Unitarian Church in Philadelphia in 1825-75. He was an earnest supporter of the anti-slavery movement and was a German scholar of eminence, translating much from the German in both prose and verse. He was a radical in his religious views but made a life study of the character of Jesus, which forms the theme of several of his works. Among his numerous works are: 'Remarks on the Four Gospels' (1836); 'Jesus and His Biographers' (183); 'A History of Jesus' (1850); 'Thoughts on the Life and Character of Jesus of Nazareth' (1859); 'The Veil Partly Lifted' (1864); 'Jesus' (1871); 'Verses and Translations from the German Poets' (1886); 'Pastoral Offices' (1893).

Furness, William Henry, 1828–67, American artist, son of the preceding: b. Philadelphia, Pa., 21 May 1828; d. Cambridge, Mass., 4 March 1867. He very early made a reputation by the excellence of his crayon portraits, and having earned from the sale of these the means for foreign travel, studied art in Europe for two years. On his return to America he established himself as a portrait painter in Philadelphia, and subsequently in Boston, and at the time of his death was one of the foremost portrait painters in the country. Among noted portraits by him are those of his father, Dr. Furness; Charles Sumner, and Lucretia Mott.

Furness, William Henry, 1866, American ethnologist: b. Wallingford, Pa., 1866. He is a son of H. H. Furness (q.v.), and was educated at Harvard and the medical school of the University of Pennsylvania. He has published: 'Folk-Lore in Borneo' (1899); 'Life in the Luchu Islands' (1899); 'Home Life of the Borneo Head Hunters: its Festivals and Folk-Lore' (1902).

Furnishing Goods. See CLOTHING AND FURNISHING TRADE.

Furniture, formerly all the various movable appliances or articles in the interior of a house, now more commonly applied to articles of wood or metal. The ancient Egyptians aimed to variety rather than symmetry in the arrangement of their houses. They had chairs made of the finest woods in great variety of design, covered with rich cloths or skins, and inlaid with gold or ivory. They also used folding stools, sofas, couches, and carpets or rugs. Their tables were of variety of shapes and constructions. Bedsteads were made of wickerwork and sometimes of bronze. The forms of household articles of furniture found in or represented on Assyrian monuments and remains, show great artistic elaboration and a profusion of highly wrought ornament. The Assyrians were especially skilful in the chasing of metals, and they delighted in reproducing natural objects on their ornaments. The Greeks had couches covered with skins or drapery, on which several persons might lie with their bodies half raised; these were used at meal times by the men only, women and children sitting on seats; they had large armchairs with footstools, portable small chairs without arms, and stools with carved legs made to fold up.

Among the Romans, Greek art gained a predominant influence, and the conquerors of the world were at all times glad to employ natives of Greece to design and execute the works intended to display the opulence of their masters. On the ornaments of the *triclinia* or couches on which they repose, immense sums were bestowed. They were often inlaid with precious materials, such as ivory, tortoise shell, gold and silver, and had ivory or metal feet. They consisted of a framework which was strung with girths, on which rested a mattress stuffed with straw, wool, or feathers, and covered with rich drapery. The *lectus cubicularis*, or bed, was higher than the couch, but not unlike it. The tables were generally of costly foreign wood, resting on frames of carved marble or an ivory column. The curule chairs, or seats of state of the patricians and magistrates, were wrought in ivory; and to form an estimate from the number of beautiful utensils in marble and bronze richly chased and inlaid with silver, that have been found in the ruins of a comparatively insignificant city, Pompeii, the wealth of the Romans in movable property of this nature must have been very great. The library first appears as a separate apartment in a Roman house; that discovered at Herculaneum was small, and lined with presses about the height of a man, in which the rolls of papyrus and parchment were kept. Still, according to modern ideas, the Roman rooms would seem rather bare of furniture. They had no writing tables or cabinets; couches, chairs, tables, and candelabra comprised the whole of the furniture with the exception now and then of a water clock, or a chafing dish.

Among European states from 500 A.D. to 1500, the ecclesiastical style prevailed in furniture as in every other species of art, attaining its greatest eminence in the decorated Gothic of the 14th century. Articles of furniture previous to 1500 are very rare. For three centuries after the Conquest domestic furniture was very scanty. The hall was furnished with tables and benches, the furniture of a bedroom consisted of little more than a bed and a chest. Chairs were large and cumbrous, and were usually fixtures; wooden forms, sometimes with black rails, being placed against the walls. The furniture of the dining-room was very limited. Boards on trestles were in general use as tables. In the 14th and 15th centuries remarkable progress was made and a considerable degree of splendor in furniture was attained. Defense began to be not the only object studied in the construction of buildings. The Gothic paneling of the carved bedsteads, chairs, screens, etc., was dazzling with scarlet, blue, and gold, and costly embroidered hangings and curtains heavy with heraldic symbolism, cabinets, reading-desks, prie-dieus, ivory and enameled coffers, fire dogs, or andirons elaborately chased and gilded, began to appear.

The progress of this decorative style was suddenly arrested by the "Renaissance," or revival of ancient classical art and literature, of which Italy was the earliest seat, and from whence the impulse was given that communicated itself speedily to the rest of Europe. A genuine and self-evolved style instantly went out of fashion, and was discarded for an imitation and counterfeit one based on the copying of understood classic models which were applied without consideration to the most incongruous objects. The classical temple was the dominant idea in the manufacture of furniture as well as in the construction of a palace or a cathedral, and columns were considered as necessary in one species of art as in the other. All the architectural details of Roman buildings were then applied to furniture; the lions, griffins, chimeras, etc., of the temple frieze encumbered the stately pillars of the Italian palaces, and caryatides and Roman trophies replaced the patron saint and the crucifix. With all its absurdities, it must be noted that this style was in the hands of great men, and their productions display a boldness and vigor of line, and a mastery over human and animal forms that give dignity to a licentious freedom of design in which all appropriateness is forgotten. Specimens of the Renaissance are still met with, though daily increasing in value. Gothic art never recovered its lost ground.

With various modifications the Renaissance style continued dominant for nearly two centuries. In England it degenerated into positive ugliness, the furniture of the time of Elizabeth and James I. having very little to recommend it in tasteful design. It is distinguished by a mixture of overwrought heavy molding, combined with thin spindly columns, twisted legs, and other inelegant characteristics. Magnificence is sometimes attempted in the value of the material, as in the famous set of chamber furniture in chased silver executed for a royal visit at Knowle Park, the seat of the dukes of Dorset in Kent. It was succeeded by the style named after the French monarch, its patron and encourager, Louis XIV.

The modern predominance of France in the construction of furniture is owing to the minister Colbert. He it was who brought together the best workmen of Europe, and by an edict of the year 1667 established the French royal manufactory of furniture. The new style which the productions of this establishment assumed appears to have been worked out undesignedly, and, like every such successful phase of art, was the genuine product of circumstances. Novelty and magnificence seem to have been the great features aimed at; these were sought by varied treatment of surface in cabinet furniture (as inlays of metals, ivory, enamels, porcelain tablets, tortoise shell, etc.), and by an incrustation of broken scroll panel work, which hid the real constructive forms and frittered away the graceful outlines of the Renaissance into a confused and unsymmetrical mass. Under Louis XV. the same school of art continued, and it received new elaboration under the successors of Boule, Riesner, and Gouthier; their works are known to connoisseurs as articles of vertu by the respective styles of each master, and fine specimens bring almost fabulous prices. Probably more of this class of furniture is to be found in Great Britain than in all the rest of Europe, a great change of owners having been brought about by the French Revolution. While the splendid extravagances of Louis XIV. were holding sway in France, the prevailing taste in England seems rather to have been modified by the fashion introduced from Holland by William III. The native woods, oak or wainscot, chestnut, etc., were about this time superseded for furniture by the dark and heavy West India mahogany, the invariable material of the ill-designed and awkward furniture familiar to us in the immortal designs of Hogarth. A better style based on that of France was introduced by Chippendale, but a severer and more artistic taste was displayed by the designs of Heppelwhite and Sheraton. In the latter part of the reign of Louis XVI. another change is apparent in French furniture. Greece and Rome were looked up to as standards of correctness in furniture as well as in politics. But instead of impressing their own genius on designs inspired by ancient models as did the great artists of the Renaissance, the authors of this revival were too often content with frigid imitation. The classical style did not long hold sway, and since that time the practice of both France and England (and with them the rest of Europe) has been purely eclectic. At present designs after the best work of the older makers are much in favor in both Europe and America. See FURNITURE INDUSTRY IN AMERICA, THE.

Furniture, Colonial. When the Colonists first landed, and during their early struggle for existence, little if any attempt was made to import furniture, and we have nothing now which could be rightfully claimed to have been brought over from Europe before the coming of the Mayflower (1620). The New Englanders were the first to make furniture copying the designs of the original pieces, which were of heavy oak with severe lines and flat carvings. Their puritanical minds apparently abhorred anything of an ecclesiastical cast. As early as 1650 the southern planters imported fine pieces from England, of oak richly carved and inlaid, the designs being influenced by the Renaissance just dawning in France, and the Elizabethan and Jacobean periods in England. The authorities in the South tried to prevent trade with Holland and New England, so a comparison of the English furniture, prior to the Revolutionary War, with that of Maryland and Virginia, shows that the English life of that time was planted there as far as it was possible. Since we find so few of these original pieces, we can only think that the planters becoming wealthy so rapidly, and wishing to keep up to the "prevailing English style," must have discarded the old for the new, as their invoices show large importations of furniture up to the Revolutionary War.

There was a marked difference between the houses of New York and of New England. The Dutch built theirs of brick, while those in New England were mostly of timber, and a striking feature in the living-room of the former was the chimney-piece, which among the wealthy was elaborately carved and tiled and held vessels of brass repoussé and Delft-ware. The fire-place with its colored tiles continued to be a decorative feature, even after coal succeeded wood as fuel and grates took the place of andirons. The floor of the average house was sanded, and rooms had no special character. The ideas which the Dutch brought from the Orient influenced the designs not only around New York but in New England as well, and fast grew into favor. Strange shapes from the East, introducing marqueterie in exotic woods, were eclipsing the old chests of drawers, cupboards, etc., and actual products of the Far East filled many of the Dutch houses. The cabriole legs superseded the severer lines. Other woods beside oak, such as walnut, pine, red cedar, maple, etc., were introduced; ebony was scarce, so the "black egg ornament" was often of white wood stained black.

In the first half of the 18th century New York was an important place, and inventories show that fashions in New York compared favorably with those of London and Amsterdam. The bed was disappearing from the hall; carpets were introduced, and in 1750 they had flowered carpets and "painted floor cloths." The walls, of houses of the better class, were papered before the middle of the 18th century, and for 50 years we have an interesting wallpaper period; their chief designs were large illustrating panels, such as "The Lady of the Lake," "The Four Seasons," etc. Fire-places were growing smaller as wood was harder to obtain, and in 1745 Franklin invented what is now known as the "Franklin stove." Upholstery was taken up and there were many cabinet-makers in New York, Boston, and Philadelphia; skilled workmanship was in demand, and "choice timber and metal furnishings for cabinets" were advertised. Then came the period when mahogany was the favorite wood, and, just as in England, all designs had a tendency toward greater lightness and grace of line, and showed the Chinese influence strongly. In 1776 the home of a wealthy American compared favorably with that of an Englishman in similar circumstances. "Chippendale" was the rage, both imported and domestic. There was a marked difference between the North and South — the Northerners lived more simply, but with a certain amount of fashion and elegance; in the South everything was ease and luxury, and many houses were noted for their costly furnishings. Around Charleston, S. C., at the present time are some excellent examples of typical Southern homes of the 18th century, containing many of the original pieces of furniture. The classic or Greek style adopted by Adam in England, found its way here, and was seen in architecture and interior woodwork, noticeably in mantels and built-in cupboards, but was little used in articles of furniture.

Mt. Vernon — now a museum of relics — is the most interesting colonial house, on account of its associations. It was inherited by George Washington in 1751 from his half-brother Lawrence Washington. Soon after it was almost entirely refurnished, and though by no means palatial was extremely comfortable. There were few of the original Washington pieces left there, as Mrs. Washington bequeathed the furniture to four grandchildren, but now many articles are gradually finding their way back, either through gift, or through purchase by the Mt. Vernon Ladies' Association of the Union. There are many Washington pieces, used by him while in Philadelphia, now in possession of the Historical Society of Pennsylvania. Second in interest is Monticello, the home of Thomas Jefferson. Its architecture and decorations are delightful, and it still contains proofs of the owner's good taste and love of art.

"Colonial designs," as termed in the vocabulary of the dealer of to-day, were not known until the colonies had become States. They are traced in America first through the Dutch, who had taken many points from Spain and the Orient, namely the ball and claw pattern. Chippendale adapted them with more lightness and grace of line, but the French Empire style which came in at that time changed it into the massive mahogany, and gave the rope-carved pillars and lion-claw feet. American makers omitted the elaborate brass and ormolu trimmings used by the French, and depended upon the beautiful grain of the wood, often veneering to obtain handsome effects. The superiority of the old furniture is due to its construction; the old makers worked solidly, dove-tailing, and blocking all drawers, and to-day the age of the wood has greatly added to its value, the stained mahogany loses the beautiful golden shafts of light. The polish was attained by constant rubbing, while to-day most pieces are simply varnished.

Mahogany was brought into England by Sir Walter Raleigh, but was not in general use until about 1725. In New England it was extensively used a little later, being imported from the West Indies. The Honduras and Mexican varieties most commonly used to-day, do not materially improve with age, and are much lighter in weight than the West Indian, therefore a really old piece may often be told by its heaviness. The date of a bureau, chest of drawers, etc., may frequently be ascertained from its handles.

Handles.— The oldest handles, chiefly brass, rarely pewter, were drop-handles, formed like an earring, backed by a small plate. Next in order was a larger plate, usually engraved, with a bail large enough to insert two fingers. The next was a larger plain plate similar to a fleur-de-lis in shape, the bail being much larger, and from now on, held into the drawer by brass nuts instead of wires as formerly, but in reproductions iron nuts are nearly always used. It gradually developed into a thin oval plate embossed with moldings, sometimes with centre design, and the bail, fitted into posts, falls outside the plate, preserving the same curve. Still later came the knob and empire rosette handles, sometimes with ring, usually of brass but also of glass or plain wood.

Chests.— No matter how meagre an inventory, it always included a box, chest, or case. First the ordinary ship's chest of pine with iron handles, which was appraised very low. There are several good examples of these in State historical societies, including one brought over in the Mayflower. Few of these were made after 1725. The oldest carved chests were in low relief with often the date and name of the person for whom it was made; they were afterward made with one drawer, having panel or turned ornaments. This developed into the "chest of drawers," made of oak and more elaborately decorated, which in turn developed into the "chest upon chest," sometimes having as many as nine drawers, and the three-tier "steps" for displaying china was sometimes placed upon these. The "high-boy" is not mentioned until the chest of drawers was placed upon a frame about three feet high, having one or more drawers; it had six legs, and later the part where the centre legs were omitted was finished with "drops." This, in the latter part of the 18th century, became a very handsome article of furniture, with carved top, usually "shell" or "sun" pattern, decorated with gilt torches or balls, and cabriole legs and carved feet.

The Dressing-Table, or "low-boy," came from England in 1716. At first it had but one drawer, afterward it was the same as the frame for the "high-boy," only about three inches lower. The "high-boy" and "low-boy" were often made to match. The Chippendale and Sheraton designs were usually furnished with dressing-boxes and mirror.

The Settle was an evolution of the chest. Handsome examples are rarely found in this country, although there are many varieties of the "fire-side" settle in painted pine and oak found in New England, with a shelf to hold a candle. The settles which appeared in the latter part of the 18th century, following the Chippendale, Sheraton, and Hepplewhite designs, might better be termed sofas, which later took on the Empire designs, with "claw-and-ball" and "wings-and-claw" feet, and "cornucopia" and "swan-neck" ends.

Beds were among the first and most frequently mentioned articles of furniture in wills, being highly prized. In the 17th century the Southern planters owned elaborate European bedsteads, usually of oak. In New England they were very simple affairs, while among the Dutch the bed, at first, was only a sort of bunk. The four-poster soon supplanted all, first of oak, but later of mahogany. Some were most elaborate, with rope-carved, or pineapple and acanthus-leaf posts, and ball-and-claw feet, with

1–5. Handles.
6. Dressing table.—Constitution mirror.
7. High-boy.
8. Windsor chair.
9. Four-post bed.

tester drapery, valance, curtains and coverlet to match, of white or bright colored materials, chiefly drugget, lindsey-woolsey, or dimity, though later chintz was popular. In the South, mosquito canopies were prevalent, sometimes colored to match the color scheme of the room. Feather beds were universally used, resting on ropes or sacking pulled taut, and owing to their height, "bed steps" were necessary. We also find mention of turkey feathers and cat-tails being used as fillings, and early in the 18th century hair mattresses appeared.

Cupboards were usually built into the wall, and whether called "livery," "court," "standing," or "press," were all fitted with light movable shelves to hold linen and display china and glass. There are few of these open cupboards to-day. First the upper part was enclosed with doors (later ones show glass doors with lattice work), afterward a drawer was added, then the lower part was enclosed, and when fitted with lock and key was highly prized as an article of furniture. These partly opened cupboards were called "beaufait," afterward contracted to "boufet." Closed-in cupboards show German as well as Dutch origin, and the finest examples were found among the Dutch, usually spoken of as "kasse," carefully carved and painted.

Chairs are scarcely mentioned before 1650, forms or benches being used almost entirely, the chair being considered the seat of honor, but toward the end of the century there was a marked increase in the numbers mentioned in the inventories. They were made of oak, pine, and walnut, turned or paneled, simply carved and with high backs, the seats either rush or cane. About the 17th century we notice leather and "turkey-work" seats with brass nail-heads. The "ball-and-claw" foot, introduced by the Dutch, appeared at the close of the 17th century and remained in favor for nearly a hundred years. Chairs made of wicker and cane were known as early as 1711, and in 1720 came the painted chairs from Holland, usually black, often decorated, with rush or cane seats. The Windsor chair, first made and used in Philadelphia in 1725, was the most popular style up to the 19th century. It was usually of hickory or ash and had a wooden seat, the back was high and either "spindled" or "fan-shaped," sometimes having an extra headpiece. The style known as Chippendale appeared in 1720, the development being apparent before Chippendale worked. Its chief characteristics were the traceried splat, bow-shaped back and cabriole legs, also the "plate-backed," which was a solid splat, usually jar-shaped, and hoof feet. The all-upholstered "wing" chair seemed to be in general use before 1750. Mahogany was now easily procurable and the tendency was toward greater lightness, and most of the designs, from now on, follow the English cabinet-makers; Chippendale, with a strong Chinese influence, then Sheraton and Heppelwhite, some being beautifully decorated with hand-paintings, carvings and inlay. In 1770 we have another style, modeled after the old "splat-back," but with the splats crosswise. About 1800 the style commonly known as "empire" began to be felt, and gave us the "lion" and "bear" claw-feet and rolling backs, copied after old Egyptian designs. The strong empire was partially modified here by the Sheraton influence. There is a style in America, a modification of the empire, with heavy mahogany splat-back, usually jar-shaped, often having the back and back legs in one piece. These were in favor until 1840; they were usually covered with "horse-hair" and are now offered as "Colonial" designs!

Tables.— What has been said of the development of chairs may be applied to tables, as almost every form of chair had its corresponding table. First we had the "table-borde," a board, often 12 feet long by 2 wide, resting on a cross-legged trestle. It gradually became customary to leave the "borde" on the trestle instead of removing it after each meal, and it was then known as a table. Marble and slate-topped tables appeared about 1693, and were considered "the latest thing." Before the 18th century we had imported "chair-top" tables, "drop-leaf," and the "100 legged," which was the first extension table, all with turned posts. About 1735 the Dutch influence was strong, and to-day we have some excellent examples, dating from 1750, of mahogany "pie-crust," "dish-top," etc. The "centre-pillar" table came in with the Empire period. Tea tables were found in every parlor of the 18th century, always ready with complete tea-service, spirit-lamp, kettle, tea-box, tongs, strainer, etc. Among the Dutch the table was frequently of rare or japanned woods, many with adjustable tops. Card tables, of which there were many, usually had a plain surface, though some were covered with green cloth; they had folding tops and corner shallows for counters. Work tables were mostly of Sheraton design, the top lifting up, disclosing compartments for sewing materials. Candle tables were of various heights, with a top only large enough to hold a candlestick.

Desks.— A desk was originally a wooden box with slanting lid, the writing materials, and frequently the Bible, were kept inside under lock and key, and the top served the double purpose of reading and writing desk. The large desk or "secretary" appeared about 1660 and seems to have been another development of the "chest of drawers," usually having two or more drawers in the lower half. The lid on the upper part was either let down on chains or rested on two wooden slides. The interior was fitted with many drawers and pigeon-holes, and they had often secret compartments. Later, a cabinet was placed on top and developed into the "cabinet-top" desk, made in one piece and reaching almost to the ceiling. The "table-topped" desk belonged to a later period, a good example being the one used by Washington while in New York in 1789, now in the City Hall. There are some good specimens of Sheraton and Heppelwhite desks in this country belonging to their respective periods. The later empire or "Colonial" pieces were large and heavy, mostly "bureau-fronts."

Clocks.— There is slight mention of household clocks prior to 1700, but in the 18th century clock-making was quite an art; the Willard Brothers of Massachusetts were the first to become famous. Around New York were found some "Frisian" wall clocks from Holland, run by weights, with elaborate designs of gilded and painted mermaids, cherubs, etc. The English "lantern" clock was on the same order, being of brass with heraldic metal work. This developed into the "bracket" clock, through having a wooden hood placed over it for protection; it was very popular about 1700. The first mention of a tall clock is in the latter part of the 17th century, when long pendulums, also moving figures upon the dial, became fashionable. It was spoken of as "clock and case," and was very plain, of oak or walnut but later of mahogany. Many of them were destroyed during the Revolution, the works being hidden and the cases, in some instances, used for shipping bayonets. Few tall clocks were made after 1815. After the Revolution cheaper time-pieces were in demand, and to meet it, clocks having white enamel dials and wooden works were invented. From then on, there were many styles of cheap clocks for walls and mantels, including the "banjo" clock patented by Willard in 1802; the "lyre" clock, and many "Colonial" designs in wood, some with painted glass covering the pendulum.

Looking-Glasses.— The first record is in an inventory in Maryland 1639. They were rare at that time even in England, being imported from Venice. The frames were of olive-wood, black or gilt, and when the glass exceeded four feet were made of small pieces joined by moldings. Later the frames were heavily carved and inlaid, but always retained the Italian appearance. We find mention of a parlor in a Maryland house in 1732, "set off with pier glasses." In New England it hung over the mantel-piece and was known as the "chimney-glass," usually ornamented at either side with candle sconces. At the end of the 18th century the shield and oval glasses appeared, showing the influence of the English cabinet-makers, followed by the Empire, with rope-carved pillars, acanthus-leaf and lyre carvings, sometimes having the top partitioned off for paintings. What is known as the "Constitution" mirror did not appear until after 1800; most of them bore the eagle at the top.

Mirrors, during the 17th and 18th centuries, were either of convex or concave glass with elaborate frames, and were frequently used for decoration.

Sideboards came into fashion about 1780, taking the place of cupboards and side tables. They were nearly always of mahogany. First after Sheraton, with inlay, noticeably the "bell-flower" design down the slender legs; later "Colonial" of heavy mahogany with the cupboards extending nearly to the floor, ball-and-claw feet and rounded pillars, similar to the bed-posts.

Washstands.— First called a "bason-frame." Few good examples before the latter part of the 18th century, which were influenced by the English cabinet-makers, and later by the Empire.

Warming-Pans were a necessity, especially in New England. The pan was usually of brass with cover, 14 inches in diameter, with a long wooden handle fastened to the pan by an iron socket. Hot coals were placed in it, and when rubbed between the sheets warmed the beds. They were often decorated with open-work carvings and were quite ornamental hanging beside the fire-place.

Screens were used to protect the face from the heat of the fire, were small, made of embroidery or painted wood, with round or square frame, fastened on a post which could be raised or lowered.

Children's Articles.— We find frequent entries of articles of furniture for children. Cradles, the first one brought over in 1620; high-chairs, also "fenders," to keep the children away from the fires.

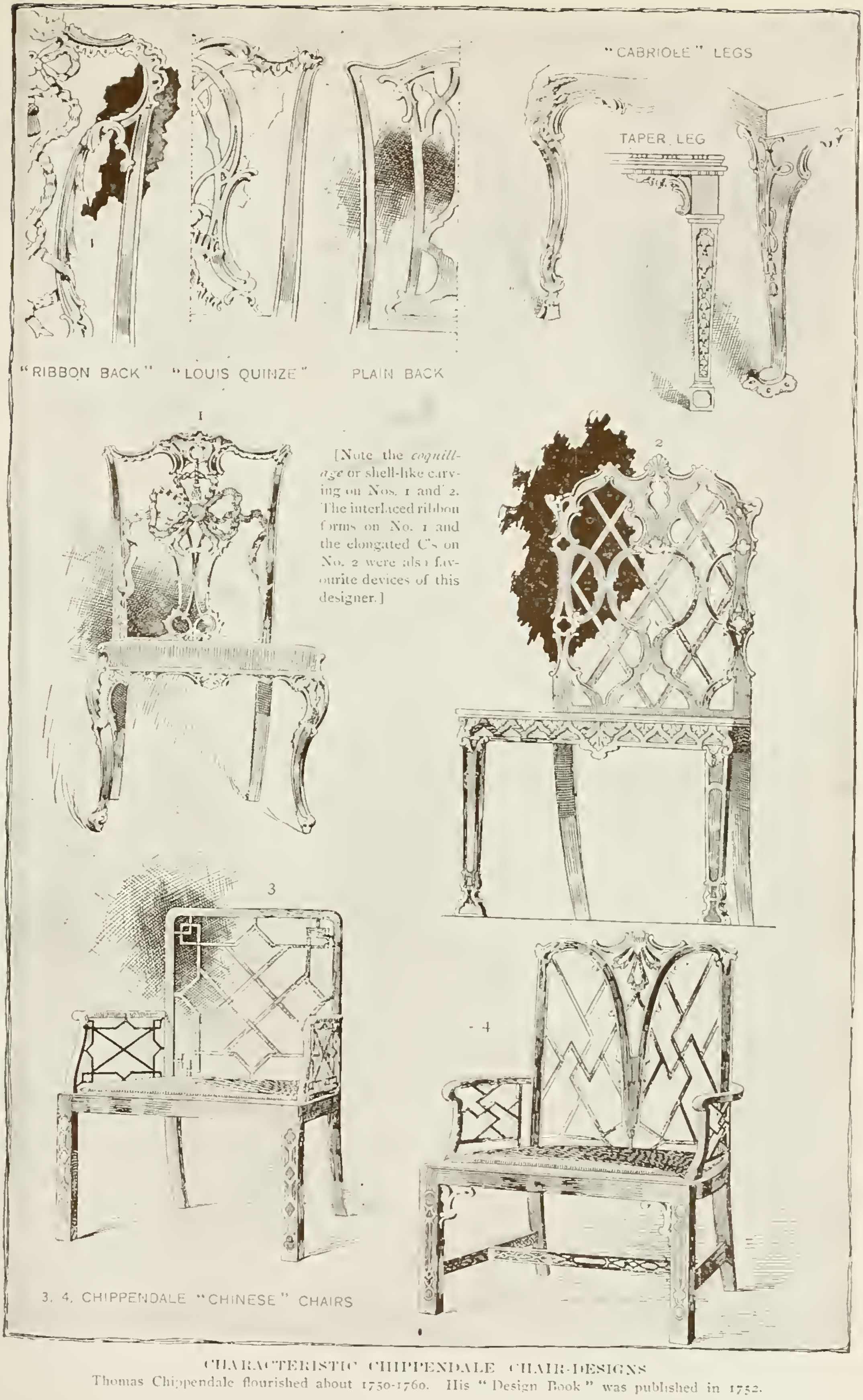
There were several miscellaneous articles of furniture mentioned after 1750, including "dumb-waiters," now called "butler's trays"; "wine-coolers," "knife-boxes," "sewing-boxes," "clothes-trees," etc.

Collections.— Among the many permanent collections of Colonial furniture may be mentioned the Connecticut Historical Society, Hartford, Conn.; the Pilgrim's Society, Plymouth, Mass.; the Essex Institute, Salem, Mass.; Van Courtlandt Mansion, Van Courtlandt Park, N. Y.; American Antiquarian Society, Worcester, Mass.; Historical Society of Pennsylvania, Philadelphia; Washington's Headquarters, Morristown, N. J.; Independence Hall, Philadelphia, Pa.; and Mt. Vernon, Va.

Bibliography.— Singleton, 'Furniture of Our Forefathers'; Lockwood, 'Colonial Furniture in America'; Morse, 'Furniture of the Olden Times'; Wallace, 'Colonial Interiors'; Chandler, 'Colonial Interiors'; Corner and Soderholtz, 'Colonial Interiors and Exteriors'; and 'The House Beautiful' (monthly).

Louise Cowperthwaite,
Of George C. Flint Company, New York.

Furniture Industry in America, The. The early cabinet-shops of America were like the second-hand repair-shops to be seen to-day in New York, Boston, Philadelphia, and other large cities. A great many cabinet-makers made furniture until late in the 1st century of commercial independence on simple Chippendale lines. Gradually the Empire fashions, which were making themselves felt all over Europe, spread to America, and shapes became heavier and more pretentious, mahogany being used almost exclusively. Heads of animals were also used, and claw-feet became a general feature. Common furniture was heavy and unattractive. The general condition of things at this time was unfavorable to the development of art industries. Little thought was given to progress in the manufacture of furniture and for some years there was a decline. Upon a revival of commerce cabinet-makers changed their style, and began producing a debased rococo style, which did not have the elegance or character of the Louis XV., but was covered with a florid ornamentation in which the only consideration was display. The extravagance of curves and lavish ornamentation brought about a reaction, and toward 1830, following the fashion in England and France, an attempt was made to construct furniture in the Gothic style, but with very unsatisfactory results. The lack of artistic training of the manufacturers who were, as a rule, cabinet-makers or carvers by trade, made it very difficult for them to handle a method of decoration and construction so little appropriate in itself to the requirements of home comfort. This Gothic style of furniture, monumental in appearance, was made to a limited extent only, although its influence is to be noticed on other furniture placed on the market at this time and later. The making of rococo furniture was kept up by a large number of cabinet-makers, the cheaper furniture being for many years made in this style. It was also during this period that steam, applied to cabinet-makers' machinery for



CHARACTERISTIC CHIPPENDALE CHAIR-DESIGNS

Thomas Chippendale flourished about 1750-1760. His "Design Book" was published in 1752.

CHARACTERISTIC HEPPELWHITE FURNITURE.

Messrs. A. Heppelwhite & Co., Chippendale's successors, published their "Design Book" in 1789.
The Heppelwhites were designers rather than manufacturers.

the first time in 1815, occasioned a revolution in the manufacture of furniture, bringing labor-saving devices into more general use, and enabling the cabinet-maker to supply the rapidly increasing demand for his product. In 1825, Richardson, of Philadelphia, introduced the circular saw, and Taylor, Rich & Company erected the first mahogany-mill in America, a number of these saws being used there. Ordinary furniture, which until now had been very plain, was covered with endless scroll-work and moldings, produced so easily by the new machines. The manufacturers indulged for a time without restraint in this ornamentation. The use of machinery in shops, and the increased facilities for transportation, wrought a wonderful improvement in the furniture trade; and the cabinet-shop, which had until this time been of small importance and partially engaged in making articles kindred to furniture, suddenly assumed large proportions, and confined itself to furniture only, using in the making of it the new devices which were constantly being brought forth by ingenious inventors. The value of the furniture product in the year 1850 may be estimated at about $15,000,000, and the industry gave employment to 37,000 people, out of a population of a little over 23,000,000. For a long time a great number of hand-shops survived, making to order special high-grade work; and they succeeded in impressing their patrons with the idea of the inferiority of machine-made furniture, which at this early stage in the introduction of machinery was not entirely without foundation. The extensive use of machinery in shops had the immediate effect of again changing the style of furniture. Manufacturers looked for a fashion in which they could use their facilities to the best advantage, and at the same time retain the attractiveness of their earlier work. This they found in the Renaissance, which for a number of years superseded all other styles in the best class of furniture.

Up to this time the furniture industry had been confined to the Eastern States, principally in and around Boston; but a number of factories were now started in the West, where situated in proximity to large forests and regions where population and wealth were rapidly increasing, they soon became important factors in the production of furniture in the United States. These factories, equipped with new machinery and using native timber, produced at first a low grade of furniture in which art seems to have been very little considered. Those who wanted more artistic furniture purchased it from the East. The art revival which had taken place in Boston and New York was fostered by increased travel in Europe, where exhibitions were taking place at short intervals in London and Paris. Moreover, the consideration that old furniture was beginning to receive brought forcibly to the people the inferiority of that then made, and manufacturers gave more attention and study to its appearance than before. Trade kept increasing with the general wealth, and in 1860 the production reached $25,500,000; but the number of workingmen employed in this industry, owing to the improvements in machinery, had fallen to 28,000, although the population had then reached almost 31,500,000.

Industries in general were now to receive another blow, on account of the War of the Rebellion. As soon as this conflict was over, the extraordinary activity which had prevailed in military circles was transferred to the industrial field, and from this time on it is by leaps and bounds that improvements can be noted. The furniture trade was in the hands of two classes of manufacturers, one class of whom, having taken the place of the old hand-shop workers made high-class work to order, continuing the old traditions, but now using machinery extensively. The other class of manufacturers studied the wants of the people, and produced suitable articles at prices which were within the reach of the masses. It is to them that we are indebted for the gigantic development of the industry, as they placed within the reach of all, strong, ornamental, and practical furniture. We have seen that men of taste had recognized for some time that our furniture was inferior to that made at the end of the last century, and had begun to study not only the styles of that period, but also those of the English and French prevailing in the past. As a result we find that a great variety of styles were employed in the productions of the leading firms, who were always striving for novel effects.

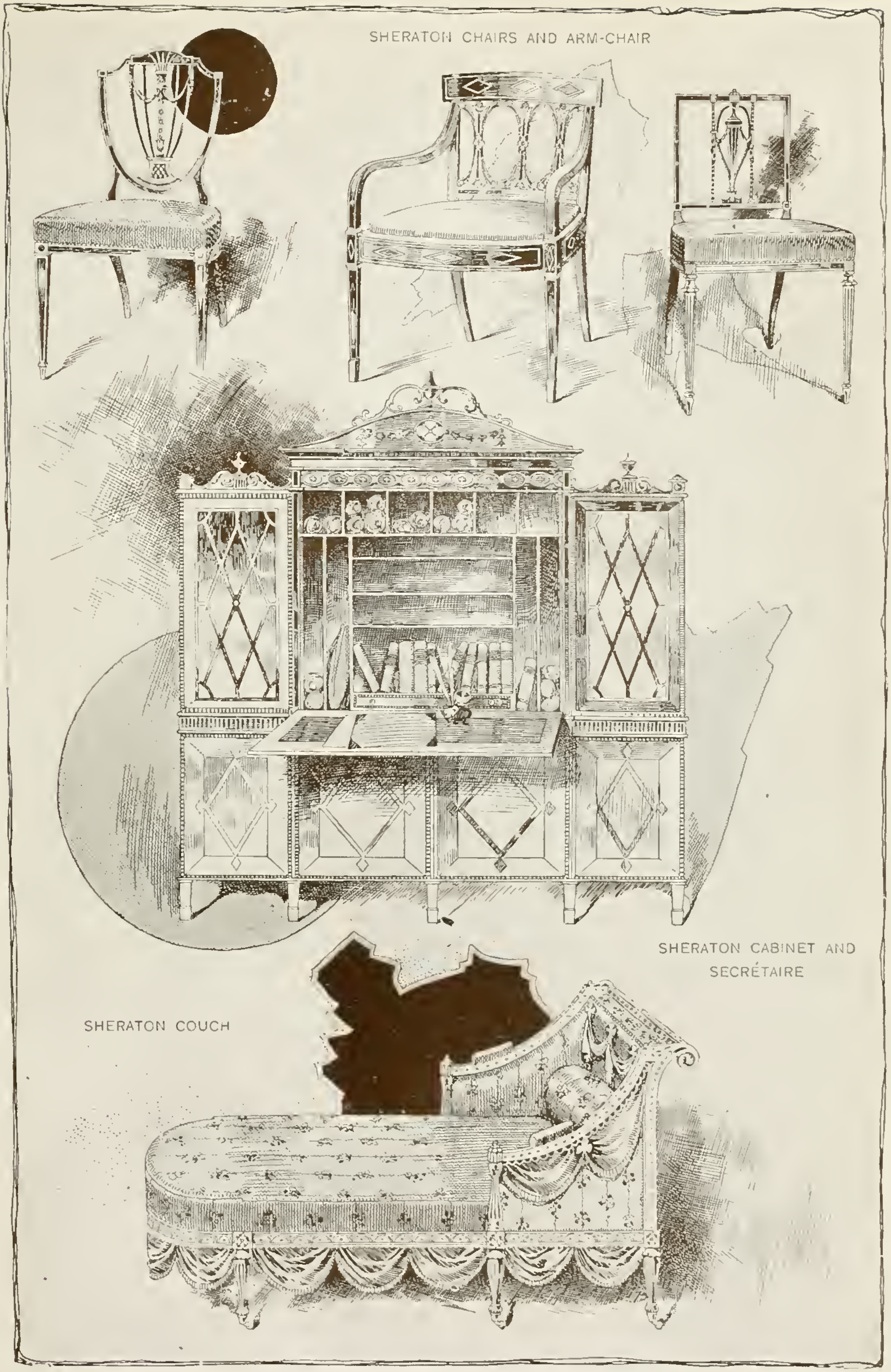
A work published in London, England, in 1868, entitled 'Hints on Household Taste,' by C. Eastlake, waged war on modern work, advocated returning to the primitive principles of Gothic construction; and gave positive instructions as to what was right or wrong, not only in the line of furniture, but in draperies, carpets, and other household decoration, as precisely as if the art had been a science. This book was looked upon as a sort of gospel treatise on furnishing, and however much we may at this time ridicule some of the ideas conveyed, it directed the public mind in its search for more artistic surroundings at home. From that time other styles were discarded, and designs in accordance with the newly developed taste took their places. The movement in favor of more perfect construction and the use of straight lines exclusively became general, the stiff appearance being relieved by an abundant use of arches, spindles, turnings, etc. This style allowed the manufacturers to do the greater part of the work by machinery, for which it seemed specially adapted. The increased interest that the public took in furniture developed the trade in an unprecedented manner, the production for 1870 being $68,500,000, or nearly two and one half times that for 1860. The number of men employed at this time shows a similar increase, being 55,800, out of a population of 38,500,000 people. The Centennial Exhibition in Philadelphia (1876) had a far-reaching influence, especially on western manufacturers, who until this time had not had occasion to compare their products with those of the best manufacturers of America and Europe. This exhibition marks the highest point that the Eastlake or early English was to attain. A number of the most prominent manufacturers of this country had their exhibits made in this particular style. It was quickly taken up by the manufacturers of cheaper furniture, who until then had given very little attention to artistic form, and they are responsible for the enormous quantity of furniture in imitation of this description that can yet be seen in the auction-rooms of large cities. The strife for originality, which was soon to be one of the characteristics of western manufacturers, had now begun to show itself; but an insufficient knowledge of art subjects rendered many of their designs more strange than beautiful, and more noticeably so when they were working on the lines of any given style; but through diligent efforts their designs were steadily improved, and this, in connection with their superior facilities, has secured to them a large part of the eastern trade. The volume of business showed a substantial increase during this decade, although not as large as during the preceding period. The value of the output of furniture for 1880 was $77,845,000 — an increase of 13.5 per cent in value, but a decrease from $1.77 to $1.55 per capita of the population. The wonderful changes which occurred in architecture in the next decade, especially the Romanesque revival due to H. H. Richardson, had a distinct effect on furniture. Richardson himself designed some Romanesque furniture. Furniture manufacturers eagerly welcomed this departure, for the ceaseless demand for new things, as strong then as it is now, obliged them to change their patterns very frequently. Unfortunately, by passing through the hands of manufacturers of cheap furniture, it lost all of its original beauty. During this decade great improvements were made in woodworking machinery, and a large number of new devices were invented. Among them was the carving machine, which enabled manufacturers to ornament even the cheapest kind of furniture. The amount of business done in 1890, large as it was, did not keep up with the increase of population. The value of the product in 1890 was $86,362,685, an increase of 11 per cent over that of 1880; but the amount per capita of population dropped to $1.38, as compared with $1.55 in 1880, and $1.77 in 1870. The International Paris Exposition of 1889 revived a taste for the 18th century furniture, especially of the Louis XV. style, which was quickly taken up by the people of the United States. In spite of the seeming difficulty of using machinery in making such work, American manufacturers made and are still making a large quantity of furniture, in that dainty mode, which certainly equals that of the same class made in Europe, and is generally better constructed. All the 18th century styles, French or English, have been and to a certain extent are now used by American manufacturers:— Louis XV., Chippendale, Louis XVI., Sheraton, Hepplewhite, Empire and the Flemish Renaissance.

Since the decline of the Empire style in the first half of the last century manufacturers have been satisfied to copy the styles of the past, with such modifications as conformed to commercial requirements. The public demand for reproductions of old furniture increased to such an extent as to leave little room for originality in their production. Within recent years a strong feeling has developed that the old styles are not in keeping with present ideals and new styles should be evolved to emphasize simplicity of construction, grace of style, beauty of proportion and harmony of color. The Mission style, at first heavy and shapeless, is acquiring more subtle and refined lines, thereby increasing in public favor. The novelty of the last century is a free natural style called Art Nouveau. Its introduction to this country from France a few years ago was attended by failure. The market was flooded with goods of inferior make in which the vagaries of this style were mistaken for its distinctive features. The meaningless curves and coarse ornaments of the beginning are being discarded and a refined elegance is now taking their place. The extensive adoption of this style in other art industries warrants the belief that it soon will be a distinctive feature in furniture.

Many of the numerous articles of furniture manufactured are distinctly American. The bureau, the rocking-chair, the folding-bed, the chiffonier, as now made with toilet, and in general most of the combination pieces of furniture made with a view of economizing space in apartments in large cities, are of this class. The American bureau is a combination of the old chest of drawers and the dressing-table, having the drawer-room of the one and the swinging mirror and table-top of the other. This has been imitated in Europe to a limited extent, in the production of what is known as the English dressing-table. As made in this country, the bureau is one of the most practical pieces of furniture used. The rocking-chair, almost entirely unknown in Europe, is found in every home in this country, yet it is difficult to ascertain when it was first put in use. We do not find any mention of it in the descriptions of articles of furniture in the 18th century. The first patent issued for improvements in rocking-chairs is dated as far back as 1830. The folding-bed, in the shape of a sofa, with a box-seat for bedding, has been used in Europe for over a hundred years, but America claims the folding-bed in other forms, such as the wardrobe, the cabinet, the mantel, and the combination; some of these were made as early as 1847. The demand for folding-beds, which reached its climax a few years ago, is now showing a material decline.

The woods used in the manufacture of furniture are varied, and subject to frequent changes. Early in the century, mahogany, maple, and black walnut were in favor; then cherry and ash became fashionable; toward 1880, oak, so long forgotten, took a prominent place. At the present time black walnut is almost entirely out of use. Oak has kept its popularity for the hall, the library, and the dining-room. Mahogany, curly birch, and maple are still extensively used; all of them for the bedroom, and mahogany for the dining-room and the drawing-room in the better grades of furniture. The changes in furniture covering have been more frequent and radical than those in the woods. Haircloth and other coverings in use 30 years ago have been superseded by materials more varied in texture and coloring. Their variety is almost endless, and they show, perhaps as much as anything else, the advance that art as applied to furniture has made in this country. The present centres of the furniture industry are, with one exception (Grand Rapids, Mich.), the largest cities, which, with their densely populated suburbs and surroundings, offer large markets. The cities whose productions amount to more than $2,000,000 per annum, in the order of their importance, are: New York, Chicago, Grand Rapids, Philadelphia, Cincinnati, St. Louis, Boston.

The following statistics show the furniture



CHARACTERISTIC SHERATON FURNITURE

Thomas Sheraton (1751-1806) was the last of the famous cabinet-makers of the 18th century. In 1790 he published his first collection of "Designs for Furniture," and this was followed by numerous other publications of a similar class.

factory product of the United States for 1900 according to the twelfth census:

Alabama	107,185
Arkansas	232,872
California	1,267,986
Colorado	170,055
Connecticut	488,738
Georgia	1,273,462
Illinois	15,285,475
Indiana	8,769,509
Iowa	1,419,862
Kansas	302,339
Kentucky	1,504,083
Louisiana	319,723
Maine	580,737
Maryland	2,976,494
Massachusetts	11,244,503
Michigan	14,614,506
Minnesota	1,932,188
Missouri	3,758,568
Nebraska	211,750
New Hampshire	734,428
New Jersey	808,185
New York	23,643,245
North Carolina	1,547,305
Ohio	9,514,764
Oregon	298,790
Pennsylvania	9,804,677
Rhode Island	32,325
Tennessee	1,106,623
Texas	185,285
Utah	42,732
Vermont	1,252,743
Virginia	212,972
Washington	412,613
West Virginia	454,097
Wisconsin	8,721,823
All other states	83,344
Total	$125,315,986

The furniture industry of the United States has to-day reached a magnitude unknown elsewhere. The perfect equipment and organization of our mammoth factories capable of an enormous production emphasize the necessity for a larger market. Intelligent efforts are now being made in this direction by a number of manufacturers with the hope that eventually a large foreign trade may be secured for our American product. George W. Gay,

Revised by George G. Whitworth, *Berkey & Gay Furniture Co., Grand Rapids, Mich.*

Fur'nivall, Frederick James, English scholar: b. Egham, Surrey, 4 Feb. 1825. He was educated at University College, London, and Trinity Hall, Cambridge, where he graduated B.A. in 1846, and M.A. in 1849, and adopted the study of the law, being called to the bar in 1849. He has, however, devoted his life chiefly to the study of early and middle English literature; and he has been mainly instrumental in establishing the Early English Text Society, the Chaucer Society, the New Shakespeare Society, the Browning Society, the Wickliffe Society, and the Shelley Society. He is also honorary secretary of the Philological Society. The societies named have given a powerful impulse to English scholarship by their publications, and this is in no small measure due to Dr. Furnivall. For them and for the Roxburghe Club and the Rolls Series he has edited numerous works, notably the Six-Text edition of Chaucer's 'Canterbury Tales' (1868–75.) Other works of his are: 'Early English Poems and Lives of the Saints' (1862); 'Early English Meals and Manners' (1867); 'Book of Nurture' (1867); 'Education in Early England' (1867); 'Bibliography of Browning' (1881); and 'The Fifty Earliest English Wills in Court of Probate' (1882).

Furrer, fur'ĕr, Jonas, Swiss statesman: b. Winterthur 1805; d. 1861. After studying at Zurich, Heidelberg, and Göttingen, he became president of the Grand Council of Switzerland in 1839, a position which he again occupied in 1844. In 1845 he received his appointment as president of the Cantonal Diet, and when the new Federal Constitution went into effect he was elected president of the Swiss Confederation. He wrote 'Das Erbrecht der Stadt Winterthur' (1832).

Fursch-Madi, Emma, French opera singer: b. Bayonne, France, 1847; d. Warrenville, N. J., 19 Sept. 1894. After studying at the Paris conservatory, she began to sing in public concerts under the direction of Pasdeloup, and then appeared in opera, first as Marguerite in 'Faust,' and then in Verdi's opera 'Aïda' at the Théâtre de la Monnaie, in Brussels. For three years she sang in Covent Garden, London, and in 1884 came to New York to fill an engagement at the Academy of Music. She then appeared frequently at the Metropolitan Opera House. From 1891 she taught music and singing in the New York College of Music.

Fürst, Julius, German scholar: b. Zerkowo, Posen (Prussian Poland), 12 May 1805; d. Leipsic 9 Feb. 1873. He was of Jewish parentage, and at an early age he had a remarkable knowledge of Hebrew literature, Old Testament Scriptures and Oriental languages. In 1825, after having studied at Berlin, he took a course in Jewish theology at Posen. In 1829, after having abandoned his Jewish orthodoxy, he went to Breslau, and in 1831 to Halle, where he completed his studies in Oriental languages and theology. In 1833 he entered journalism in Leipsic, later securing a position as tutor and lecturer in the university there, from which position he was promoted in 1864 to the chair of Oriental languages and literature, a post he filled with great distinction until his death. His works, especially those on the Semitic languages, are of great value, and among the most important may be mentioned: 'Lehrgebäude der aramäischen Idiome' (1835); 'Concordantiæ librorum Sacrorum veteris Testamenti Hebraicæ et Chaldaicæ' (1837–40); 'Bibliotheca Judaica' (1849–63); 'Hebräisches und Chaldäisches Handwörterbuch' (1851–61); 'Geschichte des Karäerthums' (1862–5); 'Geschichte der biblischen Litteratur und des jüdisch-hellenistischen Schrifttums' (1867–70). From 1840–51 he edited 'Der Orient.'

Furst, William, American composer and conductor: b. Baltimore, Md., 25 March 1852. He studied music in his native town and at the age of 14 was a church organist. His comic opera 'Electric Light' was produced and conducted by him in 1878 and for the five seasons following he received engagements as conductor of opera. He became musical director of the Tivoli Theatre, San Francisco, in 1884. His opera 'She' ran for nine weeks there, and was produced for two seasons in New York His chief productions are: 'Theodora' (1888); 'The Isle of Champagne' (1891); 'Honeymooners' (1893); 'Princess Nicotine' (1893); 'The Little Trooper' (1894); 'Ghismonda' (1894); 'The Merry World' (1895).

Furtado, Francisco José, Brazilian statesman: b. Oeiras (Piauhy) 13 Aug. 1818; d. Rio de Janeiro 23 June 1870. After graduating from the Academy of Law at Caxias and serving for some time as judge, he entered politics and rose to be leader of the Liberals. In 1847 he was elected deputy and re-elected several times. In 1856 he was elected president of the new province of Amazonas, remaining such until 1859, when he was made minister of justice. In 1864 he was elected senator, but held that position for a few months only, and in August 1864 was made premier and minister of state, in which position he did much toward the establishment of a good monetary system. During his term of office as minister of state the dispute with Uruguay was settled and war between Brazil and Paraguay was declared. In 1870 he was again a member of the Senate and as such, being an opponent of slavery, exerted all his influence in behalf of legislation looking toward its final abolition.

Fury and Hecla Strait, in the Arctic region, in lat. 70° N., separates Melville Peninsula from Cockburn Island, and connects Fox Channel with the Gulf of Boothia. It was discovered by Parry (q.v.) in 1822, and named after his ships.

Furze, fèrz, a European genus (*Ulex*) of very branched and thorny shrubs, with linear sharply pointed leaves, solitary flowers, and two-lipped calyx, belonging to the order *Leguminosæ*, sub-order *Papilionaceæ*. The common furze (*U. europæus*), also called whin and gorse, is abundant in many parts of southern Europe and in Great Britain, although not reaching any considerable elevation, and often suffering from the frost of severe winters. It affords a wholesome fodder, especially when young, or when the thorns are artificially bruised, and is grown often on dry and barren hillsides not fitted for other forage crops. A double flowering variety is grown in gardens.

Fusan, foo-sän', or **Pusan,** Korea, a seaport town on the south shore of the peninsula, from the 16th century became more and more under Japanese influence. In 1876 it was formally opened to Japanese trade, and soon after to all nations. At the outbreak of the war between Japan and China (1894–5) the bulk of the population were Japanese, who have the trade in their hands. The imports (chiefly Manchester goods, salt, and Japanese wares) have an annual value of over $1,000,000; the exports (rice, beans, hides, etc.), of $1,300,000. Pop. (1900) 15,000, of which 10,000 are foreigners.

Fuse, a device employed for firing explosives. In mining, quarrying and in military and naval mining operations there is used the "Bickford, safety running" or "tape" fuse which consists of a tubular cord of cotton or hemp that has been rendered slowly combustible, the cavity in the centre of the cord being filled with a slow-burning gunpowder composition. To make the fuse firm and hard, so as to prevent its being cut by the sharp edges of the rock during tamping, the outside of the cord is served with a covering of strong twine, which is wound about it at nearly right angles to the direction of the twist of the cord by the process called countering. To protect the powder from moisture, the wrapped fuse is immersed in a bath of heated varnish composed of glue, soap, and whiting. Finally, to prevent the surfaces of the fuse from sticking together when coiled they are coated with dry whiting, bran, or powdered soapstone. The fuse described is known as "single fuse" and, as the varnish used is not waterproof, this fuse is only suitable for use in dry ground. In wet ground, a fuse is used which is made by coating the countered cord with tar or resin varnish and then, before the varnish is quite set, countering it with tape and again coating it with varnish. This is known as "taped fuse." When the fuse is to be subjected to especially severe treatment, it is provided with a double coat of twine or thread and is known as "double fuse." The varieties in use are: "common hemp fuse"; "common cotton fuse"; "white fuse"; "superior mining fuse"; "single-taped fuse"; "double-taped fuse"; "triple-taped fuse"; "small gutta-percha"; "large gutta-percha"; "small gutta-percha taped," and "large gutta-percha taped." Running fuse comes in lengths of about 50 feet, and, when properly made, is so uniform in quality that it can be depended upon to burn at the rate of 3 feet per minute. This is important, as it is necessary for the safety of the operator. The fuse should be stored in a dry place so that the powder core may not become damp; and, if so treated, it will retain its efficiency until the varnish has lost all its essential oils and become dusty. Care must be taken not to touch the tape with any oily or greasy matter, as this penetrates through the varnish to the powder core and affects the rate of burning. The fuse should not be roughly handled, as pinching and squeezing alter the rate at which the powder burns. Care should be exercised in opening out a coil which has become stiff through age or exposure to cold weather, for the fuse is then brittle, and if the covering is cracked by sudden and violent unrolling the fuse becomes unfit for use. If there be any doubt as to the behavior of a coil of fuse a piece one foot long should be taken and its rate of burning timed.

Although in firing single charges, safety fuse answers admirably, where several charges are to be fired simultaneously, the safety fuses are connected together by "instantaneous fuses." These consist of a strand of quickmatch enclosed in hemp or flax and several layers of gutta-percha and tape, or of a core of guncotton enclosed in a leaden tube. Besides these nitroglycerin compositions have been proposed by Quentin and Nobel, and one containing mercuric fulminate by Philip Hess.

In naval and military operations, and for simultaneous blasts in mining and quarrying, "electric fuses" are preferred to running fuses. These are gunpowder "igniters" or fulminate "detonators," that are fired by electricity. They are classified as "low tension fuses," designed for use with strong currents of low potential, from primary or secondary batteries, or from dynamo-electric machines; "medium tension fuses," for use with magneto-electric machines which generate currents of medium potential, and "high tension fuses," for use with condensed sparks capable of traversing a sensible air space. The use of the word tension is not warranted by the present condition of electrical science, but it has become technical in this art. To-day, only low tension electric fuses are employed and they are described under DETONATORS (q.v.).

Fuses are employed in ordnance for exploding shell and they may consist of a compressed core of gunpowder enclosed in a tube of wood or metal, or of a fulminating composition or of both. They are known as "nose fuses" when put in the front end or "nose" of the conical pointed shell, or "base fuses" when inserted in the lower end or base of the shell. They are known as "time fuses," when they are planned to burn a certain length of time after they have become ignited, before they set fire to the explosive charge in the shell; "percussion fuses" when they are set in operation by the impact of the shell against an object after it has been projected from the gun. They may act instantaneously in firing the charge in the shell, or there may be a column of compressed powder interposed between the charge of explosive in the shell and the fulminating composition which is fired by impact. As sometimes a second or more intervenes between the striking and the bursting of the shell, these are styled "delayed action fuses." They may be used with armor piercing shells designed to penetrate armor and burst within the ship. In time fuses, used with spherical shell, the powder in the fuse used to be ignited from the flame of the burning charge with which the shell was propelled from the gun. In modern time fuses, there is a metal cylinder which serves as a hammer placed within the fuse case and held in place by brittle pegs of metal, or by a number of small balls. When the shell containing such fuses is fired, the inertia causes the hammer to strip from the pegs and set back toward the base of the shell, or, if it be a shell from a rifled gun, the centrifugal force causes the balls to fly outward and release the hammer. When the shell strikes, and is arrested in its flight, the hammer moves forward, strikes a percussion cap and fires the charge.

"Chemical fuses" have been used in firing gunpowder mines and torpedoes. As an example of these we cite the mixture of cane sugar and potassium chlorate used in the Harvey torpedo. Above a column of this mixture was placed a small glass bulb filled with concentrated sulphuric acid, the whole being enclosed by a soft copper cover projecting from the torpedo. When this cap was struck, it collapsed and broke the glass bulb, and, as the sulphuric acid came in contact with the mixture of sugar and chlorate, the latter burst into flame and ignited the powder in the torpedo. Such fuses have been used by anarchists in infernal machines and they have ascertained the rate at which the acid would eat through sheets of bibulous paper so that by interposing a sufficient number of sheets of paper they could set the train in operation and get safely out of the way before the machine exploded. Fuses, consisting of columns of compressed gunpowder composition, are used in pyrotechny by which to ignite the charges in rockets, bombs, roman candles and other devices. By their use the operator is enabled to get to a safe distance after igniting the device before it functions fully.

Fuses are used in "electrical installations," but these are of an entirely different character from the above. They consist of strips of metal of low fusibility which are interposed, in electric lighting and other circuits, between the generator and the lamp, or other device, to prevent damage to the device by an excess of current. When the load is greater than is desired the current heats the fuse to its fusion point, when it melts and cuts out the circuit. See ELECTRIC FUSES; EXPLOSIVES.

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Fusee, fū-zē', in clock and watch making, is the conical pulley used in connection with the main spring, to equalize the power of the latter, so that the watch may run regularly. The spring coiled within the barrel, when fully wound up and at its greatest tension, draws on the part of the chain wound on the smaller portion of the fusee. The first wheel of the watch or clock is attached to the fusee, and as the latter unwinds by the gearing motion in the watch, the spring also uncoils and loses a part of its tension; as this proceeds, the chain draws on a larger portion of the fusee, and attains an increased leverage on the latter to counterbalance the decreased power of the spring.

Fusel Oil, an injurious and exceedingly objectionable constituent of improperly prepared distilled liquors (q.v.), consisting of an indefinite and variable mixture of amyl alcohol (see AMYL) with certain other alcohols and ethers, and certain organic acids and their esters. Fusel oil always contains amyl alcohol, and usually contains butyl and propyl alcohols also. It comes over in the later parts of the distillate, and may be separated from ethyl alcohol (in large measure at least) by resort to fractional distillation.

Fushimi, foo-shē'mē, Japan, a seaport town in the province of Yamashiro, southern coast of Nippon, on the right bank of the river Uji-gawa, which serves as a trade outlet and depot for Kioto, Otsu, and Nara, and is connected by steam service with Osaka. Pop. (1900) 21,515.

Fusible Metal, any alloy, or metallic mixture, which melts at a comparatively low temperature. (See ALLOY; AMALGAM; BISMUTH; CADMIUM.) Fusible metals are used in the arts for many purposes. Automatic sprinklers, for example, are capped with alloys of this sort, which are chosen so as to have melting points that are higher than any temperature that would normally occur in the room that is to be protected. If a fire breaks out, however, the abnormal rise of temperature so produced causes them to melt, the water in the sprinkler pipes being thereby released, and the fire extinguished. Fusible metals have also been used quite generally in the manufacture of "fusible plugs," for the protection of steam boilers; such plugs being screwed into the boiler at the height which is considered to be the lowest limit to which the water level in the boiler can be allowed to descend with safety. So long as the inner end of the plug is covered with water, the plug itself is thereby kept too cool to melt under the influence of the furnace gases; but when the protecting action of the water is removed by the water level descending below the safety limit, the hot furnace gases melt the material of the plug, and the steam in the boiler escapes. Fusible plugs are excellent appliances, and in fact they are required by law in some of the States. There is no advantage in filling them with an alloy, however, because in any event the alloy must have a melting point higher than that of the steam that the boiler is to generate (365° F., for a gauge pressure of 150 pounds per square inch), and pure tin, with a melting point of 450° F., is entirely satisfactory for the purpose. Indeed, tin is far superior to any alloy for this purpose, because its melting point remains sensibly constant for an indefinite time (so long as oxidation is prevented), while the melting points of alloys that are continuously exposed to heat for considerable periods become quite uncertain, and are often found to be far higher than when the alloy is freshly prepared.

Fusible Plug. See FUSIBLE METAL.

Fusidæ, fū'sĭ-dē, a family of gastropod mollusks, by some conchologists regarded as only a genus (*Fusus*) of the family *Fasciolariidæ*. In either case it is a world-marked group allied to the turban-shells and volutes in structure, but having a long, more or less spindle-shaped, comparatively thin shell, with a very long canal. The animal is closely similar in its soft parts to a whelk or a murex. The family contains the genera *Fasciolaria, Clavella, Latirus*, etc., but interest centres chiefly on the genus *Fusus*, of which many species are known in various parts of the world, and which goes back to Cretaceous time in geological history. North American species are inconspicuous, but some of the several kinds found upon the coast of Great Britain are highly valued by collectors of shells, and constantly sought for by fishermen who bring them up in their dredges from time to time. The "red-whelk" or "roaring buckie" of Scotland is a species (*F. antiquus*) made famous in folklore and by Wordsworth's poem; and it is extensively eaten in various parts of Great Britain and along the continental coast. In Zetland its shell was formerly used by the peasantry as an oil lamp. *F. proboscidialis* is one of the largest of mollusks.

Fusing Point. See MELTING POINT.

Fustel de Coulanges. See COULANGES, NUMA DENIS FUSTEL DE.

Fus'tian, named after Fustat, a suburb of Cairo, where the material originated, is (1) a species of cotton cloth similar to velvet, having, in addition to the warp and weft, a species of pile, consisting of other threads doubled together, which are thrown up in ridges and conceal the groundwork of the fabric. When in the loom, this pile presents the appearance of a set of loops; these are cut in two and sheared down, and when polished and finished, present an evenly ribbed surface on the exterior. The best fustians are known as cotton-velvet and velveteen; besides these there are moleskin, corduroy, and several other kinds. (See WEAVING.) (2) In literature, fustian signifies a forced, bombastic style of writing, abounding with metaphors or other rhetorical figures.

Futa-Jallon, foo'tä zhä-lôṅ', a region of West Africa, in Senegambia. It is extremely mountainous, and remarkable for the romantic beauty of its scenery; and is the source of the rivers Senegal, Gambia, etc. Large herds and flocks are pastured; and the soil produces in abundance bananas and other fruits, besides numerous palm-trees, which furnish dates, wine, and oil. The inhabitants are fanatical Mohammedans. They are governed by an elective chief under French protection. The capital is Timbo. Pop. (1900) 600,000.

Futhark, foo'thôrk, the Runic alphabet which derives its name from the first six letters, *f, u, th, a, r, k*, and is applied to all the systems of phonetic signs of the Teutonic stock, for the same reason as those of classical derivation are called "alphabet" or "abecedarium." They occur in the same order in Old German, Gothic, Anglo-Saxon, and Northern Runes, with a nomenclature in all of them borrowed from trees and other familiar natural objects, suggestive of the derivation of the series of phonetic symbols from a primitive system of pictorial writing. See ALPHABET; RUNIC CHARACTERS.

Fyffe, fīf, **Charles Alan**, English historian: b. Blackheath, Kent, England, December 1845; d. 19 Feb. 1892. He was graduated at Oxford in 1868; and called to the bar in 1876, but never practised. As correspondent of the *Daily News* during the Franco-Prussian war he is said to have sent to that journal the first account of the battle of Sedan that appeared in print. His historical works are distinguished by accuracy and a pleasing, perspicuous style. They include: 'History of Greece' (1875), in a series of 'History Primers'; and the well-known 'History of Modern Europe' (1880, 1886, 1890), covering the period from 1792 to 1878.

Fyles, Franklin, American dramatic critic and author. In 1886 he became dramatic critic of the New York *Sun*. He wrote several successful plays, including the military dramas, 'Cumberland '61,' and 'The Girl I Left Behind Me,' and some works in book form, among them 'The Theatre and Its People,' a popular account of the profession; 'A Ward of France'; 'Drusa Wayne'; etc.

G

G seventh letter of the English alphabet and of other alphabets derived from the Latin. In very early Latin, G stood for the proper g-sound (g hard, as in go) and also for the k-sound of C, as in cup; afterward the k-sound was represented by K, while G continued to represent the sound of G hard; but K did not remain long in the Latin alphabet, being superseded by C (always hard and equivalent to K). Both in Greek and Latin the gamma (Γ, G) was always the hard guttural in whatever situation, and hence *geographia* was pronounced gheographia, *genus* ghenus, etc. The softening of g-hard to j when g precedes e, i, or y, began to prevail in the 6th century of our era, and it persists in the modern languages derived from Latin and in our own. In languages having words derived independently by each from some common stock, for example, the Indo-European languages, the interchange of c-hard, g-hard, k, and the aspirate gutturals ch, gh, is very common; examples: Eng. kin, Lat. *genus,* Gr. *genos;* Gr. *chen,* Ger. *gans,* Eng. goose; Gr. *gnonai,* archaic Lat. *gnosco,* Ger. *kennen,* Eng. ken; Lat. *hesternus,* Gr. *chthes,* Ger. *gestern,* Eng. yester: the same equivalence of g and y is seen in Ger. *gelb,* Eng. yellow; Ger. *gähnen,* Eng. yawn; Ger. *garn,* Eng. yarn. In French words of Teutonic origin an original w is often represented by gu (equal to g-hard), thus Wilhelm becomes *Guillaume;* Ger. *weise,* Fr. *guise;* Teuton *werra,* Eng. war, Fr. *guerre.*

Gabb, William More, American palæontologist: b. Philadelphia 1839; d. 1878. In 1862–5 he was director of the palæontological section of J. D. Whitney's geological survey of California, and later made surveys in Santo Domingo (1868) and Costa Rica (1873). His publications include: Vols. I. and II. of the ‘Geological Survey of California’ (1864); and monographs on the topography and ethnology of Costa Rica and the geology and topography of Santo Domingo in the ‘Transactions’ of the American Philosophical Society and Petermann's ‘Mittheilungen.’

Gabbro, găb'rō, a general name for a large group of evenly crystalline igneous rocks, composed, typically, of plagioclase and pyroxene. Gabbros show by analysis much the same composition as basalts; the silica ranging from 46 to 59 per cent. They may be regarded as plutonic basalts, basalt magmas which have cooled at great depths. Under the general term gabbro, are included anorthosites, abundant in Canada and the Adirondacks, high in silica and composed almost wholly of crystalline labradorite; true gabbros; norites, composed of plagioclase and orthorhombic pyroxene. With decreasing pyroxene and increasing olivine gabbros grade into peridotiles. Gabbros are heavy, dark-colored, usually greenish, rocks. They occur in the Adirondacks, in the neighborhood of Baltimore, Md., and particularly in the highlands along the north shore of Lake Superior, from Duluth to the international boundary. The gabbro near Duluth has this composition: SiO_2 49.15; Al_2O_3 21.90; Fi_2O_3 6.60; FeO 4.54; CaO 8.22; MgO 3.03; Na_2O 3.83; K_2O 1.61. See Basalt.

Gable, the triangular or quadrangular end of a house or other building, from the cornice or eaves to the top, and distinguished from a pediment by this, among other things, that it has no cornices, while a pediment has three. The word is also applied to the highly decorated canopy or screen which in Gothic church architecture rises over some doors or windows. The wall of a house which is surmounted by a gable is called the gable-end. In modern towns the gable-ends of houses are usually at right angles to the line of the street, but in the Middle Ages the reverse was usually the case, the gable-ends being turned toward the street. Many old towns in France, Belgium, and Germany, are still to be seen with this peculiarity, and some even in Britain. In Scotland, a wall separating two houses, and common to both, is called a mutual gable, and according to Scotch law such a gable is the property of the builder, who can therefore prevent the owner of an adjoining property from using the support of his gable, unless he pays half the cost of erecting it.

Gaboriau, Emile, ā-mēl gä-bō-rē-ō, French writer of detective stories: b. Saujon, Charente-Inférieure, France, 9 Nov. 1835; d. Paris 28 Sept. 1873. His early years were a succession of vicissitudes; the army, the law, and even the Church, were in turn the objects of his inconstant attentions till at last when he had already contributed to some of the smaller Parisian papers, he leaped into fame at a single bound with his story ‘L'Affaire Lerouge’ (1866), in the feuilleton to ‘Le Pays.’ It was quickly followed by ‘Le Dossier 113’ (1867); ‘Le Crime d'Orcival’ (1868); ‘Monsieur Lecoq’ (1869); ‘Les Esclaves de Paris’ (1869); ‘La Vie Infernale’ (1870); ‘La Clique Dorée’ (1871); ‘La Corde au Cou’ (1873); ‘L'Argent des Autres’ (1874); and ‘La Dégringolade’ (1876).

Gabriac, Paul Joseph de Cadoine, pōl zhō-zĕf dė kā-dwän gä-brē-äk, Marquis de, French diplomatist: b. Heidelberg, Baden, 1 March 1792; d. Paris 12 June 1865. He was consul-general in New York in 1812-14; appointed minister to Stockholm in 1823; and minister to Brazil in 1826. While in Brazil he induced all the other states in South America to adopt the French maritime law. He was created a peer in 1841, and made a life senator in 1853. His publications include: 'The Question of Brazil' (1829); 'The Republics of South America Considered in Their Future' (1851); 'King Pedro I., Notes and Personal Recollections' (1854).

Ga'briel (Heb. "hero of God"), among the post-exilic Jews, one of the seven archangels (q.v.). In the book of Daniel and in the third gospel he is the messenger and interpreter of God. The rabbins represented him as the angel of death to the Israelites, as Azrael was to the Mohammedans. According to the Talmud he is the prince of fire, who presides over the thunderstorms and the autumnal ripening of fruits. By the command of God he set fire to the temple before it could be burned down by the soldiers of Nebuchadnezzar. According to the teaching of the Koran he is one of the four angels, of which the other three are Michael, Uriel, and Raphael, most highly favored by God, and dictated the Koran to Mohammed.

Gabriel, Brothers of Saint, an order of the Roman Catholic Church in France, founded by the Abbé Deshayes in 1835. Its object was stated as the education of the young, especially deaf-mutes and the blind. In 1880 the order reported 122 elementary schools, 3 boarding schools, 8 schools for deaf-mutes, and 2 for the blind. Its headquarters are at Saint Laurent-sur-Sèvre, La Vendée.

Gabriels, Henry, American Roman Catholic prelate: b. Wannegem-Lede, Belgium, 6 Oct. 1838. He studied classics in the colleges of Audenarde and Saint Nicholas and theology in the Seminary of Ghent, where he was ordained priest, 21 Sept. 1861. He continued his studies at the University of Louvain, from which institution he received the degree of S. T. L. in 1864 and the honorary degree of Doctor in Theology in 1882. When the Theological Seminary of Troy, N. Y., was founded, Dr. Gabriels was one of the four priests sent from Belgium to manage it. He was diocesan examiner for New York and Albany, vicar-general of Ogdensburg and Burlington and one of the secretaries of the Third Plenary Council of Baltimore, the decrees of which he assisted in formulating. For 20 years Dr. Gabriels was rector of Troy Seminary and for nearly 30 years its professor of dogmatic theology, Church history and Hebrew. On 21 Dec. 1891, Pope Leo XIII. appointed him bishop of Ogdensburg and he was consecrated at Albany, N. Y., 5 May 1892. The diocese of Ogdensburg at present (1905) has a Catholic population of about 84,000; 121 priests; 138 churches; 16 parochial schools; 5 hospitals; 2 orphanages, etc. King Leopold of Belgium has recently conferred upon him the decoration of the Royal Order of Leopolds, in recognition of the services he has rendered the Belgium Church and people, particularly by his writings.

Gabriel's Insurrection, an attempted slave rising near Richmond, Va., in 1800, headed by a slave named Gabriel, called also "General Gabriel" and "Jack Bowler." He belonged to a planter named Thomas Prosser, and was about 24; tall, powerful, and noted as a fighter. He drew about a thousand negroes into a plot to attack Richmond by night, massacre the inhabitants, seize the arsenal and arming themselves effectively, rouse a general insurrection. One August night he collected his forces, armed them with scythe blades, and marched toward the city. Meanwhile a negro had disclosed the plot; James Monroe, then governor, had ordered out the militia; a creek in Gabriel's way proved to be unfordable, and hearing that the citizens were in arms, the whole force dispersed to the swamps and woods. They were hunted out, and many hanged, including Gabriel.

Gade, Niels Wilhelm, nēls vĭl'hĕlm gä'dė, Danish composer: b. Copenhagen 22 Feb. 1817; d. there 21 Dec. 1890. In 1841, by his overture entitled, 'Echoes of Ossian,' he gained in Copenhagen the prize of the Musical Union. He was supported during his studies abroad by a royal stipend, and in 1844 was appointed to succeed Mendelssohn in the direction of the Gewandhaus concerts at Leipsic. In 1850 he was appointed musical director to the king of Denmark, and in 1876 received a life pension. His works, which are Mendelssohnian in character, include seven symphonies, several overtures, sonatas, quintets, etc.; a lyrical drama, 'Comala'; a religious cantata, 'The Crusaders'; an opera, 'The Nibelungen'; etc.

Gadfly. See Horsefly.

Gadidæ, găd'ĭ-dē, a family of fishes, the cods, sub-order *Anacanthini* (spineless fishes), with ventral fins attached to the breast or throat. The body is rather long, a little compressed, and covered with small, soft scales; the teeth are in several rows; the gill covers, which are large, have seven rays; the median fins are generally very large, and divided into several portions. They are voracious fishes. They are found chiefly in the depths of the colder seas, and are largely used for the food of man. Fossil remains are rare, but scattered bones have been found as far back as the Eocene. See Cod; Haddock; Ling; etc.

Gadolin, gä'dō-lēn, **John**, Finnish chemist: b. Abo, Finland, 5 June 1760; d. Wirmo, Finland, 15 Aug. 1852. He studied chemistry under Bergman and in 1797 was appointed professor of chemistry in Abo — an office which he held till 1822. He devoted himself to investigations on mineral and metallurgic subjects. But the research for which he is specially remembered was upon a black mineral found in the porcelain feldspar quarry at Ytterby, near Stockholm, by Arhenius, of which an account had been published in 1788. In 1794 he read a paper to the Academy of Sciences, and showed that it contained a new kind of earth. This discovery was subsequently confirmed by Ekeberg, who called the earth yttria, and the mineral gadolinite, after its first investigator. The yttria was afterward shown to be a mixture of several earths.

Gads'den, Christopher, American patriot: b. Charleston, S. C., 1724; d. there 28 Aug. 1805. He was educated in England; returned to the United States in 1741 and later engaged in business in Philadelphia; was a member of the first Colonial Congress which convened in New York in October 1765, and was also a member of the first Continental Congress which assembled in Philadelphia in 1774. He joined the American army as colonel at the beginning of the Revolution, and was promoted brigadier-general in 1776.

Gadsden, James, American diplomatist: b. Charleston, S. C., 15 May 1788; d. there 25 Dec. 1858. He was graduated at Yale College in 1806; served with distinction in the War of 1812; and afterward took part in the campaign against the Seminole Indians. He was appointed minister to Mexico in 1853, and on 30 December of that year negotiated the Gadsden Purchase (q.v.), which fixed a new boundary between Mexico and the United States.

Gadsden, Ala., town and county-seat of Etowah County, on the Gadsden and Attalla Union, the Louisville and Nashville, and other railroads, 60 miles northeast of Birmingham. It is dominated by Lookout Mountain, on the north bank of the Coosa River which gives its name to the rich coal and iron mines in the vicinity. There are several steam-mills which manufacture considerable quantities of yellow-pine lumber. Further industries include steel and wire-nail mills, cotton mills, a pipe works, a car and foundry establishment, a pressed-brick plant, a cotton-seed oil mill and ginnery, and coal and iron interests. There are 15 churches, a national and a state bank, and two newspapers, a daily and a semi-weekly. Pop. (1900) 4,282.

Gadsden Purchase, The, a tract of territory, embracing 45,535 square miles, which was purchased by the United States from Mexico in 1854. This region, which is bounded on the north by the Gila River, on the east by the Rio Grande, and on the west by the Colorado, was acquired by treaty and the payment of $10,000,000, and is now included in the southern part of the Territories of Arizona and New Mexico. It is called the Gadsden Purchase after James Gadsden (q.v.), United States minister to Mexico in 1853, by whom, in December of that year, the treaty of sale was negotiated with Santa Anna (q.v.). Issues growing out of the execution of the treaty of Guadalupe-Hidalgo (q.v.) made this negotiation a matter of great importance, as well as a business of much difficulty. Disputes had arisen concerning the boundary line between Chihuahua and New Mexico, involving the possession of the Mesilla Valley, of which, though claimed by the United States, the Mexicans took armed possession. The 11th article of the treaty, imposing upon the United States the obligation to restrain the Indian marauders on the Mexican frontier, had been neglected, and the reclamations in consequence amounted to between $15,000,000 and $30,000,000. By Gadsden's treaty that article was abrogated and a new boundary was agreed upon, while Mexico also agreed to forego all claims against the United States for damages on account of Indian depredations between the years 1848–53. The settlement of the boundary dispute was considered in this country to be of greater moment than the requisition of the land, which was thought to be of little or no value for cultivation; and it was in the minds of enterprising Americans that through this region the Southern Pacific Railroad, already projected, might find an advantageous route, as in fact it did. In Mexico the transaction was vigorously opposed, and on account of his part in the sale Santa Anna, in 1855, was banished from his country as a traitor. On the part of the United States, the Senate made some modifications in the original treaty and then ratified it. On 10 June 1854 it was finally proclaimed. Consult Haswell, 'Treaties and Conventions.'

Gadsden Treaty. See ANNEXATION; GADSDEN PURCHASE.

Gads'hill, England, a hill near Rochester, on the road from London to Gravesend. It is commemorated in Shakespeare's play, 'Henry IV.,' as the place where Falstaff had his encounter with the robbers, and an inn at the place is called Falstaff's Inn. It is interesting in modern times for Gadshill Place, opposite the hill, which was long the residence of Charles Dickens and was the home in which he died.

Gadski, Johanna, yō-hän'nä gädz'kē, German opera singer: b. Anclam, Prussia, 1871. She received her musical training in Stettin, made her début in opera in New York, and appeared as Brünhilde and in numerous other Wagnerian parts. She made a concert-tour in America in 1898–9.

Gad'wall, or Gray Duck, a migratory wild duck (*Chaulelasmus streperus*) found on all the four continents. It is less in size than the mallard, and mainly black, brown, and white in color. It frequents western marshes in small flocks, but is rare east of the Alleghany Mountains. As a table delicacy it is highly prized.

Gæa, jē'ä, or **Ge,** jē, in Greek mythology, the goddess of the earth. She appears in Hesiod as the first-born of Chaos, and the mother of Uranus and Pontus. She also bore the Titans, Cyclops, Erinyes, Giants, etc. As the vapors which were supposed to produce divine inspiration rose from the earth, Gæa came to be regarded as an oracular divinity; the oracles at Delphi and Olympia were believed to have once belonged to her. Her worship extended over all Greece, black female lambs being offered on her altars. She was also the goddess of marriage, and again of death and the lower world. At Rome Gæa was worshipped as Tellus.

Gaedertz, gĕd'ĕrts, **Karl Theodor,** German poet: b. Lübeck 8 Jan. 1855. In 1880 he obtained a post in the Royal Library of Berlin, of which he became chief librarian in 1900. His poems in Low German include 'Julklapp' (1879) and 'Eine Komödie' (2d ed. 1881). He has also written several valuable monographs on German poets and on the history of German drama, his chief works in this field being 'Goethe's Minchen' (2d ed. 1888); 'Aus Fritz Reutersjungen und alten Tagen' (3d ed. 1899); 'Emanuel Geibel. Ein deutsches Dichterleben' (1897); 'Bismarck und Reuter' (1898); 'Bei Goethe zu Gaste' (1900); etc.

Gæl, gāl, the name of a branch of the Celts inhabiting the Highlands of Scotland, Ireland, and the Isle of Man. Gadhel, or Gæl, is the only name by which those who speak the Gælic language are known to themselves. By way of distinction the Highlanders of Scotland call themselves Gæl Albinnich (Gæls of Albin) and the Celtic population of Ireland call themselves Gæl Erinnich (Gæls of Erin). See CELTS.

Gaelic Language. See CELTIC LANGUAGE.

Gaelic Literature. Although the oldest existing MSS. in Gælic are of no earlier date than the 7th century, there is ample evidence that the literature of the Gaels, not only the traditional but the written literature, is of much greater antiquity. The internal evidence furnished by the ancient sagas, songs and chronicles preserved in mediæval manuscripts indicates a regular development extending from a period antedating by many centuries the beginning of the Christian era, down to a time well within the compass of authentic history. And both the internal and external evidence point to the existence of a written as well as a traditional literature long before the Gæl came into close contact with the civilization of the other nations of Western Europe.

The Gaelic, or Gaedhealg, language is an Indo-European tongue, highly inflected, and rich in beautiful forms and euphonious combinations. It is spoken in Ireland, the Highlands of Scotland and the Isle of Man. Being a Celtic tongue it is akin to the Brythonic group of languages, the Welsh, Cornish and Breton, and to the tongues, now extinct, spoken by the Celtic peoples who occupied central Europe before the extension of the Roman power. The isolation of Ireland insured the development of the language along lines peculiarly its own, unaffected by outside influences. This is true not only of those centuries before the dawn of history, when the language was in the making, but is true also of the later period when momentous changes were stirring the rest of Europe and the modern nations were springing into being out of the fragments of the shattered Roman Empire. This isolation made for the development of a unique language and literature and it resulted, too, in the preservation and development of those peculiar social conditions, the record of which is now shedding light on a period which would otherwise be shrouded in darkness. The development of the language is usually assigned by scholars to three periods: Old Gaelic, from the earliest time to about the end of the 10th century, A.D.; Middle Gaelic, from the 11th to the 17th century; and Modern Gaelic, from the 17th century to the present day.

Though much of the old Gaelic literature came down to mediæval times in the form of oral tradition it must not be supposed that it is on that alone that its history is based. The fact that the earliest writing extant can be traced no further back than the 7th century is far from proving that previous to that time writing was unknown in Ireland. During the 8th, 9th and 10th centuries Ireland, like the other nations of Europe, suffered from the incursions of the Danes and Northmen. These marauders landed on the coast, established themselves in seaport towns, set up their own government and raided the interior. Monasteries were sacked and burned and, as in England, almost every existing book and manuscript was burned at their hands. That such manuscripts and books existed before that time, however, is amply proved. Ireland had at that time been long in touch with the rest of Europe and her schools had supplied teachers and missionaries to the western world for centuries. During the Dark Ages, when continental Europe was plunged in almost universal war, Ireland was the home of the monastic schools, where the learning of the ages was preserved and the arts of writing and illuminating were generously fostered.

The present alphabet, which is a modification of the Roman, was introduced, it is believed, by Saint Patrick when he came in the 5th century to preach Christianity. But the art of writing was known before that. Many inscriptions have been found, especially in the southern counties, in Ogam, a system of writing which was peculiar to the early Irish. This script consisted of a series of short lines, drawn either above, below or through a stem-line. Each group of short lines represented a letter, the letter being indicated by the number and position, some being at right angles and some being at acute angles with the stem-line. This stem-line was generally the angle between two sides of a long upright rectangular stone. The vowels were indicated by very small cuts on the angle of the stone, but much larger than points. The use of Ogam was not confined to monumental inscriptions, for some small metal articles have been found inscribed with it, and the old sagas and chronicles contain many allusions to Ogam writings on poets' staves, the shields of warriors and other articles. With the introduction of the modified Roman alphabet the use of Ogam was practically discontinued, although instances of its occasional use have been discovered. In a Saint Gall manuscript of the 9th century eight Ogam sentences were discovered, and others as late have been commented on by Zeuss, Nigra and others. How Ogam was invented is still a profound mystery, but it is certain that it is peculiar to the Irish Gael and only found where he settled.

The literary form in which the primitive Gaelic genius chiefly found expression was the *sgeul*, or *ursgeul*—the saga or song-story—partly in prose, partly in verse, which recited the deeds of gods and demi-gods and heroes in spirited and dramatic fashion. Of drama, strange to say, no trace can be found in ancient Ireland; there is not a record of even a mystery or a miracle play in the early Christian days. But the romance began early and reached a very advanced stage of development, probably long before the art of writing was known. It took the form of prose narrative, interspersed with flights of spirited and highly imaginative poetry. The 'Book of Leinster,' a MS. of the 12th century, enumerates 187 of these romances and the names of many more are given in the 10th or 12th century tales of Mac Coise. Many of these tales show evidence of accretions during subsequent periods. Some of palpably pagan origin, bear traces of Christian additions, such as the legend of Niul, the ancestor of the Milesians, meeting Moses and the Israelites fleeing from Pharaoh, with the miraculous healing of Niul's infant son by the Hebrew prophet; and the tale of the children of Lir, whose enchantment was to be ended by the ringing of the first Mass-bell in Ireland. But in every instance it is an easy matter to separate the accretions from the original tale and so reconstruct the story in its primitive form.

The value to the antiquarian and student of history of the material thus obtained is incalculable. For these old hero-tales give a vivid picture of the social life of the primitive Celts, a history of the early stages of Celtic civilization, that it is impossible to find elsewhere. For although the entire of central Europe, as well as the British Isles, was peopled by Celtic tribes, the records of their civilization have been obliterated everywhere except in Ireland. The Romans, wherever they planted their standards, introduced their own civilization, wiping out of existence whatever antedated their coming, and their historians, writing of the Roman conquests, measured everything by a Roman standard and found nothing worthy of record in the culture of the barbarian. Hence, practically all record of the continental Celt prior to his subjugation by the Roman has been lost. But the Roman legions never secured a foothold in Ireland, and the Gaelic Celt worked out his own destiny without interference. The record of this development is found in his traditional literature and is proving a mine of invaluable material for the investigator of conditions in ancient Celtic Europe. The most important of these sagas resolve themselves into three distinct groups, representing three periods of the history of the race: The Mythological Cycle; the Heroic, or Red Branch Cycle, and the Fenian or Ossianic Cycle.

The Mythological Cycle.—In the oldest Gaelic sagas the confusion of gods and men is baffling. So thoroughly have the ancient deities been euhemerized that later generations came to look upon them simply as earlier races of inhabitants. These romances tell the story of successive settlements of Ireland. They tell of Partholan and his followers who were the earliest settlers; of Nemedh, who followed and possessed himself of the land; of the Fomorians, who conquered the Nemedians and drove them out; of the return some centuries later of the descendants of a part of the Nemedian force, now known as Firbolgs, to dispute with their former conquerors, and the subsequent return of the descendants of another division of the Nemedians, the Tuatha de Danaans, who in turn became masters of the land, holding it until the coming of the conquering Scots, or Gaels, or Milesians as they are variously called. The saga of the 'Battle of North Moytura' tells of the fight between the Tuatha de Danaans and the Firbolgs, which resulted in the utter defeat of the latter, who were driven into the smaller islands. This story and the story of the 'Battle of South Moytura,' between the Tuatha de Danaans and the Fomorians, abound in descriptions of the marvellous achievements of the heroes and ends in the complete defeat of Fomorians. To this period belongs also the pathetic tale of the 'Death of the Children of Tuireann,' included by Hyde in 'The Three Sorrows of Story-Telling.'

The Red Branch, or Heroic Cycle.—This group of tales deals with the history of the Milesians, the warlike race which finally conquered the island and held it until the coming of the English. Unlike the earlier tales, which palpably treat of a fabulous age and purely mythical persons and events, these romances deal with a world which has an apparent basis of reality, despite the legendary character of many of the events there recorded, and of the heroes who participate in them. The people of this cycle, Cuchulain, Conall Cearnach, Deirdre, Naoise, Meve, Conor mac Nessa, Fergus mac Roigh, though of heroic stature, are yet human; their deeds, and the motives for those deeds, are human; and though the marvellous and the preternatural are found there in as marked a proportion as in the 'Iliad' and the 'Odyssey,' they do not dominate as in the tales of the Mythological Cycle. This group of romances is, without question, the finest in all the ancient Irish literature. The period, which is identified by the annalists with the birth of Christ and the beginning of the Christian Era, is associated chiefly with the long war between Connaught and Ulster arising out of the murder of the children of Usnach. This incident is recorded in one of the most beautiful and pathetic tales in the whole range of ancient story-telling, the tale of 'Deirdre, or the Fate of the Children of Usnach.' Cuchulain, the Ultonian champion, is the great hero of this cycle. Conall Cearnach, Ferdiad and Meve, the warrior-queen, are figures hardly less heroic. The most important of the romances of this group is the 'Tain Bo Cuailgne,' or the 'Cattle-Spoil of Cooley,' a tale that has proved a valuable source of information for the antiquarian from the light it throws on early Celtic life and manners. The 'Death of Conlaoch' is a curious parallel of the story of Sohrab and Rustum.

Fenian or Ossianic Period.—Though Cuchulain is the great hero of the heroic age of the Gael, there is another of a later age who comes closer than he to the popular heart. Fionn, or Finn, mac Cumhail, if one may judge by the affectionate reverence with which his name and the records of his deeds are preserved in peasant lore, is without question the most popular of the traditional heroes. While the wonderful achievements of the elder hero are familiar to the scholar, those of Fionn are known to every unlettered peasant and are embalmed in folk songs and folk tales without number. Moreover, the whole body of Fenian story is intimately bound up in the popular interest. Hyde points out that for a period of from 1,200 to 1,500 years these tales showed a most remarkable instance of continuous literary evolution. Century after century saw accretions in the form of stories and poems about Finn and the Fenians, and there are to-day extant in Gaelic-speaking communities numberless stories that have never been reduced to writing in which Finn is the central figure. This was never, at any time, true of Cuchulain and the Red Branch Cycle. Finn is distinctively the popular hero, the hero who stands in the popular imagination for all that is heroic and patriotic.

Like Cuchulain, he is the central figure of a cycle of romance, almost as important as the Red Branch Cycle. The Fenian Cycle, so-called from the fact that it deals largely with the Fianna, or Irish Militia; or the Ossianic Cycle, from Ossian, or more properly Oisin, the son of Finn, who is credited with the authorship of many of the poems, comes nearer than either of the other cycles to the limits of authentic history. These sagas treat of such historical personages as Conn of the Hundred Battles, Ard-Ri (High-King), whom the annalists assign to the 2d century; his son, Art the Lonely; his grandson, Cormac mac Art (A.D. 227, according to the «Four Masters;»

213, according to Keating); and his great-grandson, Cairbre of the Liffey. Finn, himself, is generally accepted as an historical figure, though much of myth and romance has been woven into his history. The earliest, in point of the chronology of the romances of this period, is the tale of the 'Battle of Cnucha,' in which Cumhail, the father of Finn, is killed by Conn of the Hundred Battles. Thence through a long cycle of romances the many adventures of Finn and his redoubtable band of warriors, Oisin, his son, Oscar, his grandson, Caoilte, the poet, Diarmidh and many another, are related until in the 'Battle of Gabhra,' which closes the series, is told how Cairbre of the Liffey broke the power of the Fenians forever.

The most fascinating, and when everything is considered, perhaps the most meritorious of the Fenian sagas is the 'Pursuit of Diarmidh and Grainne.' Like the story of 'Deirdre,' despite its antiquity the human appeal is almost modern, so close does it come to our own manner of thought. It tells of Finn's suit for the hand of Grainne, daughter of Cormac mac Art, the High-King; Grainne's passion, developed while the negotiations for her hand were in progress, for Diarmidh of the Love-Spot, one of Finn's warriors; the flight of the pair and the pursuit of the vengeful Finn.

Miscellaneous Romances.—Besides the stories of the three main groups above enumerated, there is a considerable number of sagas, some as old as those of the Red Branch Cycle, and some more recent, which cannot well be included under any of these headings. The most important is the 'Bruidhean of Da Derga,' a Leinster tale of the Red Branch period; and others that fall under this same heading are: 'The Dream of Mac Conglinne,' a satire full of an irresistible humor; the 'Voyage of Maelduin' and the 'Battle of Moy Rath.'

Early Christian Period.—With the coming of Christianity came a new phase of Gaelic literature. Saint Patrick and his followers found a soil ready to receive the seed of Christianity. Theirs was a bloodless conquest, and although the Bardic Schools struggled long against the innovation of Christianity they at length succumbed and the subsequent literature of Ireland is thoroughly Christian and largely devotional in tone. Saint Patrick himself was a man of works rather than a man of letters, and yet it is to him that the earliest literature of Christian Ireland and, if we except the Ogam inscriptions the earliest authentic writings now in existence can be traced. Of the 'Canon Phaidraig,' or 'Patrick's Testament,' a MS. copy of the late 8th or early 9th century is still in existence, and this, it has been demonstrated, was made from an older copy in the Saint's handwriting. The authenticity of 'Saint Patrick's Confession,' which, strictly speaking, is not a confession but an apology, has been questioned, but it is vouched for by such eminent authorities as Stokes, Todd, and Hyde. These two works, it is true, are in Latin and might be excluded from a consideration of purely Gaelic literature, but as they are the first literary utterance of Christian Ireland, they are worthy of note, despite the alien tongue in which they are written. This objection, however, does not apply to the 'Epistle to Coroticus' and 'The Cry of the Deer,' two compositions in Gaelic which are also attributed to Saint Patrick. Seachnall, a nephew of the great apostle, is looked upon as the first Christian poet in Ireland, although he, too, wrote in Latin.

Biography, chronicle-history and genealogy make up a large part of the remains of Gaelic literature and, as might be expected from the fervor with which the Irish adopted Christianity, the literature of this period is rich in lives of the saints. It is appropriate, too, that among the earliest we should find lives of Saint Patrick. The 'Book of Armagh' contains two very early biographies. There are many others, but the most important is the 'Tripartite Life,' the MS. of which, written in ancient Gaelic, was discovered by O'Clery, one of the «Four Masters,» early in the 17th century. This «Life» might, perhaps, be more fittingly described as a group of three semi-historical homilies on the life of the Saint. Saint Columcille (521-597), after Saint Patrick the most renowned of the early churchmen, contributed generously to the Gaelic literature of this period. His Gaelic poems voice an ardent patriotism, those written after his exile to Iona especially breathing a passionate love for the land of his birth. The same century that knew Saint Columcille boasts of another great churchman and writer, Saint Brendan the Navigator, founder of the famous abbey and school of Clonfert. Saint Brendan is the reputed author of the 'Navigatio Brendani,' a tale of marvellous romance, the influence of which was felt throughout Europe. MS. copies of it may be found in many monasteries on the continent, and it has been edited and annotated in many tongues. Giraldus Cambrensis (1146?-1220?) alludes to it as being well known in his time. The life of Saint Brendan in the 'Book of Lismore' tells of his setting out in three vessels in search of an isle in the west which was to be a land of promise, probably the Moy Mell and Hy Brassil of the ancient pagan legends.

But it must not be supposed that the making of literature in Ireland was confined to the churchmen. The arts of poetry and prose composition flourished after, as before the coming of Christianity and the race of bards did not die out for many centuries. Notable among those who flourished prior to the period of the Danish incursions was Eochaidh, better known as Dallan Forgaill, a contemporary of Saint Columcille. He was Chief Ollamh of Ireland, a dignity which on his death devolved on his pupil, Senchan Torpeist. Others, equally as important, were Cernfaeladh (c. 678) and Angus Céile Dé, or the Culdee. The 'Saltair na Rann,' a collection of 162 poems in Early Middle Gaelic, giving a rather fanciful account of the creation of the world and the fall of Adam and Eve, was long attributed to Angus, but later research by Whitley Stokes has shown that it could not have been written earlier than 1000.

Danish Occupation to Norman Invasion.—Despite the continual warfare and waste of life and property that marked the two or three centuries of Danish occupation of Ireland, literature and learning flourished. Cormac mac Culinan (d. 908), king, and bishop of Cashel; statesman, ecclesiastic, poet and scholar, is the most eminent figure at this stage of Gælic literary development. 'Cormac's Glossary' is the earliest attempt at a comparative vernacular dictionary made in any language of modern Europe. It is valuable not only as an example of early scholarly effort, but also for the light it throws on pagan customs, on law, history and romance. The 'Saltair of Cashel,' also the work of Cormac, has been lost. Others of lesser fame have left examples of their work, the most noted of them being Cinaeth O'Hartigan, Eochaidh O'Flynn and Mac Liag, bard to King Brian Boroimhe, the monarch who in the decisive battle of Clontarf (1014) defeated the Danes and broke forever their power in Ireland. Mac Liag and Errard mac Coise are credited with the joint authorship of the valuable chronicle, 'The Wars of the Gael with the Gaill' (*i. e.* Norsemen), the accuracy of which has withstood some very remarkable tests of modern scholarship. Clontarf saw the end of the Scandinavian power in Ireland, and the 11th and 12th centuries witnessed a great revival of learning. The industrial arts, architecture, letters all flourished, and it is to this period that we are indebted for the three most important relics of Celtic literature now in existence: the 'Leabhar na h-Uidhre,' the 'Book of Leinster' and the 'Book of Hymns.' Tighearnach, Abbot of Clonmacnois, the great annalist, and Flann, head-teacher of the school of Monasterboice, chronologist and poet, are the most eminent individual figures. Irish scholars travelled to the continent and left the impress of their learning on many a European school.

Arrest of Development and Subsequent Revivals.—With the Norman invasion in 1169 came the arrest of development. Hitherto wars, whether between the septs or with foreign invaders, did no lasting injury to the intellectual or aesthetic development of the race, but with the coming of the Normans began a period of decay that lasted for four centuries. The tradition of poetry was kept alive, but no great names illumine the record, and it is not until the beginning of the 17th century that we find a reawakening of the literary spirit. With this period came the last great outburst of classic Gaelic poetry. Teig mac Daire is looked upon as the last of the classic poets and the greatest of his time, although Lughaidh ua Clerigh, with whom he engaged in a notable controversy («The Contention of the Bards»), is also conspicuous for the merit of his poetry. Others whose work has survived were Teig Dall O'Higin and Eochaidh O'Hussey.

This period, too, saw some of the earliest and most notable achievements in the field of antiquarian research and compilation of annals. Chronicle-history and genealogy had been favorite fields of literary effort for the Gael from the earliest time, but this period brought to the ancient labor the resources of mediæval scholarship and the habit of study bred in the monastery. Among the chroniclers of the 17th century we find men of acknowledged learning and skilled in antiquarian research, such men as Brother Michael O'Clery, the learned Franciscan, who compiled the 'Reim Rioghraidhe' («Succession of Kings») and the 'Leabhar Gabhala' («Book of Invasions»); and who, with O'Mulconry, O'Duigenan and Peregrine O'Clery, compiled that greatest of all mediæval Irish chronicles, the 'Annals of the Four Masters.' This work, covering the whole field of Irish history, legendary and authentic, is the most comprehensive and exhaustive record of the kind in the language. Others equally eminent were Duald mac Firbis, the genealogist; and Geoffrey Keating, theologian, poet and historian, whose 'History of Ireland' is a model of Gaelic prose. Keating, in one sense the greatest of these, was the first to depart from the dialect of the learned, the ancient bardic idiom, and write in a popular style. All his predecessors were learned men writing for the learned few; he, a learned man writing for the many. His history was the most popular book ever written in Gaelic. In his poetry, as in his prose, he was an innovator and was the first to depart from the ancient metres.

The metrical systems of the old bardic schools were intricate and elaborate and, technically, had reached an advanced stage of development centuries before. The underlying principle was not alliteration as in Anglo-Saxon and other Teutonic verse; or quantity as in the metres of the Classic tongues, but a consonantal rime, based on a division of the consonants into groups, any consonant in a particular group riming with any other consonant in that group. The syllables, too, were reckoned, but without regard to stress. It was an intricate system and ease of composition according to it could be acquired only after years of arduous labor over its technicalities. But with the breaking up of the bardic schools in the 17th century came the introduction of a new verse-form in which accent and not syllable was the unit of measure and in which vowel rime took the place of consonantal. The change was almost instantaneous and with the introduction of the simpler form the whole nation seemed to burst into song. The new method was elaborated and developed until the rime affected every accented syllable in the line, with a result that was wonderfully melodious. «The Gælic poetry of the last two centuries both in Ireland and in the Highlands,» says Hyde 'Literary History of Ireland,' 1903, p. 542), «is probably the most sensuous attempt to convey music in words, ever made by man. It is absolutely impossible to convey the lusciousness of sound, richness of rhythm, and perfection of harmony, in another language. Scores upon scores of new and brilliant metres made their appearance.»

Eighteenth Century and After.—The 18th century was a period of persecution, and with the means of education and the opportunities for bettering themselves denied them, the Irish people found an outlet for their feeling only in song. The number of poets produced is almost countless, but a few names, such as David O'Bruadar, John O'Neaghtan, Torlogh O'Carolan, Tadhg Gaoloch O'Sullivan, Donough Mac Conmara, and Brian Mac Giolla Meidhre, are worthy of special mention. But with the 18th century the history of Gaelic literature practically ends. Through the early years of the 19th century the struggle to preserve it was kept up, but the famine, coming as the climax of a long series of calamities, put an end to it. Such men as O'Curry, O'Donovan, Petrie, and

Todd; such societies as the Ossianic Society and the Society for the Preservation of the Gaelic Language, labored for the salvation of the tongue, but it was not until the great popular movement of the last two decades of the century that any real progress was made. The Gaelic League has during that time stirred the nation to a sense of its impending loss and as a result the study of the language has been taken up with enthusiasm not only in Ireland but in the United States, South America and Australia. Although this movement, which is purely popular and patriotic and has for its object the restoration of the language and the literature, is distinct from the scholarly interest shown by such scholars as Zeuss, Zimmer, Kuno Meyer, Windisch, D'Arbois de Jubainville, Whitley Stokes, yet its indebtedness to the researches of these investigators is unquestionable. That indebtedness is greater, however, to men like Dr. Douglas Hyde, Dr. Sigerson, Rev. Eugene O'Growney, Rev. P. J. Dineen, Rev. Peter O'Leary and others, who couple with thorough scholarship an enthusiasm that makes their efforts doubly effective. Dr. Hyde is a poet of undoubted gifts, with a command of Gaelic and the intricacies of its metres as sure as is his command of English, and a prose writer of equal fluency in both languages. Father O'Growney's series of text-books is the standard course in most of the classes, and the others have contributed generously to the product of the new school.

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Gaeta, gä-ā'tä (Cajeta of the Latins), a city and seaport of Italy and one of the most strongly fortified maritime cities of the country, located in the province of Caserta on the Gulf of Gaeta, 74 miles by rail northwest ot Naples. It is picturesquely situated on an abrupt promontory projecting into the Mediterranean and connected with the mainland by a low and narrow isthmus protected by solid walls. On the summit of the promontory stands the circular tower D'Orlando, said to be the ancient mausoleum of Lucius Munatius Plancus, friend of Augustus. Many interesting classic remains have been found in Gaeta, including a fine marble vase by the Athenian scupltor Salpione, the ancient campanile of the Cathedral of Saint Erasmus and the remains of a Roman theatre and a Roman ampitheatre. The citadel, which is of great strength, contains in its tower the tomb of the Constable Bourbon.

The inhabitants of Gaeta derive their chief profits from the fisheries and their coasting-trade in oil, wine, and fruit—principal productions of the surrounding country. Cajeta, ancient name of Gaeta, derived its origin, according to Virgil, from its being the burial-place of Cajeta, the nurse of Æneas. On the dismemberment of the Roman empire, Gaeta became a centre of civilization and commercial prosperity, and gained still more importance after the decadence of the eastern empire. It successively withstood the invasions of the barbarians and the Lombards and Saracens. Both in ancient and modern times, Gaeta has sustained remarkable sieges, and recently it has been the theatre of several interesting events. In 1134 it fell before Roger II. and was annexed to the Norman Kingdom of Sicily. In 1806 it was defended for six months by Prince Ludwig von Hessen-Philippsthal against the forces of Masséna. From 1848-50 it was the refuge of Pope Pius IX., when the revolution at Rome compelled him to retire. In 1860 after the defeat of the Neapolitans on the Volturno by the forces of Garibaldi, Gaeta was the last stronghold of the Bourbon dynasty of Naples, and after a protracted siege lasting from November 1860 to 13 Feb. 1861 Francis II. of Naples surrendered the city to Gen. Cialdini. Pop. about 6,000.

Gaff, in a ship or boat, spar or a sort of boom to which the head of a fore-and-aft sail is bent, such sail having its foremost side made fast by rings to the mast, and its lower edge, in most instances, held straight by the boom proper. The thick end of the gaff is constructed with «jaws» to pass half round the mast, the other half being inclosed by a rope or wire; this serves to keep it close when the sail is hoisted or lowered. The jaws are usually made by fastening two pieces of wood by means of bolts to the thick end of the gaff, the forward side of these pieces being hollowed out in the form of a semicircle so as to fit snug to the mast but sufficiently loose to allow of free play for the hoisting and shifting of the sail. Lately these jaws have been made entirely of metal, chiefly bronze. The after end of the gaff is called the «peak,» because it is usually raised much higher than the jaws when the sail is set. The ropes used in hoisting and lowering the gaff are called «halyards,» the rope for raising the peak being designated the «peak-halyard» and that near the «jaws» or «throat» the «throat-halyard,» «spankers» and «trysails» are the only ones which have gaffs in square-rigged ships, but these gaffs do not ordinarily lower or hoist and in place of jaws have eyelets holding the forward end to the mast or to a traveler working on a batten to the mast. The latter method, however, is preferable as the gaff may be lowered when the sail is reefed.

Gag-rules, a series of rules adopted 1836-44 by the House of Representatives, to prevent the reception of anti-slavery petitions and check the possibility of debate on the subject. No other measure created more virulent debate. The Constitution forbids Congress to pass any law «abridging the right of the peo-

LYMAN JUDSON GAGE

EX-SECRETARY, U. S. TREASURY

ple to petition the government for a redress of grievances," and impliedly to refuse to receive petitions, as an unheard petition is a nullity. From 1831 on, the abolition societies rained petitions on Congress, urging the abolition of slavery in the District of Columbia, over which it had complete legislative power. They were referred to the committee on the District, which at first reported adversely, then ceased to report at all, despite complaints. The 24th Congress, 1835–6, laid them on the table instead; but in both Houses there soon arose an outcry to bar them from congressional cognizance altogether. In the Senate, Calhoun on 7 Jan. 1836 moved not to receive two such petitions, on the ground that the South must in the end be worn out and degraded by having constantly to justify its institutions, before a body which had no jurisdiction over them anywhere; but after two months' debate, it was voted to receive them and they were immediately rejected, which remained the rule thereafter. In the House, on 8 February, Henry L. Pinckney of South Carolina moved that all the petitions be referred to a select committee, under instructions to report that Congress could not constitutionally interfere with slavery in the States, and ought not to do so in the District; on 18 May the committee so reported, with another resolution that all petitions relating to slavery be laid on the table without action or reference. Under the previous question both resolutions were passed 25–26 May; the last 117 to 68, John Quincy Adams refusing to vote and denouncing them as a violation of the Constitution, the rules of the House, and the rights of his constituents. Thereafter Mr. Adams, as the champion of the right of petition, became involved for years in an endless struggle against the "gag." On 18 Jan. 1837 this struggle was renewed. The furious scenes in which Mr. Adams was pitted against nearly all the rest of the House are among the most picturesque in American history. On 21 Dec. 1837, John M. Patton of Virginia moved and secured the passage (122 to 74) of a resolution to lay on the table without debate, reference, or action, all papers concerning slavery in any State, "District or Territory" of the United States. Adams again denounced it and refused to vote. On 11 Dec. 1838 the "Atherton Gag" was moved by Charles J. Atherton of New Hampshire, and passed 126 to 73; it was the same in essence as the others. On 21 Jan. 1840 the House adopted as its 21st Rule that no paper praying the abolition of slavery or the slave trade should in future be received by the House or entertained in any manner. But this only passed by 114 to 108; the refusal of the right of petition was incensing the North, and forcing even Democratic representatives to protest. Thereafter at every session, in adopting the rules, Mr. Adams moved to strike out the 21st; the violence of the assaults on him increased, but the majorities against him decreased. At the special session of 1841 his motion was carried on a motion to adopt the rules only for 10 days, but reconsidered and defeated. Finally, on 3 Dec. 1844 a motion to lay his motion on the table was lost by 104 to 81, and the 21st Rule was abolished by 108 to 80. Nothing of the kind was again attempted. Since 12 Dec. 1853 petitions are no longer presented in the House, but handed to the clerk.

Gage, Frances Dana Barker, American reformer. b. Marietta, Ohio, 1808; d. 1884. In Ohio, and later at St. Louis, Mo., she appeared as a lecturer on total abstinence, women's rights, and anti-slavery, and underwent the many unpleasant experiences then the lot of abolitionists. She served as a nurse in the Civil War, and wrote over the signature "Aunt Fanny."

Gage, Lyman Judson, American financier: b. De Ruyter, N. Y., 28 June 1836. He removed to Rome, N. Y., in 1848, and was educated at the Rome Academy. He worked in the Oneida Central Bank 1853–5, when he went to Chicago, becoming a clerk, and later, bookkeeper and cashier of a planing-mill company. In 1868 he became cashier and in 1891 president of the First National Bank of Chicago. He was the first president of the Board of Directors of the World's Columbian Exposition, and several times president of the American Bankers' Association and the Civic Federation of Chicago. On 5 March 1897 he was appointed secretary of the treasury, by President McKinley; in 1901 was reappointed; resigning in March 1902. He received the degree of LL.D. from the New York University 4 June 1903. He was the originator of the movement for civic reform which started in Chicago under his inspiration and became a national influence. He wrote the platform of the Economic Conferences, a unique feature of Chicago's social organization, where Republican and Democrat, rich and poor, conservative and anarchist, meet for debate and exchange facts and theories.

Gage, Matilda Joslyn, American woman suffragist: b. Cicero, N. Y., 24 March 1826; d. 18 March 1898. She was secretary to the State Woman Suffrage Society of New York in 1869–70, was later for nine years its president, and in 1875–6 president of the National Woman Suffrage Association. She was president of the Woman's National Liberal Union in 1893, published and edited (1878–81) the 'National Citizen,' and wrote a 'Woman's Rights Catechism' (1870); 'Woman as an Inventor' (1871); 'Woman in Church and State' (1893).

Gage, Thomas, English general: b. 1721; d. 2 April 1787. In 1755 he accompanied Braddock's ill-fated expedition as lieutenant-colonel, and as brigadier-general became in 1760 military governor of Montreal, and in 1763 commander-in-chief of the British forces in America. His inflexible character led the government to regard him as well fitted to end the disturbances in the American colonies. In 1774 he was nominated governor of Massachusetts, a post of peculiar difficulty, and his enforcement of the rigorous decrees of Parliament brought matters to a climax. On the night of 18 April 1775 he despatched an expedition to seize a quantity of arms which had been stored at Concord; and next day took place the memorable encounter of Lexington, which announced that the Revolution had begun. The battle of Bunker Hill (q.v.) made him unpopular. For a short time he was commander-in-chief in America, a post he soon resigned to return to England.

Gahnite, gä'nīt, "zinc spinel," is essentially a zinc-aluminate, $Zn\ Al_2O_4$. The variety automolite has this formula; in kreittonnite the zinc is in part replaced by ferrous iron and magnesium, and the aluminum by ferric iron. The variety dysluite is similar except that manganese is present instead of magnesium. Gahnite usually occurs in octahedrons of a black, gray, dark-green, or brown color, with a hardness of 7.5 to 8. Its most important localities are in Sweden, Bavaria, and Sussex County, New Jersey.

Gail Hamilton. See DODGE, MARY ABIGAIL.

Gaillard, gä-yä, **Claude Ferdinand**, French painter and engraver: b. Paris, France, 7 Jan. 1834; d. there 19 Jan. 1887. He was a pupil of Leon Cogniet, and studied painting and engraving at Ecole des Beaux-Arts. In 1856 he gained the Prix de Rome. Among his pictures are: 'The Education of Achilles' (1863); 'St. Sebastian' (1876); 'Christ at the Tomb' (1877), besides several portraits, and some copies of old masters. His principal engraved portraits are: 'Chateaubriand,' 'Monseigneur Bouvier,' 'Count of Chambord,' 'Monseigneur Merode.' 'The Plates of St. Sebastian,' of one of Botticelli's 'Holy Families,' and of the 'Man With the Pink,' of Van Eyck, rank among the masterpieces of modern engraving. Gaillard gained three medals for engraving and one for painting, and was decorated with the cross of the Legion of Honor in 1876.

Gaillardet, gä-yär-dā, **Théodore Frédéric**, French dramatic author: b. Auxerre 7 April 1808; d. Plessis-Bouchard 12 Aug. 1882. He practised law at Tonnerre. He sent a drama to the Porte Saint-Martin, which partly rewritten by Alexander Dumas, the elder, and signed by him, achieved an enormous success as 'La Tour de Nesle,' 28 May 1832. This led to a duel with Dumas, Gaillardet afterward gaining a lawsuit which permitted him to place his name as one of the authors of the piece. He is the author of two other plays, 'Struensee ou le Medecin de la Reine' (1832), and 'Georges ou le Criminel par Amour' (1833). He also wrote from private papers found at Tonnerre, and the archives of foreign affairs, the 'Memoires du Chevalier d'Eon' (1836, new edition 1866). Coming to New York in 1839 he founded the 'Courrier des Etats Unis,' a French newspaper which he edited until 1848 and which is still published. He returned to France later and served on the editorial staff of the 'Presse.'

Gailor, Thomas Frank, American Protestant Episcopal bishop: b. Jackson, Miss., 17 Sept. 1856. He was graduated from Racine College, Wis., in 1876, and from the General Theological Seminary, New York, in 1879. Entering the ministry he was rector of the Church of the Messiah, Pulaski, Tenn., 1879–82; and in 1882 became professor of ecclesiastical history in the University of the South, Sewanee, Tenn. In 1893 he was consecrated bishop-coadjutor of Tennessee, and in 1898, on the death of Bishop Quintard, became bishop of Tennessee. His writings include: 'A Manual of Devotion'; 'The Apostolical Succession'; 'Things New and Old'; 'The Trust of the Episcopate.'

Gaines, Edmund Pendleton, American army officer: b. Culpeper County, Va., 20 March 1777; d. New Orleans 6 June 1849. He was appointed second lieutenant in the Sixth Regiment, United States Infantry, in 1799, in 1805 became collector of customs of the port of Mobile, Ala., and received the rank of captain 1807. Serving through the War of 1812, he became brigadier-general in 1814, commanding at Fort Erie, in August, until wounded. He afterward became brevet major-general; commanded the Southern Military District during the first war against the Seminoles 1817, the Western District 1821, being wounded in the second war with the Seminoles in 1837, and the Department of the Southwest when war was declared with Mexico.

Gaines, Myra Clark, American claimant: b. New Orleans 1805; d. 1885. She was a daughter of Daniel Clark, who emigrated from Ireland to New Orleans and inherited his uncle's property there in 1799. He was supposed to have lived a bachelor, but it was known that he was the father of two daughters by a French woman of great beauty. He died in 1813; his will gave his property to his mother. In 1830 letters were found detailing the circumstances of Myra's birth; in 1832 one that gave an account of a will made by her father in 1813, in which he acknowledged her as his legitimate daughter and bequeathed her all his property. She then began her remarkable litigation, first to establish her legitimacy, then to secure her father's estate. The supreme court of Louisiana pronounced her legitimate and his lawful heir in 1856. Subsequently, the United States Supreme Court decided that the facts of her father's secret marriage in Philadelphia and her own legitimacy were fully established. Then began the struggle to secure possession of the estate. She filed a bill in equity in the United States Supreme Court in 1856, and a favorable decision was rendered in 1867. In 1861 the property in New Orleans was valued at $35,000,000, and previous to 1874 she obtained $6,000,000. Appeals and counter-suits were in progress at the time of her death in 1885. She married W. W. Whitney in 1832, and at his death Gen. Edmund P. Gaines, in 1839.

Gaines' Mill, Battle of. After the battle of Mechanicsville or Beaver Dam Creek, 26 June 1862, McCall's division was withdrawn from the field of its victory, and Gen. Fitz John Porter, with it and the Fifth corps, took up a defensive position near Gaines' Mill, east of Powhite Creek, a small stream flowing into the Chickahominy. Porter's corps and McCall's division, numbering in all about 20,000 infantry and artillery and 2,500 cavalry, were the only Union troops north of the Chickahominy, the rest of McClellan's army being south of it. Porter's line was formed in the shape of a semicircle, its left resting in the low ground near the Chickahominy, with its right bending around south of Old Cold Harbor. The line was naturally strong, and was strengthened by rifle-pits, by felling trees in front of them, and by piling rails and such other material as was at hand. The east bank of the creek was quite high and the slope to the creek was covered with brush and timber. The line covered several of the bridges over the Chickahominy, and through the centre and right ran the roads from New Cold Harbor and Old Cold Harbor to Dispatch Station. Sykes' division of the Fifth corps was on the right, and Morell's division on the left, with McCall's division in reserve. Gen. Cooke, with three small cavalry regiments, watched the left. The line was somewhat too extended for the number of troops Porter had at his disposal, but these were well posted and his artillery placed in good positions, sweeping the ground in front. On 27 June the Confederates advanced upon Porter's position, A. P. Hill and Longstreet from the west, Jackson and D. H. Hill from the northwest. A. P. Hill led the advance from Mechanicsville, and on reaching Powhite Creek, near Gaines' Mill, at noon, Gregg's South Carolina brigade was so stoutly resisted by the 9th Massachusetts, holding an advanced position, that Hill was checked and compelled to deploy a large force to push the Massachusetts men back, which consumed the time until 2 P.M. Meanwhile the other divisions had come up, Longstreet on A. P. Hill's right, Jackson, Ewell, and D. H. Hill in the order named, on A. P. Hill's left. The main battle began a little after 2 o'clock with an impetuous assault by A. P. Hill on Porter's left division, and resulted in the final repulse of Hill with great loss. Longstreet came to his support, Jackson and D. H. Hill closed in on Porter's right, and for nearly two hours Porter's entire line was successively assailed and pressed at every point, but held firm, so firm that Gen. Lee thought that "the principal part of the Federal army was on the north side of the Chickahominy" and "apparently gaining ground." McCall's division was placed in line; all fought well and were admirably handled; but there were not enough of Porter's men long to withstand the energetic and continued pressure of 57,000 Confederates at all parts of the line. At about 4 P.M. Slocum's division of Franklin's corps came on the field from beyond the Chickahominy; its three brigades were separated and disposed of in weak places on the line, and the general attack was repulsed about 5 P.M. A few minutes later another attempt was repulsed, the Union line holding fast and not yielding a foot. The Confederate forces were now all up; Whiting's division had come to the relief of A. P. Hill; and Stuart, with his cavalry and artillery, opened heavily on Porter's right. Gen. Lee now ordered a general advance, which was responded to in a most gallant manner. Porter's lines were fiercely assaulted; parts remained firm, but other parts gave way, and soon all gave back, losing 22 guns and some 2,800 prisoners. Some of the commands fell back in much confusion; others retired in good order, upon the brigades of French and Meagher, of Sumner's corps, which had crossed the Chickahominy, and now assisted in checking the Confederate pursuit. During the night the Union troops crossed to the south side of the Chickahominy, destroyed the bridges behind them and joined the rest of the army in its retreat to Harrison's Landing on James River. The entire number of Union troops engaged was about 34,000; the loss was 894 killed, 3,107 wounded, and 2,836 missing, an aggregate of 6,837. The number of Confederate troops engaged was about 57,000, of whom 8,751 were killed and wounded. Consult: 'Official Records,' Vol. XI.; Webb, 'The Pininsula'; 'McClellan's Own Story'; the Century Company's 'Battles and Leaders of the Civil War,' Vol. II.

E. A. CARMAN.

Gainesville, Fla., city and county-seat of Alachua County, on the Gainesville and Gulf, the Florida Central and Peninsular, and other railroads, 60 miles southwest of Jacksonville. Owing to its temperate climate it is a favorite invalid winter resort. Its industrial interests are chiefly agricultural; fruit growing, especially oranges, is largely carried on. Pop. (1900) 3,633.

Gainesville, Ga., city and county-seat of Hall County, on the Gainesville, and the Richmond & Danville R.R.'s, 53 miles northeast of Atlanta. From its situation at the summit of the Chattahoochee ridge, and owing to the numerous mineral springs in the vicinity, it is a much-frequented health resort. The educational establishments include Gainesville College and the Georgia Seminary. There are milling industries and manufactures of machinery and cars, and the city owns its electric lighting plant and waterworks. Pop. (1900) 4,382.

Gainesville, Texas, city and county-seat of Cooke County, on the Missouri, K. & T., and the Gulf, C. & S. F. R.R.'s., 65 miles north of Fort Worth. This is the centre of an important agricultural and stock-raising district. It has large meat-packing establishments and manufactures of flour, foodstuffs, cotton-seed oil, carriage works, hide and leather factories, and pressed-brick works. The town was first settled in 1851, and was incorporated in 1873. It was governed under a new charter in 1879 with a mayor and council elected by popular vote every two years. Pop. (1900) 7,874.

Gainsborough, gănz'bŭr-ō, **Thomas,** English painter: b. Sudbury, Suffolk, May 1727; d. London 2 Aug. 1788. He was the son of a wool manufacturer, and was educated under his uncle in the grammar-school of his native town. His artistic genius early displayed itself, and for a time he studied art in London under the French engraver Gravelot, and afterward under Frank Hayman. He married at 19, and in 1760 took up his residence in Bath, where he soon acquired a leading position as a portrait painter. He sent pictures to the exhibitions of the Society of Artists from 1761 to 1768, and in the latter year was elected one of the original members of the Royal Academy. He contributed to the Academy exhibitions during the period 1769–72, and again, after an interval of estrangement from Sir Joshua Reynolds, from 1777 till 1783. The pictures shown during the first of these periods comprised some landscapes and numerous portraits, among them those of Garrick (two), the Duke of Argyll, and Lord Nugent. Owing to a quarrel with his friend and patron, Philip Thicknesse, he left Bath for London in 1774, and in the metropolis his fame rapidly increased. Among the pictures exhibited at the Academy after his arrival in London none is more celebrated than the 'Blue Boy' (1779), said to have been painted to refute a statement made by Sir Joshua Reynolds in one of his discourses. Among portraits painted during this period are those of the Duchess of Devonshire, Duchess of Cumberland, Duke of Argyll, Gen. Conway, Sir Bate Dudley, George III. and his queen, Bishop Hurd, the Prince of Wales, Col. St. Leger, Lord Cornwallis, the Princess Royal, and other members of the royal family. Owing to a quarrel about the hanging of some pictures he never exhibited at the Academy after 1783. Before his death he was reconciled to Sir Joshua Reynolds. Among his other works the following should be mentioned: portraits of Mrs. Siddons, Hon. Mrs. Graham, Pitt, Blackstone, Johnson, Sterne, Richardson, Clive, Burke, Canning, Franklin, besides others; 'The Market Cart'; 'The Watering Place'; 'The Brook'; 'Rustic Children'; 'The Cottage Door'; 'Cows in a Meadow'; 'Gainsborough's Forest'; and other fine landscapes. Both in portrait painting and in landscape painting he is one of the greatest of English masters. A portrait by him of the Duchess of Devonshire was sold in 1876 for £10,605, and was immediately thereafter stolen, not being recovered until 1901 (in the United States). Consult: 'Lives,' by Fulcher (1856); Brock-Arnold (1881); Bell (1897); Wedmore, 'Studies in English Art,' first series (1878); Armstrong, 'Gainsborough and His Place in English Art' (1898); Chamberlain, 'Gainsborough' (1903).

Gairdner, gärd'nėr, **James**, English historian: b. Edinburgh 22 March 1828. At 18 as a clerk he entered the 'Public Record' office in London, where he became assistant keeper in 1859. He has distinguished himself by the rare combination of profound erudition, patient accuracy, and judicial temper which he has shown in the editing of a long series of historical documents: 'Memorials of Henry VII.' (1858); 'Letters and Papers Illustrative of the Reigns of Richard III. and Henry VII.' (1861–3), in the Rolls series; the continuation from Vol. V. onward of the late Prof. Brewer's 'Calendar of Letters and Papers, Foreign and Domestic, of the Reign of Henry VIII.' (9 vols. 1862–86); and 'Historical Collections of a London Citizen' (1876), and 'Three Fifteenth-Century Chronicles' (1880), for the Camden Society series. Equally valuable are the books addressed to a wider audience: an edition of the 'Paston Letters' in Arber's series (1872–5); 'The Houses of Lancaster and York,' in 'Epochs of Modern History' (1874); 'Life and Reign of Richard III.' (1878); 'England' in 'Early Chroniclers of Europe' (1879); 'Studies in English History' (1881), a series of essays written in conjunction with Spedding; and 'Henry VII.,' 'Statesmen' series (1889).

Gairdner, Sir **William Tennant**, Scottish pathologist: b. Edinburgh 8 Nov. 1824. He was graduated M.D. at Edinburgh in 1845, and from 1862 until his retirement in 1900 occupied the chair of practice of medicine in Glasgow University. Among his published books are: 'Pathological Anatomy of Bronchitis and Diseases of the Lungs' (1850); 'Notes on Pericarditis' (1861); 'Clinical Medicine' (1862); 'Public Health in Relation to Air and Water' (1862); 'On Some Modern Aspects of Insanity: Lectures to Practitioners' (1888); 'The Physician as Naturalist' (1889).

Gaisford, Thomas, English scholar and Greek philologist: b. at Ifort, Wiltshire, England, 22 Dec. 1779; d. 2 June 1855. He was educated at Christ Church, Oxford, took orders in the Church, and in 1811 was appointed regius professor of Greek in the University of Oxford. In 1831 he became dean of Christ Church, remaining such till his death, and in 1847 rector of Westwell and curator of the Bodleian Library. He was a prolific writer, his principal works being: 'Hephæstronis Enchiridion de Metres' (Oxford 1810; Leipsic 1832); 'Poetæ Græci Minores' (1814–20, 4 vols.); 'Stobæi Florilegium' (1822, 4 vols.); 'Herodoti Historiæ' (1824); 'Sophoclis Tragædiæ' (Oxford, 1826, 2 vols.; Leipsic 1827, 8 vols.); 'Suidæ Lexicon' (1834, 3 vols.); 'Parænuographi Græci' (1836); 'Scriptores Latini rei Metricæ' (1837); 'Entymologicum Magnum' (1848); and 'Eusebii Demonstratio Evangelica' (1852, 3 vols.). He was elected a member of the Institute of France, and in 1856 the Gaisford prize, for Greek composition, was founded at Oxford in his memory.

Gaius, gā'yŭs, the name of several persons mentioned in history: (1) A Roman general, the son of Marcus Agrippa and Julia, daughter of Augustus Cæsar. He was adopted by Augustus and distinguished himself as a soldier during the 1st century B.C., having reduced Armenia and routed Tigranes. (2) A Roman jurist who lived 130 to 180 A.D. Before the revision of the Roman law and the reform of legal studies by Justinian, the 'Institutes' of Gaius, afterward the groundwork of the 'Institutes' of Justinian, were the received text-books of the schools of law. Almost completely lost until 1816, their discovery at Verona by Niebuhr threw a flood of light on the history of the early development of Roman law. (3) A Christian controversialist of the 3d century. He regarded the Epistle of Saint Paul to the Hebrews as apocryphal, and was the first who wrote against Cerinthus and the Millenarians. (4) Gaius, Saint, bishop of Rome, 283 to 296; d. 21 April 296. A native of Dalmatia and nephew of Diocletian, he suffered many hardships during the first persecution of the Christians by the emperor.

Galabat, gä-lä-bät', or **Kalabat**, Africa, a small district situated near the western frontiers of Abyssinia. The people, some 20,000 in number, and fanatical Mohammedans, trade with Abyssinia in coffee, cotton, hides, and beeswax. The district contains about 1,500 square miles.

Galac'tic Circle, the great circle of the heavens which coincides best with the course of the Galaxy or Milky Way. According to Sir John Herschel, the north pole of this great circle is situated approximately in right ascension 12 hours 47 minutes, and declination $+27°$, the circle crossing the equator at the points whose right ascensions are about 6 hours 47 minutes and 18 hours 47 minutes. See Galaxy.

Galac'tin, or **Galactine**, in chemistry, a nitrogenous substance obtained from milk by first precipitating the casein with acetic acid; coagulating the albumen by boiling, removing the fat by ether, concentration, filtration from earthy phosphates, allowing the milk-sugar to crystallize out, and finally precipitating the galactin by alcohol. Thirty-five parts of dried milk yield one part of galactin, which is soluble in water, insoluble in alcohol and ether. It is precipitated by tannin, but differs from gelatine in redissolving at 60°. Galactin emulsifies fat. It is found in the blood, gastric juice, animal membranes, milk, eggs, and many morbid animal fluids. It also exists in the juices of edible plants and in the fluid of the embryonal cotyledons.

Galago, ga-lā'gō, a genus of African lemurs (q.v.), arboreal and nocturnal in habit, living on fruit and insects. They vary from the size of a rabbit to that of a rat, are covered with soft fawn-gray woolly fur, have somewhat bushy tails longer than the body, and hind legs longer and stronger than the arms, with two of the ankle bones (*calcaneum* and *navicular*) greatly elongated. The head is round like a cat's; the eyes are large with oval pupils contracting in daylight to vertical slits; the ears are naked and very big, expanded during activity, but rolled together when the animal rests. The female is said to bear one young one at a birth, and often carries it about. Soft nests are also made in the branches. The galago proper (*G. senegalensis*) seems to be distributed throughout tropical Africa, and is known in Senegal as "the gum animal" from its frequent habitat in mimosa or gum-acacia forests, and from its alleged habit of gum-chewing. It is said to be eaten there. The largest species (*G. crassicaudatus*) measures a foot in length, not including the bushy tail, which is 15 or 16 inches more. In Zanzibar the komba (*G. agisymbanus*) is said frequently to make itself intoxicated with palm-wine, so that it falls from the tree and gets caught. It is readily tamed and utilized to catch insects and mice in the houses. There are numerous species, and the Madagascar genera *Chirogale, Microcebus* and *Opolemur* are joined with it in the sub-family galaginæ. Consult Beddard, 'Mammalia' (1902).

Gal'ahad, Sir, the noblest of the Knights of the Round Table, of whom he alone was successful in the search for the Holy Grail. He was introduced into the Grail legend by Walter Map (q.v.). See Grail; Round Table, Knights of.

Gal'angal, a dried rhizome obtained from different species of *Alpinia* growing in the East. What is known as the lesser galangal is brought from China. It occurs in small pieces, cylindrical and forked, striated, and diversified with whitish rings; the outside is brown, the inside paler. It has an aromatic taste and odor, and is an agreeable substitute for ginger in dyspepsia. It yields an oil and a soft resin, but its chemical composition is not settled. The larger or Java galangal is coarser, and is not so strongly aromatic. The rhizome of *Alpinia officinarum* has been used in medicine as a stimulant aromatic.

Galan'thus. See Snowdrop.

Galápagos (găl a pā'gŏs) **Archipelago,** a group of volcanic islands in the Pacific Ocean, belonging to the Republic of Ecuador. (For population, etc., see Ecuador.) Features of wholly exceptional interest in the natural history of the archipelago were noted by Charles Darwin in his 'Journal of the Voyages of the Beagle,' which forms the basis of the present description. The archipelago consists of 10 principal islands, of which 5 much exceed the others in size. They are situated under the equatorial line, and between 500 and 600 miles to the westward of the coast of Ecuador, and directly south of Guatemala. The constitution of the whole is volcanic; with the exception of some ejected fragments of granite every part consists of lava, or of sandstone resulting from the attrition of such materials. The higher islands (which attain an elevation of 3,000 to 4,000 feet) generally have one or more principal craters toward their centre, and on their flanks smaller orifices. There are, in all the islands, at least 2,000 craters. Though the islands are placed directly under the equator, the climate is not in all parts of them excessively hot; a circumstance which is owing to the singularly low temperature of the surrounding sea. Very little rain falls, except during one short season, but the clouds generally hang low; therefore the summits, at an elevation of 1,000 feet or more, possess a tolerably luxuriant vegetation, while the lower parts of the islands are extremely arid. On a part of Chatham Island, black cones, the former chimneys of the subterranean heated fluids, are so numerous and in form so regular that they give the country a "workshop" appearance, which strongly reminded Mr. Darwin of the great iron foundries of Staffordshire. All the craters on Chatham are extinct, but on the western islands "the volcanic forces were in frequent activity." Charles Island was frequented by buccaneers and whalers long before Ecuador established a small penal colony there (1829–30). The soil of the elevated portions of that island is fertile black mud; the climate of the same regions is tempered by a cool southerly tradewind; and wild pigs and goats are found in the woods, "but the main article of animal food is derived from the tortoises"— which sometimes weigh 200 pounds each. On both Albemarle and Marlborough islands, eruptions occasionally take place. Of the former, Mr. Darwin writes: "I should think it would be difficult to find in any other part of the world an island situated within the tropics, and of such considerable size (namely, 75 miles long), so sterile and incapable of supporting life." On James Island there is a lake from which salt is procured. The equatorial heat was observed in its effect upon the soil of the lower and sterile parts. There the thermometer placed in sand of a brown color immediately rose to 137°, and black sand was so much hotter that it was disagreeable to walk over, even in thick boots. An acacia, a cactus, and one of the euphorbiaceæ — a bush with minute brown leaves — are common in some parts of these lowlands. Near the summits the vegetation has a very different character; ferns and coarse grasses are abundant; and the commonest tree is one of the Compositæ. There are no members of the palm family. "The natural history of this archipelago," Mr. Darwin says, "is very remarkable. It seems to be a little world within itself; the greater number of its inhabitants, both vegetable and animal, being found nowhere else." And again, "In my collections from these islands there are 26 different species of land birds. With the exception of one, all probably are undescribed kinds, which inhabit this archipelago and no other part of the world." The order of reptiles forms the most striking feature in the zoology of the islands, the species not being numerous, but the number of individuals of each kind extraordinarily great. There is one kind both of the turtle and tortoise; of lizards four; and of snakes about the same number. Of the tortoise (*Testudo Indicus*) some old males have been found so large that it required six or eight men to lift them from the ground. Mr. Darwin says: "I frequently got on their backs, and then, upon giving a few raps on the hinder part of the shell, they would rise up and walk away; but I found it very difficult to keep my balance. The tortoise is very fond of water, drinking large quantities, and wallowing in the mud. The larger islands alone possess springs, and these are always situated toward the central parts, and at a considerable elevation. The tortoises, therefore, which frequent the lower districts, when thirsty, are obliged to travel from a long distance. Hence broad and well-beaten paths radiate off from the wells even down to the seacoast. Near the springs it was a curious spectacle to behold many of these great monsters: one set eagerly traveling onward with outstretched necks, and another set returning, after having drunk their fill." Mr. Darwin inclines to the opinion that the Galápagos islands are the original home of the *Testudo Indicus*, though it is now found in many parts of the world. Also characteristic of this archipelago are the lizards, individuals of the aquatic variety, being 3 or 4 feet long. Many of the islands possess trees, plants, and birds, which do not occur on the others. At the date of Mr. Darwin's visit the birds had not learned to fear man. He writes: "A gun is here almost superfluous; for with the muzzle of one I pushed a hawk off the branch of a tree."

MARRION WILCOX.

Galata, gä'lä-tä, a suburb of Constantinople (q.v.).

Galatea, găl-a-tē'a, in mythology, daughter of Nereus and Doris. The Cyclops Polyphemus persecuted with his love this charming nymph, though he gained nothing but ridicule in return. The handsome shepherd Acis, of Sicily, enjoyed her affection, and suffered death on her account; for Polyphemus, finding them together, and mad with jealousy, hurled a rock at them, which dashed Acis in pieces, while Galatea escaped into the sea. Acis was transformed into a fountain, and hastened to meet his mistress in a safer region.

Galatia, gā-lā'shĭ-a, Asia Minor, the ancient name of an extensive region, so called from its Gallic inhabitants, who were immigrants from Europe. With the Gauls were intermingled a considerable proportion of Greeks; hence the inhabitants were often called Gallo-græci, as well as Galatians.

Gala'tians, Epistle to the, one of the epistles of St. Paul, the genuineness of which has never been questioned by a critic of the first rank. The internal evidence is incontrovertible. No forger would have ventured on the admissions made by the writer; no false Paul would have allowed that Paul's apostleship was doubted and his successes discredited. The occasion of the letter seems to have been as follows: At his first visit St. Paul experienced a most favorable reception from the Galatians, who exhibited a strong personal attachment to him (Gal. iv. 14). After his departure the judaizing teachers commenced their work, and on the Apostle's second visit he found the noxious influence taking effect. During his short sojourn he endeavored, by oral instruction, to meet the evil; but learning after his departure to Ephesus that his converts were again lapsing from the faith, he addressed to them this indignant warning. This epistle has been often commented upon. Consult: Winer (1829), Ruckert (1833), Usteri (1833), Meyer (1851), Ellicott (1867), Lightfoot (1887), Findlay (1889), and Drummond (1893).

Gal'ba, Servius Sulpicius, Roman emperor: b. 3 B.C.; d. 15 Jan. 69 A.D. Caligula appointed him general in Germany. He soon repulsed the Germans who had invaded Gaul, and restored the ancient military discipline. After the death of Caligula he caused his troops to swear allegiance to Claudius, who sent him in 45 A.D. as proconsul to Africa, where great confusion prevailed. In two years Galba restored order, obtained the honors of a triumph, and was received among the priests of Augustus. Nero appointed him in 61 A.D. governor of Hispania Tarraconensis, but soon after became so exasperated against him that he ordered him to be secretly assassinated. Galba then revolted, but when news arrived of the insurrection among the prætorians at Rome, and of the death of Nero, 68 A.D., he himself was chosen emperor by the prætorian cohorts in Rome. Ambassadors from the senate made known to him his elevation. He chose a colleague in the government under the name of an adopted son, but instead of Otho, favored by the soldiery, he selected Piso Licinianus, hated by them on account of his rigid virtue. Otho, offended by this neglect, resolved to get possession of the throne by force of arms. The prætorian cohorts first declared themselves in his favor, and Galba, attempting in vain to restore order, was attacked and slain.

Gal'banum, a gum-resin obtained from *Ferula galbaniflua* and allied plants, used in medicine as a carminative and expectorant, and externally as an irritant.

Gale, a tree. See CANDLEBERRY.

Gale College, a coeducational institution in Galesville, Wis., founded in 1844 under the auspices of the Presbyterian Church. It has 10 professors and instructors; 120 students; volumes in the library, 10,000; productive funds, $20,000; benefactions, $2,000; grounds and buildings valued at $30,000; income, $4,500; number of graduates, 700; president, William D. Thomas.

Ga'len, or Claudius Galenus, Greek physician: b. Pergamus, Mysia, 131 A.D.; d. Sicily about 201 A.D. He began the study of medicine at Pergamus, and afterward studied at Smyrna, Corinth, and Alexandria. On his return to his native city in 158 he was appointed physician to the school of gladiators. Six years later he went to Rome, where he stayed four years, and gained wide reputation. Scarcely had he returned to his native city when he received a summons from the Emperors M. Aurelius and L. Verus to attend them in the Venetian territory, and shortly afterward he accompanied them to Rome. There he remained several years, though how long is not known precisely, and about the end of the 2d century was employed by the Emperor Severus. Galen was a voluminous writer not only on medical, but also on philosophical subjects, such as logic, ethics, and grammar. The works that are still extant under his name consist of 83 treatises, acknowledged to be genuine; 19 whose genuineness has been questioned; 45 undoubtedly spurious; 19 fragments; and 15 commentaries on different works of Hippocrates. His most important anatomical and physiological works are: 'Of Anatomical Administrations' and 'Of the Use of the Parts of the Human Body.' As an anatomist, he combined with patient skill and sober observation as a practical dissecter — of lower animals, not of the human body — accuracy of description and clearness of exposition as a writer. He gathered up all the medical knowledge of his time and fixed it on such a firm foundation of truth that it continued to be, as he left it, the authoritative account of the science for centuries. His physiology does not, according to modern ideas, attain the same level of scientific excellence as his anatomy. He seems to place a more implicit faith in amulets than in medicine, and he is supposed by Cullen to be the originator of the anodyne necklace which was so long famous in England. The best modern edition of Galen's works is by Kühn (1821–33).

Galena, Ill., a city and county-seat of Jo Daviess County, a port of entry on the Galena River, and on the Illinois C.; Chicago, B. & Q., and the Chicago & N. W. R.R.'s, 17 miles from Dubuque. Galena is famous as the home of Gen. U. S. Grant (q.v.) from May 1860 until the opening of the Civil War, and the old Grant homestead still remains one of the attractions of the city. There is here Grant Park, a fine statue of Gen. Grant, a United States customs house, government building, and a public library. The city has an extensive trade by rail and river, and is the centre of large lead and zinc mining interests. There are also smelting works, shoe factories, and other industries. The town, which was named after the galena ore found in the vicinity, was settled in 1827 and incorporated as a city in 1839. The mayor and council are elected every two years. The city owns its electric light plant. Pop. (1900) 5,005.

Galena, Kan., a city in Cherokee County, on the Kansas City, Ft. S. & M., and the St. Louis & S. F. R.R.'s; 7 miles west of Joplin, Mo. It is noted principally for its remarkable growth during 10 years, 1890 to 1900. Like its namesake in Illinois, Galena is engaged largely in lead and zinc mining and smelting. The mining district, about 4 miles square, has 200 concentrating mills, and gives employment to 3,000 men. Over $5,000,000 in ore was mined in 1900. The mayor and council are elected every two years. The deputy marshal and police are appointed by the council. Galena was settled and incorporated in 1877, and its population rapidly increased, as follows: (1880) 1,463; (1890) 2,496; and (1900) 10,155.

Galena, a sulphide of lead (PbS), containing when pure 86.6 per cent lead. It crystallizes in the isometric system, commonly in cubes or cubo-octahedrons, but is often found massive with a well-marked and characteristic cubic cleavage. It has a metallic lustre and lead-gray color. Its hardness is 2.5 and its specific gravity 7.5. Galena is the most important ore of lead, nearly all the world's supply of that metal being obtained from it. As it is always more or less argentiferous the mineral is frequently an important silver ore, the amount of silver present sometimes amounting to over 1 per cent, but galena containing less than 1 per cent silver is often mined as a lead-silver ore. The mineral is widely distributed, frequently being associated with the sulphides of iron, copper, or zinc, and often with native gold. The principal mines working deposits of galena in the United States are in Missouri, Colorado, Idaho, Utah, and Montana. See LEAD; SILVER.

Galenists, gā'lĕn-ĭsts, a religious sect founded by Galen or Galenus Abrahans de Haan. They were a branch of the Mennonites. Galen was a doctor of medicine and a minister among the Mennonites at Amsterdam. He taught freer doctrine in practice and belief than his co-religionists, declaring that the Christian religion was not so much a body of truths to be believed as of principles to be obeyed. His enemies accused him of having Socinian proclivities, a charge from which the States-General acquitted him 14 Sept. 1663.

The term was also in medical controversy during the Renaissance to mean a follower of Galen, whose authority as a physician they maintained against the introduction of new chemical methods into the preparation of medicinal drugs. The new school professed to extract essences, or quintessences, and like modern homœopathists gave doses small in bulk, but alleged to be powerful in effect, as containing a concentrated preparation of the original drug. The Galenists adhered to the ancient tinctures and extracts, which, they maintained, possessed all the virtues necessary.

Galerites, găl-ẹ-rī'tēz, a genus of fossil sea-urchins, peculiar to and abundant in the Cretaceous system. The body in breadth is nearly circular or polygonal. The under surface is entirely flat, and has the mouth placed in its centre, with the vent near the margin. There are five avenues of pores reaching from the mouth to the summit. These fossils are often found silicified. *G. albogalerus* is one of the most abundant; it has received its specific name from its resemblance to the white caps worn by the priests of Jupiter.

Galerius, gă-lē'rĭ-ŭs, or **Galerius Valerius Maximianus**, Roman emperor: b. near Sardica, Dacia; d. 311 A.D. Entering the imperial army, he rose rapidly to the highest ranks. In 292 Diocletian conferred on him the title of Cæsar and gave him his daughter in marriage. On the abdication of Diocletian (305) he and Constantius Chlorus became joint rulers of the Roman empire, Galerius taking the east half. When Constantius died in York (306) the troops in Britain and Gaul immediately transferred their allegiance to his son, Constantine (afterward Constantine the Great). Galerius, however, retained possession of the East till his death.

Gales, Joseph, American journalist: b. Eckington, England, 10 April 1786; d. Washington, D. C., 21 July 1860. He came to the United States with his father in 1793, was educated at the University of North Carolina and learned the printer's trade of his father. In 1807 he was made assistant and later partner of Samuel Harrison Smith in the management of the 'Independent Gazetteer,' which had been removed to Washington and its name changed to the 'National Intelligencer.' He became sole editor of that paper in 1810, and took his brother-in-law, William Winston Seaton, into partnership in 1812. Had it not been for the industry of Gales and Seaton an important part of the proceedings of the Senate and House of Representatives, which they reported, would not have been preserved. Especially is this true of the great debate between Hayne and Webster.

Galesburg, Ill., a city and county-seat of Knox County, on the Atchison, T. & S. F.; the Chicago, B. & Q., and Chicago & N. W. R.R.'s, 43 miles northeast of Burlington, Iowa. This is the seat of Knox College, founded in 1837, where took place the famous Lincoln-Douglass debate in 1859. Lombard University (Universalist) was established here in 1852, and the St. Joseph Academy and the Ryder Divinity School are also located here. There is a public library containing 24,000 volumes. The Burlington railroad shops give employment to many mechanics, and there are extensive stock-yards, brick-making plants, boiler and engine works, farm machinery works, and carriage factories. Under a general State law, passed in 1872, the mayor and city council are elected every two years, and the smaller offices are filled by appointments made by the mayor with consent of the council. The town was settled in 1837 by pioneers from New York State, and named in honor of Rev. George W. Gale, who planned to establish a theological seminary here. During the Kansas-Nebraska struggle Galesburg was a rendezvous and rallying point for the free-soilers. The city was chartered in 1857. The municipality owns and operates its electric light and water plants. Pop. (1900) 18,607.

Galesville, Wis., a village in Trempealeau County, on the Chicago & N. R.R.; 15 miles east of Winona. It is the seat of Gale College (Presbyterian). Pop. (1900) 862.

Gali, Francisco, frän-thēs'kō gä'lē, Spanish navigator: b. Seville 1539; d. Mexico City 1591. He sailed from Acapulco in 1585 with two vessels, under commission of Pedro Moya de Contreras, provisional viceroy of New Spain, to look for a harbor on the coast of California where ships returning from the East Indies might be restocked with provisions. He visited the Philippines, Macao, the Lin-Kins, Japan, and other islands, and on his return (1584) discovered what is now the Bay of San Francisco. The report of the voyage sent by him to the viceroy of the Indies was published by Linschot in a Dutch rendering in 'Track Charts of the Indies' (1596), and an English translation appears in Hakluyt's 'Voyages.' In the National Library, Mexico, are fragments of what is believed to have been a more extended narrative by Gali. He was a skilful navigator and acute observer.

Galicia, gă-lĭsh'ĭ-a, Austria, a crownland or province of Austria, composed of the kingdoms of Galicia and Lodomeria, the duchies of Auschwitz and Zator, and the grand-duchy of Cracow, and formerly including the duchy of Bukowina. It is bounded on the north, northeast and east by Russia, southeast by Bukowina, south by Hungary, and west by Moravia and a small portion of Prussian Silesia; area, 30,307 square miles; pop. (1900) 7,315,939. The physical features of the country are determined by the Carpathians, which form a long and irregular curve on the south, the convexity being toward Galicia. Farther north the hills subside and merge into vast plains. The chief river in the northwest is the Vistula, which partly bounds the province. The Western Bug, a tributary of the Vistula, is partly in Galicia. The chief river is the Dniester. The only part of the surface belonging to the basin of the Danube is in the southeast. It is drained by the Pruth, and is of limited extent. The climate is severe, particularly in the south, where more than one of the Carpathian summits are beyond the limit of perpetual snow. While Galicia is open to the cold north and east winds, these mountains intercept the warm winds from the south. The winters are long and rigorous, and the summers very warm, but comparatively short.

The soil is much diversified. In the more mountainous districts scanty pasture only is obtained, but in general, where the elevation is small, the ground, more especially where resting on a substratum of limestone, is of great fertility, and yields abundant crops of wheat, rye, barley, oats, and maize. Hemp, flax, and tobacco are also extensively grown, and the sugar beet is cultivated. The domestic animals include great numbers of horned cattle, generally of a superior description, and a fine hardy breed of horses, well adapted for cavalry. Sheep are neglected; but goats, swine, and poultry abound. The rearing of bees yields great quantities of wax and honey, and is a lucrative industry. Bears and wolves are frequently met with in the forests, and all the lesser kinds of game are in abundance. The minerals include marble, alabaster, copper, lead, zinc, calamine, coal, iron, and rock-salt. Only the last two are of much importance. Iron occurs in numerous parts of the central Carpathian chain, and bog-iron ore is frequently met with in extensive seams on the plains. They are both worked to a considerable extent. Rock-salt is particularly abundant, stretching in continuous beds for nearly 250 miles along the base of the Carpathians, and of course beyond the limits of Galicia, into Bukowina and Transylvania. The most important mines have their central locality at Wieliczka. Manufactures have not made much progress. The spinning and weaving of flax and hemp prevail to a considerable extent on the confines of Silesia. Distilleries exist in every quarter. Tobacco, sugar, leather, beer, agricultural machinery, etc., are also manufactured. The principal exports are salt, wood, grain, coal, aniseed, linen and spirits. The population is generally of Slavonian origin, and consists of two principal branches — Polish in the west and Russniak in the east. In religion they are divided among Roman Catholics, Greek Catholics, and Armenians. The number of the Jews is considerable. The court of third instance for the country is the superior court at Vienna; there are two courts of second instance, one at Lemberg and the other at Cracow; and there are various district courts of first instance. The government has its headquarters at Lemberg. Educational establishments, both for superior and ordinary instruction, are numerous. At the head of the former stand the University of Cracow, with about 130 instructors and some 1,300 students, and the younger university of Lemberg, with 80 instructors and a similar attendance. The principal towns are Lemberg, the capital, Brody, Cracow, Stanislau, Tarnopol, Przemysl, Sambor, etc.

The nucleus of the modern kingdom of Galicia and Lodomeria was formed by the duchies of Halicz and Vladimir (the original forms of the present names), which were established about the beginning of the 12th century under two princes of the Russian dynasty of Rurik.

After being the field of continuous strife between Russians, Poles, and Hungarians, Galicia continued a Polish dependency from 1382 till the first partition of Poland, in 1772, when it was acquired by Austria. Galicia is now one of the Cis-Leithan provinces of the Austrian empire, and is represented in the Reichsrat by 63 deputies, while the affairs peculiar to itself are deliberated and determined on by its own Landtag or Diet. Polish is the language of official intercourse and of the higher educational institutions.

Galicia, Sp. gä·lē'thē-ä, Spain, an ancient kingdom and province, bounded north and west by the Atlantic, south by Portugal, and east by Leon and Asturias, with an area of 11,340 square miles. It has been divided since 1833 into the minor provinces of Coruña, Lugo, Orense, and Pontevedra, whose joint population in 1900 was 2,073,618. The country is mountainous, being traversed by offsets of the Asturian chain, rising in their highest peaks to about 6,500 feet. The west spurs, Capes Ortegal and Finisterre, project into the Atlantic. The numerous short but rapid rivers form small estuaries which afford secure havens and roads. The principal river is the Minho, which, with its feeder the Sil, is navigable for small vessels on its lower course. Galicia has a mild, nourishing climate, but agriculture is in a backward condition, capital is scarce, roads are bad, and railways are few. Rich meadows and dense forests occur everywhere, but the soil is more suited to the cultivation of garden produce than of corn. Mines of lead, tin, copper, and iron pyrites are worked. The inhabitants, called Gallegos, are a robust, vigorous, industrious race. Great numbers of them annually visit central and southern Spain and Portugal, where they find employment as harvesters, water carriers, porters, etc. Chief exports, live cattle, preserved meat, eggs, minerals, fish, fruits, and grain; imports, coal, oil, hides, spirits, sugar, and tobacco. The principal towns are Santiago di Compostella and the two strongly fortified seaports Coruña and Ferrol. Galicia was a kingdom under the Suevi from 411 to 585, and again from 1060 to 1071, at which date it was finally incorporated with Leon and Castile.

Galignani, gä-lēn-yä'nē, **John Anthony,** English journalist: b. London, England, 13 Oct. 1796; d. Paris 31 Dec. 1873. He was taken by his father to Paris in the latter part of 1798, and succeeded him in publishing the weekly paper 'Galignani's Messenger,' which had become popular among the English residents of Paris. He remained a subject of Great Britain during his life, and was very liberal to the charitable institutions of that country. His brother, WILLIAM (b. London 10 March 1798; d. Paris 12 Dec. 1882) was associated with him in the management of the 'Messenger,' and in the building of a hospital in Neuilly for indigent English people. In his will he provided money and land for the erection in Neuilly of the Galignani Brothers' Retreat for 100 printers, booksellers, etc., or their families.

Galile'an, one of the followers of Judas the Gaulonite, who resisted the payment of the tax imposed by Quirinius, the Cyrenius of St. Luke (Luke ii. 1), and gave the Romans trouble till the capture of Jerusalem by Titus in 70 A.D. Galileans is a name applied to Jesus and his disciples, from the intimate connection they had with Galilee (Matt. xxvi. 69; Mark xiv. 70); hence applied by pagans and Mohammedans, as a term of reproach to Christians generally.

Gal'ilee, Palestine, during the Roman period and at the commencement of the Christian era, a province comprehending the northern part of Palestine, west of the Jordan. In pre-Roman times it was referred to as a district inhabited by the tribe of Naphtali. Its name is derived from the Hebrew *galil,* signifying a circle or circuit. It now forms part of the pashalic of Damascus, in the Turkish province of Syria. Anciently it was divided into Upper and Lower Galilee, and was a fertile region with many towns and villages, thickly inhabited by Syrians, Phœnicians, Arabs, Greeks, and Jews. The Jewish inhabitants, on account of their ignorance, simplicity of manners and less rigid sentiments in regard to religion, were held in contempt by other Jews; but after the destruction of Jerusalem despised Galilee became the refuge of the doctors of Jewish law, and the city of Tiberias the seat of Rabbinical learning. As the cradle of Christianity and the scene at Nazareth, Cana, Capernaum, the Lake of Gennesaret, Mount Tabor, and other localities, of a great deal of Christ's ministry on earth, Galilee has worldwide interest. Consult: Merrill, 'Galilee in the Time of Christ' (1885).

Galilee, Sea of, in biblical history also called the SEA OF CHINNERETH or CINNEROTH, LAKE OF GENNESARET and SEA OF TIBERIAS, is a large pear-shaped lake in the north of ancient Galilee (q.v.), Palestine. It lies 682.5 feet below sea-level; is 13 miles long by 6 broad, and 820 feet deep. It occupies the bottom of a great basin, and is of volcanic origin. The Jordan flows into it red and turbid from the north, and it is fed also by many warm and brackish springs, but its waters are cool, clear, and sweet. Its shores on the east and north sides are bare and rocky; on the west gradually sloping, and luxuriantly covered with vegetation. On its shores are Bethsaida, Capernaum, Magdala, and Tiberias.

Galilei, Galileo, gä-lē-lā'ō gä-lē-lā'ē, Italian astronomer: b. Pisa 14 Feb. 1564; d. Arcetri 8 Jan. 1642. His father, Vincenzo Galilei, a nobleman of Florence, caused him to be instructed in the ancient languages, drawing, and music, and he very early showed a strong inclination to mechanical labors. In 1581 Galileo entered the University of Pisa, to attend lectures on medicine and the Aristotelian philosophy. That spirit of observation for which he was distinguished was early developed. When only 19 the swinging of a lamp suspended from the ceiling of the cathedral in Pisa led him to investigate the laws of the oscillation of the pendulum, which he was the first to apply as a measure of time. He studied mathematics under Ostilio Ricci, soon exhausted Euclid and Archimedes, and was led, by the works of the latter, in 1586, to the invention of the hydrostatic balance.

He now devoted his attention exclusively to mathematics and natural science, and in 1589 was made professor of mathematics in the University of Pisa. In the presence of numerous spectators he went through with his experiments, which he performed on the tower of the cathedral, to show that weight has no influence on the velocity of falling bodies. By this means he excited the opposition of the adherents of Aristotle to such a degree, that after two years he was forced to resign his professorship. Later he became acquainted with Francesco Sagredo, a Venetian, upon whose recommendation the Senate of Venice, in 1592, appointed him professor of mathematics in Padua. He lectured here with unparalleled success. Scholars from the most distant regions of Europe crowded about him. In 1597 he invented the sector.

One of the most important mathematical discoveries which he made at a period subsequent to this is that the spaces through which a body falls, in equal times, increase as the numbers 1, 3, 5, 7; that is, if a body falls 16 feet in the first second, it will fall 48 in the next second, 80 in the third, and so on. Whether the thermometer was his invention it is difficult to determine; perhaps he only improved it. He made some interesting observations on the magnet, and by means of the telescope in a short time made a series of the most important discoveries. He found that the moon, like the earth, has an uneven surface; and he taught his scholars to measure the height of its mountains by their shadow. A particular nebula he resolved into individual stars, and even conjectured that the whole Milky Way, with good instruments, might be resolved in the same manner. His most remarkable discovery was that of Jupiter's satellites, 7 Jan. 1610. He likewise observed Saturn's ring, though he had not a just idea with regard to it. He saw the sun's spots somewhat later, and inferred, from their regular advance from east to west, the rotation of the sun, and the inclination of its axis to the plane of the ecliptic.

Galileo's name, meantime, had grown so celebrated that Cosmo II., grand-duke of Tuscany, appointed him grand-ducal mathematician and philosopher, and invited him to become first instructor in mathematics at Pisa. Here he gained a decisive victory for the Copernican system by the discovery of the varying phases of Mercury, Venus, and Mars; as the motion of these planets about the sun, and their dependence on it for light, were thus established beyond the possibility of doubt. He wrote a work afterward on the floating and sinking of solid bodies in water, and in this, as well as in all his other writings, scattered the seeds of many new doctrines.

While thus employed in enlarging the field of natural philosophy, a tremendous storm was gathering about his own head. He had declared himself in favor of the Copernican system, in his work on the sun's spots, and was therefore denounced as a heretic by his enemies. In 1611 he visited Rome for the first time, where he was honorably received, and where a favorable report was made on his writings by the mathematicians of the Collegio Romano at the instance of Cardinal Bellarmin. On his return to Florence, however, he became more and more involved in controversy, which gradually took a theological turn, and in the course of which he declared the literal understanding of the utterances of Scripture with regard to physical phenomena to lead to absurdities. From Rome he received, in the name of the Cardinal Barberini (afterward Pope Urban VIII.) the warning not to overstep the limits of mathematics and physics, but he paid no heed to the well-meant advice. The monks preached against him, and in 1616 he found himself again obliged to proceed to Rome, where he is said to have pledged himself to abstain for the future from promulgating his system either orally or otherwise. The genuineness of the document on the basis of which this is asserted, has, however, been questioned in modern times, and the controversy regarding this matter is not yet finally settled.

In 1618 the appearance of three comets gave him an opportunity to communicate to his friends some general observations on these bodies. His scholar, Mario Guiducci, wrote a work immediately after, in which he severely condemned the Jesuit Grassi. Supposing Galileo to be the author, Grassi attacked him. Galileo replied in his 'Saggiatore,' a masterpiece of eloquence, pronounced by Algarotti to be the finest controversial work Italy has ever produced, and, notwithstanding the errors contained in it, a work always worthy to be read.

About this time he completed his famous work, in which, without giving his own opinion, he introduces three persons in a dialogue, of whom the first defends the Copernican system, the second the Ptolemaic, while the third appears as a blind and unreasoning supporter of the views of Aristotle. With this work, in which the greatest elegance and accuracy of style is united with the clearest and most concise statements, Galileo went to Rome in 1630, and succeeded in obtaining the privilege to print it. Having obtained the same permission in Florence, he published it there in 1632 — 'Dialogo di Galileo Galilei, dove ne' Congressi di quattro Giornate si discorre de' due massimi Sistemi, Tolemaico et Copernicano.' Scarcely had it appeared when it was attacked by the disciples of Aristotle, and most violently of all by Scipione Chiaramonti, teacher of philosophy at Pisa. A congregation of cardinals, monks, and mathematicians examined his work, condemned it as highly dangerous, and summoned him before the tribunal of the Inquisition. The veteran philosopher was compelled to go to Rome, and in June 1633 was condemned to renounce, in presence of a great assembly, kneeling before them, with his hand upon the Gospel, the great truths he had maintained. "Corde sincero et fide non ficta, abjuro, maledico et detestor supradictos errores et hereses," was the formula which he was compelled to pronounce. Upon this he was sentenced to the dungeons of the Inquisition for an indefinite time, and every week, for three years, was to repeat the seven penitential psalms of David. His 'Dialogo' was prohibited, and his system condemned as contrary to the Bible. His judges were merciful enough to commute his sentence of imprisonment to banishment to the villa of the Grand-duke of Tuscany at Rome, then to the archiepiscopal palace at Sienna, and soon after he was allowed to return to Arcetri, not far from Florence.

He employed his last years here principally in the study of mechanics and projectiles. The results are found in two important works on the laws of motion, the foundation of the present system of physics and astronomy. At the same time he tried to make use of Jupiter's satellites for the calculation of longitudes; and though he brought nothing to perfection in this branch, he was the first who reflected systematically on such a method of fixing geographical longitudes. He was at this time afflicted with a disease in his eyes, one of which was wholly blind, and the other almost useless, when, in 1637, he discovered the libration of the moon. Blindness, deafness, want of sleep, and pain in his limbs united to embitter the last years of Galileo's life. He died in the year Newton was born, and his relics were ultimately deposited in the Church of Sta. Croce, at Florence, where a splendid monument was erected to him near that of Michelangelo.

Galileo was of diminutive size, but strong and healthy. His countenance was agreeable; his conversation lively. He loved music, drawing, and poetry. He knew Ariosto by heart; and in one of his works, first printed in 1793, 'Considerazioni al Tasso,' the product of his leisure hours, he points out the superiority of Ariosto to Tasso, whom he criticises very severely. His style is lively, natural, and fluent. His collected works have been edited by Alberi (16 vols. 1842–56). Consult: Nelli, 'Vita e Commercio Litterario di Galilei' (1821); Brewster, 'Martyrs of Science' (1841); Chasles, 'Galileo Galilei' (1862); L'Epinois, 'Les pièces du procès de Galilée' (1877); L'Epinois, 'La question de Galilée' (1878); 'Galileo Galilei und die Römische Kurie' (1876), Gebler; 'Die Akten des Galileischen Processes' (1877); Favaro, 'Galileo Galilei' (1882); Scarbazzini, 'Galileo Galilei' (1883); Wegg-Prosser, 'Galileo and his Judges' (1889).

Galimberti, Luigi, loo-ē'jē gä-lēm-băr'tē, Italian cardinal and diplomat: b. Rome 1838; d. 1896. He became professor of church history in the College of the Propaganda and of theology in the University of Rome, and was appointed by Pius IX. canon of the Lateran in 1868. From Leo XIII. he received appointment as canon of Saint Peter's, archbishop of Nicæa, and secretary to the Congregation of Extraordinary Ecclesiastical Affairs. He was papal arbiter in the award to Spain, as against Germany, of the Carolines, and in 1880 was sent as ambassador to Germany, where he was successful in adjusting the difficulties of the "Kulturkampf" through the abrogation by the crown of the so-called "May Laws." In 1893 he was made a cardinal and prefect of the papal archives.

Gal'ion, Ohio, a city in Crawford County, on the Erie and the Cleveland, C., C. & St. L. R.R.'s, 81 miles southwest of Cleveland. Galion is an important railroad town, being a connecting point and division terminal. There are railroad shops and round-houses here, brick and tile works, carriage and wagon factories, wheel and gear works, iron foundries, and lumber-mills. The town was originally laid out in 1831, by settlers from western Pennsylvania, and was chartered as a city in 1878. The city owns and operates its electric light and water plants. The government is composed of a mayor, who holds office for two years, and a common council, elected by popular vote. Pop. (1900) 7,482.

Galitzin. See Gallitzin.

Gall, Saint, Irish monk: b. Ireland about 550; d. Saint Gall, Switzerland, about 645. He accompanied Saint Columba to France about 585, and took part with him in all his missionary labors. Banished from France, they went together into the wilder regions of Switzerland, and near the Lake of Constance they founded the monastery which bore the name Saint Gall and gave name to the town and canton of Saint Gall. After a few years Columba retired to Italy, leaving his companion abbot of the new house. The monastery was burnt by Hungarians in the 10th century.

Gall, Franz Joseph, fränts yō'sĕf gäl, German phrenologist: b. Tiefenbronn, Baden, Germany, 9 March 1758; d. Montrouge, near Paris, 22 Aug. 1828. He studied medicine at Strasburg and Vienna, and settled in the latter city in 1785 as a physician. In 1796 he began to give courses of lectures on phrenology (q.v.) in Vienna; but these lectures were prohibited in 1802 by the Austrian government as being subversive of the accepted religion. With Spurzheim, who became his associate in 1804, he quitted Vienna in 1805, and began a lecturing tour through Germany, Holland, Sweden, and Switzerland. He reached the height of his fame when in 1807 he settled as a physician in Paris. On March 14, 1808, he and Spurzheim presented to the Institute of France a memoir of their discoveries, on which a committee of the members of that body (including Pinel, Portal, and Cuvier) drew up an unfavorable report. Thereupon Gall and Spurzheim published their memoir, 'Introduction to Physiology of the Brain'; this was followed by 'Researches on the Nervous System' (1809); and by 'Anatomy and Physiology of the Nervous System' (1810–19) with an atlas of 100 plates. In 1811, in answer to accusations of materialism and fatalism brought against his system, Gall published 'Of the Innate Inclinations of the Soul and Spirit.' He continued to practise medicine and pursue his researches at Montrouge, near Paris, till his death. See Spurzheim, Kaspar.

Gall. See Bile.

Gall-bladder, a pear-shaped bag, attached to the under surface of the liver, the function of which is the storage of bile. It is about four inches long and two inches in diameter at the widest part. It will hold from an ounce to an ounce and a half of fluid. The broad end almost reaches the abdominal wall under the edge of the liver at the border of the ribs, about three inches from the middle line of the body. From a groove on the under surface of the liver two ducts that collect secretion from all parts of the organ join and pass down to the duodenum. The gall-bladder is connected with this common duct by another duct or canal of the same structure. They are all about the size of a quill, but are capable of being distended. Bile is not poured out into the intestine unless the chyme from the stomach passes over the mouth of the duct, but the bile travels down the ducts from the liver, and back through the cystic duct to be stored in the gall-bladder until needed.

Acute catarrhal cholangitis is an acute inflammation of the lining membrane of the ducts, causing swelling of the membrane and obstruction to the outflow of bile. The process is usually an extension of an acute gastritis and duodenitis. Jaundice results from the obstruction to the passage of bile, and aside from this the disease presents the picture of acute gastritis. Three to five weeks usually elapse before the jaundice disappears. Chronic cholangitis is due to the presence of stones, to stricture, to carcinoma, or the pressure on the outside. There is nothing distinctive in its evidences.

Acute cholecystitis is due to infection of the gall-bladder from the intestines by various microbes. It is usually associated with the presence of stones within the bladder. It may be a mere catarrh or may be suppurative, going on to perforation and peritonitis. The symptoms are violent pain, exquisite tenderness on the right side of the abdomen, and a high fluctuating temperature. Operation is usually demanded. Gall-stones, cholelithiasis, a disease attended by the formation of stones within the gall-bladder. These stones are formed chiefly of cholesterin, a normal constituent of the bile. It is held that previous infection and stasis of the bile in the bladder are essential to their formation. Large numbers may be formed and held in the gall-bladder for years without causing disturbance, but there is constant likelihood of inflammation, as well as attempts of the bladder to force out these stones. Stones may be passed directly through the ducts or at any point in the cystic or common duct find lodgment. If stones lodge in the cystic duct no bile can pass into the gall-bladder, but that already there may be added to by a mucous secretion, causing the bladder to distend. This condition is called hydrops of the gall-bladder. A stone lodging in the common duct dams back the bile and causes jaundice of pronounced type.

Hepatic colic is the name given to the intense cramp that accompanies the passage of a gall-stone through the bile-ducts or an attempt at such a passage. There is a sudden excruciating pain in the right side at the free border of ribs or even over the whole abdomen; frequently the pain may shoot up to the right shoulder-blade and arm. The patient rolls and tosses in agony with his face suffused with cold perspiration. Sometimes there is a chill followed by fever. The duration depends on the course of the stone; frequently relief is had in a few hours, only soreness remaining.

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Gall-fly, one of the several minute gall-making insects, as the British ash-fly. See Galls and Gall-makers.

Gall-gnats, a gall-making gnat of the genus *Cecidomyia.* See Galls and Gall-makers.

Gall-stones. See Calculus.

Gal'la. See Nut-galls.

Gallait, Louis, loo-ē gä-lā, Belgian historical painter: b. Tournai, Belgium, 10 May 1810; d. Brussels 20 Nov. 1887. He studied in Tournai, Antwerp, and Paris, where he acquired a name by his portraits as well as his genre and historical paintings. Among his earlier pictures of note were: 'Christ Restoring Sight to a Blind Man'; 'The Strolling Musicians'; 'The Beggars'; 'Montaigne Visiting Tasso in Prison'; 'Abdication of Charles V.' Among his subsequent pictures are: 'Temptation of St. Anthony'; 'The Dead Bodies of Counts Egmont and Hoorn'; 'The Prisoner's Family'; 'The Last Moments of Count Egmont'; 'Alva Signing Death Warrants'; and lastly (1882), 'The Plague at Tournai,' purchased for Brussels Museum at the price of $24,000.

Galland, Antoine, äṅ-twän gä-lōṅ, French Orientalist and archæologist: b. Rollot, France, 4 April 1646; d. Paris 17 Feb. 1715. Attached in 1670 to the French embassy at Constantinople, he three years later accompanied the ambassador to Syria and the Levant. In 1676, and again in 1679, he made other visits to the East. In 1701 he was made a member of the Académie des Inscriptions, and in 1709 professor of Arabic in the Collège de France. The greatest part of his writings relate to archæological subjects, especially to the numismatics of the East; but the work which has secured him the greatest reputation is his translation of the 'Arabian Nights Entertainments' (1704–8), the first translation of these stories made into any language of Christendom. Among his other writings are: 'Remarkable Sayings, Witticisms, and Maxims of the Orientals' (1694), and 'The Indian Tales and Fables of Pilpay and Lokman' (1724).

Gallardo, Aurelio Luis, ō rēl yō loo-ēs' gäl-yär'dō, Mexican poet: b. León, Guanajuato, Mexico, 3 Nov. 1831; d. Napa, Cal., 27 Nov. 1869. He published three volumes of poems: 'Dreams and Visions' (Mexico 1856); 'Clouds and Stars' (Guadalajara 1865); and 'Legends and Romances' (1868); also a collection of poems, 'Home Stories.' He wrote many comedies. The drama, 'Maria Antonieta of Lorena' is regarded as his best work.

Gallas, gäl'läz, an Ethiopian race inhabiting Africa between lat. 9° and 3° S. and lon. 34° and 44° E. Their language is a descendant of the ancient Geez of Abyssinia. They are of average stature, with strong, well-made limbs, skin of a light chocolate brown, hair frizzled but not woolly. Though cruel in war they are frank and faithful to promises and obligations. They are distinguished for their energy, both physical and mental, especially the southern tribes, which pursue pastoral avocations, notably the breeding of horses, asses, sheep, cattle, and camels, and those which live by hunting, especially the elephant. These same tribes are mostly still heathens, though Mohammedanism is rapidly making way among them. The more northerly tribes who dwell about Harar profess a crass form of Christianity, derived from Abyssinia, and for the most part raise cotton, durra, sugar, and coffee. The total Galla population, who call themselves Argatta or Oromo, is estimated at about 3,000,000. Politically they are divided into a great number of separate tribes, which are frequently at war with one another. But their inveterate foes are the Somali, who have gradually driven back the Gallas from the shores of the Red Sea and the extremities of the Somali peninsula, regions which were occupied by them in the 16th century, just as on the other side the Abyssinians and Shoans have beaten them back. The country they now inhabit is a plateau northwest of the Indian Ocean, with a hilly, well-timbered surface.

Gal'latin, Albert, American financier: b. Geneva, Switzerland, 29 Jan. 1761; d. Astoria, N. Y., 12 Aug. 1849. He was graduated at the university there in 1779. In 1780 he went to the United States, and was for a time teacher of French in Harvard College. In 1786 he removed to Pennsylvania, became a member of the State legislature, and in 1793 was elected to the United States Senate, but was declared ineligible. From 1795 to 1801 he served in the House of Representatives, and from 1801 to 1813 was secretary of the treasury, in which post he showed himself one of the first financiers of his day. He took an important part in the negotiations for peace with England in 1814, and signed the Treaty of Ghent. From 1815 to 1823 he was minister at Paris, and in 1826 was sent to London as ambassador extraordinary. On his return in 1827 he settled in New York, and devoted much of his time to literature, being chiefly occupied in historical and ethnological researches. He was one of the founders and the first president of the Ethnological Society of America; and from 1843 to his death was president of the New York Historical Society. His works include publications on finance, politics, and ethnology; among these last are: 'The Indian Tribes East of the Rocky Mountains, etc.' (1836), and 'Notes on the Semi-Civilized Nations of Mexico, Yucatan, and Central America' (1845). Consult Henry Adams, 'Life of Albert Gallatin' (1879).

Gallatin, Mo., city and county-seat of Daviess County, on the Wabash, and the Chicago, R. I. & P. R.R.'s, and on the Grand River, 55 miles northeast of St. Joseph. It is in a farming region and has lumber industries. Pop. (1900) 1,780.

Gallatin, Tenn., town and county-seat of Sumner County, on the Louisville & N., Chesapeake, and Nashville R.R.'s, 26 miles northeast of Nashville, and three miles from the Cumberland River. Its industrial and commercial activities are connected with stock-raising, agricultural products, lumbering, cotton, and woolen manufactures, flour milling, and foundry and machine products. Pop. (1900) 2,409.

Gallaudet, găl-â-dĕt', **Edward Miner,** American educator: b. Hartford, Conn., 5 Feb. 1837. He is a son of Thomas Hopkins Gallaudet (q.v.), and was graduated at Trinity College in 1856. He organized the Columbia Institute for the Deaf, Dumb, and Blind in Washington, D. C., in 1857, and from it developed the Gallaudet College for the Deaf, of which, in 1864, he became president. His publications include: 'Manual of International Law' (1879), and 'Life of Thomas Hopkins Gallaudet' (1888).

Gallaudet, Thomas, American Episcopal clergyman: b. Hartford, Conn., 3 June 1822; d. 27 Aug. 1902. He was a son of T. H. Gallaudet (q.v.); graduated at Trinity College in 1842; was teacher in the New York Institution for Deaf-Mutes 1843-58. He was ordained in 1851; founded and became rector of St. Ann's Church, New York, for deaf-mutes, in 1852; was appointed general manager of the Protestant Episcopal Church Mission to Deaf-Mutes in 1872; and founded the Gallaudet Home for Deaf-Mutes, near Newburg, N. Y., in 1885.

Gallaudet, Thomas Hopkins, American educator: b. Philadelphia 10 Dec. 1787; d. Hartford, Conn., 9 Sept. 1851. In 1817 he founded at Hartford, Conn., the first deaf-mute institution in America, and was president of the same till 1830. In 1838 he became chaplain of the Insane Asylum at Middletown, Conn., where he remained till his death. He was the author of 'Bible Stories for the Young' (1838), and 'The Child's Book of the Soul,' etc. See Lives by Humphrey (1858), and E. M. Gallaudet (1888); Barnard, 'Tribute to Gallaudet.'

Galle, Johann Gottfried, yō'hän gŏt'frēd găl'lĕ, German astronomer: b. in Pabsthaus, Prussia, 9 June 1812. He studied natural sciences and mathematics in Berlin 1830-3; discovered three comets in 1839-40; was the first to observe the planet Neptune (23 Sept. 1846); and in 1851 became director of the observatory in Breslau and professor of astronomy in Breslau University

Gallegos, gäl-yā'gōs, Argentina, a river and city in the extreme southern part. The river rises in the Latorre Mountains and empties into the Atlantic Ocean; length 160 miles. The city is near the mouth of the river in Santa Cruz Territory and has a population of about 5,000.

Gallein, găl'e-ĭn, Pyrogallolphthaleïn. Formula, $C_{20}H_{10}O_7$. Obtained by heating for some hours one part of phthalic anhydride with two parts of pyrogallol from 190° to 200°, then dissolving the fused mass in alcohol, precipitating with water, and recrystallizing from dilute hot alcohol. It is used as a dye.

Gallenga, gäl-lĕn'gä, **Antonio Carlo Napoleon,** Italian publicist and author: b. Parma, Italy, 4 Nov. 1810; d. Llandogo, Wales, 17 Dec. 1895. He left Italy in 1831 by reason of political disturbances, and lived abroad. He represented Piedmont at Frankfort in 1848-9, and was a member of the Italian Parliament 1854-64. He was long the London *Times'* special correspondent in Italy. His works, many of them issued under the name of "L. Mariotti," include: 'Italy, Past and Present' (1841-9); 'Castellamonte, an Autobiography' (1854); 'Mariotti's Italian Grammar,' which went through 12 editions; 'History of Piedmont' (1855-6); 'The Pearl of the Antilles' (1873); and several books of travel.

Gal'leon, a name formerly given to a very large kind of vessel, with three masts and three or four decks, such as those used by the Spaniards in their commerce with South America, to transport the precious metals. They were large, clumsy, square-sterned vessels, having bulwarks three or four feet thick, all of which were so encumbered with tophamper, and so overweighted in proportion to their draft of water, that they could bear very little canvas, even with smooth seas and light winds.

Gallery, in architecture, a long, narrow room, the width of which is at least three times less than its length. Galleries are destined for dancing, music, dining on festival occasions, and are generally decorated with pictures in oil or fresco. Galleries have sometimes been built merely to receive collections of pictures, or to give a painter an opportunity for fresco paintings; hence a large collection of pictures, even if contained in several adjoining rooms, is called a gallery. A celebrated gallery described by Cicero was established by Verres, the well-known spoiler of Sicily. In modern Europe the gallery founded by Cosmo II. in Florence long held the first place; but it has now been eclipsed by several European galleries. The art treasures of Florence now form two collections, that of Uffizi, and that of the Pitti Palace. The Galérie du Louvre in Paris is among the finest in the world, though in 1815 it was stripped of many works of art, reclaimed by the different nations from whom they had been plundered.

Among the other renowned European galleries are those at Versailles and Dresden, the Royal Gallery at Madrid, the Belvedere Gallery at Vienna, the Hermitage at St. Petersburg, the gallery of Berlin, the National Gallery in London, the National Museum at Naples, the Vatican and Borghese collections at Rome, and those in Munich, Brussels, Venice, Antwerp, Milan.

The term gallery is also sometimes applied to what is more properly termed a corridor, or to a platform projecting from the walls of a building supported by piers, pillars, brackets, or consoles, and in churches, theatres, and similar buildings to the upper floors going around the building next the wall. In ship-building, a gallery is a balcony projecting from the stern or quarter of a ship of war, or of a large merchantman; in fortification, a covered walk across the ditch of a town; and in mining to a narrow passage from one part of the mine to another.

Galley, the ancient and mediæval ship of the Mediterranean. The Venetian galleys were about 160 feet long above, and 130 feet by the keel, 30 feet wide, and 20 feet length of stern-post. They were furnished with three masts, and 30 banks of oars, each bank containing two oars, and every oar being managed by six or seven slaves, who were usually chained to it. In the fore part, after the invention of cannon, they had three small batteries of cannon, namely, two 36-pounders, two 24-pounders, and two 2-pounders. They had also three 18-pounders on each quarter, and carried from 1,000 to 1,200 men.

The term galley, as applied to the ships of the ancient Greeks and Romans, refers especially to their war-ships, which were propelled chiefly by oars.

The Greek or Græco-Etruscan vases show many illustrations of biremes, that is, galleys with two banks, or longitudinal rows, of oars. The invention of this form of vessel was a very important advance in naval construction, for it permitted of a large increase in rowing-power, in proportion to the bulk and weight of the vessel. It was the trireme, however, which formed the chief war-ship of Greece during her prime. It had three banks of oars on each side. The seats for the rowers, which were removable, were placed between the sides of the vessel and a series of upright and inclined timbers supporting the main deck. The stem of the vessel was generally curved, and terminated in an ornamental figure-head, and the stern-post was also usually curved upward and finished off ornamentally. At the stern there was an elevated quarter-deck, whence the helmsman and the trierarch or naval captain gave their orders. The latter had full command of the ship; the former acted as navigating officer, having the oarsmen and sailors under his command. The trireme had regularly two masts — a mainmast with one large sail, and a very small foremast.

The rowers formed much the largest portion of the crew, while an Attic trireme carried also 10 marines, 17 sailors, a sort of paymaster, two men in charge of the lines of towers, besides two boatswains, one with a flute, to give the time to the rowers. The total crew would thus be about 220. The total length of a trireme was about 120 feet, of which about 100 was devoted to the rowers; the breadth at the water-line was some 12 feet; and the draught about 5 feet. A speed of 8 or 9 knots was probably about the highest obtainable.

The Romans did not become important as a maritime nation till the period of their struggle with Carthage. They built large numbers of ships, chiefly of higher rates than the trireme. But the triumph of the bireme vessels, known as Liburnian galleys, at Actium led the way for a reversion to lower-rated ships.

Galli, găl'ī, the emasculated priests of the Greek goddess Rhea, afterward identified with the Asiatic Cybele, and worshipped as symbolizing the procreative powers of nature. Cybele was the "Great Mother" and inspired the arts of agriculture. The true home of this cult was Pessinus in Galatia, but it never obtained public recognition in Greece, where the excesses and mendicity of its priests exposed it to contempt. It was introduced into Rome 204 B.C., at the bidding of the Sibylline oracle, and for the purpose of expelling Hannibal from Italy. The Galli were permitted to pass in a procession through the streets of the city, led by an Asiatic priest and priestess, but Roman citizens were forbidden to participate in this service. The cult gained an increasing favor and popularity and in the 2d century A.D. other rites were added, such as baptism in the blood of bulls and rams, by which the devotee was supposed to be cleansed from pollution and regenerated. This baptism was undergone by the Emperor Julian, called the Apostate. The worship of Cybele was checked by Constantine and abolished by Theodosius.

Gallic Acid, $HC_7H_5O_5,H_2O$, is an acid which exists in small quantity in gall-nuts, in valonia (the acorn-cup of *Quercus ægilops*), in dividivi (the pod of *Cæsalpinia coriaria*), in sumach, and other vegetables. It is usually prepared from gall-nuts, which, in addition to gallic acid, contain a large proportion of tannin (tannic acid or gallo-tannic acid). When the gall-nuts are digested with water for some weeks fermentation takes place, and the tannic acid is gradually converted into gallic acid. The same result is obtained more quickly if sulphuric acid be present. To obtain pure gallic acid the gall-nuts are boiled with water, and the hot liquor separated. On cooling gallic acid crystallizes out, and is further purified by solution in hot water and treatment with animal charcoal. It forms delicate, silky, acicular crystals, nearly colorless, and having a sourish taste. It is soluble in three parts of boiling water, but only in 100 of cold water, and on this account it can be readily purified by recrystallization. With solution of iron salts (ferric) it produces a blue-black color, and finally yields a black precipitate on exposure to the air. Hence it may be used in the production of ink, for which purpose it has some advantages over tannin or gall-nuts. When the crystals are strongly heated pyrogallic acid is produced and sublimes over. Gallic acid is a useful astringent. As it does not coagulate albumen it is readily absorbed into the blood, and in this way it is efficacious in Bright's disease. Where a decided local astringent effect is desired tannic acid is much more powerful.

In medicine gallic acid is used as an astringent. In most respects its action is similar to that of tannic acid (q.v.), but it does not coagulate albumen, and therefore does not possess the local action as an astringent. It has been used in excessive sweating, and is useful for sweating feet and as a local spray and gargle in tonsilitis, pharyngitis, and similar affections of the nose and throat.

Gallican Church. See GALLICANISM.

Gallicanism, the tendency to enlarge the prerogatives of a national Church in restriction of the authority of the Roman See. This term more especially describes the manifestation of that spirit in the history of the Church in France, and takes its derivation from the controversies between the French monarchy at various times and the Roman pontiffs in regard to ecclesiastical jurisdiction. It is a mistake to suppose that Gallicanism took its rise in France prior to the 13th century, or that the decrees of Louis IX., including the Pragmatic Sanction, were in any proper sense an attempt to restrict the authority of the Roman pontiffs. So far from this being true, their object was to assure the immunities and franchises accorded to the clergy from the exactions of the royal officers and feudal lords. In his ordinance of April 1228, Louis IX., or rather his mother, Blanche of Castile, the regent, says not a word about the relations of the clergy or the laity with the Roman pontiff, and Pope Innocent IV., in 1250, in a letter to the queen, thanks her for issuing it.

It was not until the time of Philip the Fair that Gallicanism in any proper sense can be said to have manifested itself. That monarch in his contest with the papacy sowed the seeds of the long controversy as to the question of papal jurisdiction, which so long agitated the French Church. As a result of his contest with Boniface VIII., and of the later declarations of the Councils of Constance and Basel, the principles began to be enunciated by the national party; one that the king of France was absolutely independent of the pope in all temporal matters; the other, that the papal power was not absolute, must be exercised within the limits of the canons, and was inferior to that of a general council. By the Pragmatic Sanction passed at Bourges in 1438, the Gallican Church, in union with the king, adopted the decrees of the Council of Basel abolishing papal reservations and expectatives, and restricting appeals to Rome to the *causæ majores.* Against this many popes protested, but it was not until the date of the concordat (1516) between Leo X. and Francis I. that it was abolished.

During the 16th century there were many customs and privileges of more or less ancient date still extant, which the national party delighted to call "Gallican liberties." The crisis came in the 17th century, during the reign of Louis XIV., over the question of the royal right of regalia (q.v.). Two bishops excommunicated the crown nominees to benefices in their dioceses. Their Metropolitans canceled their sentences; whereupon they made appeal to Rome, and the pope annuled the decisions of the Metropolitans. The crown resented the pope's decision as an intrusion upon its rights. Louis XIV. called an assembly of French bishops (1682) to confirm his position. This assembly formulated the famous Four Articles setting forth the "Gallican liberties." The first declared that the jurisdiction of Peter's successor did not extend to civil and temporal affairs, that kings were subject to no ecclesiastical power in temporals, and denied the deposing power of the popes. The second ratifies the third and fourth sessions of the Councils of Constance as regards the respective authority of the pope and general councils, and denies that these sessions refer only to times of schism. The third asserts the validity of the laws, customs, and constitutions of the realm, and of the Gallican Church. The fourth declares that although the pope has the principal share in questions of faith, and that his decrees regard all and particular Churches, still his judgment is not irreformable, unless the consent of the Church be added.

Afterward, at the command of the king, who subsequently realized the radical character of the Four Articles, the bishops who had signed them individually wrote to the pope retracting their *Declaration.* Later Louis himself wrote to Innocent XII., in 1693, stating that he had "given the necessary orders to the effect that the contents of my edict of 22 March 1682, concerning the *Declaration* emitted by the clergy of France, be not observed."

Nevertheless, the spirit of Gallicanism lingered on in France, finding fresh impetus in Jansenism. During the 18th century its strength rapidly waned, and by the time of the French Revolution (1789) it had ceased to have any vital significance.

Gallienus, găl-ĭ-ē'nŭs, **Publius Licinius Valerianus,** Roman emperor: d. 268 A.D. He received the title of Cæsar from the senate at the same time with his father, Valerianus, and associated with the latter in the empire on his accession in 253 A.D. His father having been defeated and taken prisoner by Sapor, king of the Persians, in 260, Gallienus showed complete indifference, and continued to reign alone without making any attempt to deliver his father. With a like indifference he saw his empire dismembered by numerous usurpers, and invaded in all parts by barbarians.

Gallifet, Gaston Alexandre Auguste, gäs-tôṅ äl-ĕks-ändr ō-güst gä-lē-fā, MARQUIS DE, French general: b. Paris, France, 23 Jan. 1830. He joined the army in 1848, serving in the Crimea, Mexico, and Algeria. He took part with the Army of the Rhine during the Franco-German War, being made prisoner at Sedan. During the second siege of Paris he commanded a brigade of the Army of Versailles, and was unenviably distinguished for his frightful severity to the Communard prisoners. Promoted to the rank of general of division 3 May 1875, he obtained the command of the 1st division of cavalry, and in February 1879, that of the 9th regiment. He became minister of war in 1899.

Gallin, in chemistry, gallin, $C_{20}H_{14}O_7$, or $O[C_6H_2(OH)_2]_2.CH.C_6H_4.CO.OH$. Obtained by long boiling gallein and zinc-dust and ammonia, then acidifying with dilute H_2SO_4 and shaking out with ether. It crystallizes out of ether in fine needles, and quickly reddens in the air. It can be used as a dye instead of logwood.

Gallinger, Jacob H., American politician: b. Cornwall, Ont., 28 March 1837. He studied medicine, which he practised from 1858 until his entrance upon public life as a member of the New Hampshire legislature in 1872–3. He was in the State Senate in 1878–80, and its president during the last two years. In 1885–9 he was a representative in the Federal Congress, and in 1891–1903 senator. From 1882 to 1890 he was chairman of the Republican State Committee.

Gallinule. See MUD-HEN.

Gallio, găl'ĭ-ō, **Lucius Junius**, Roman proconsul of Achaia under Claudius when St. Paul was at Corinth, 53 A.D. He was brother of the famous Seneca, and had procured his name by adoption into the family of Gallio the rhetorician. The narrative in the 'Acts of the Apostles' tells how, with regard to the clamor of the Jews against Paul, he was "not minded to be a judge of these matters"; and how "Gallio cared for none of these things"; hence his name has become a synonym for a careless, easy-going, and indifferent man who keeps himself free from trouble and responsibility.

Gallipoli, găl-lĕp'ō-lē, Turkey, a seaport on the peninsula of the same name, at the extremity of the Dardanelles, 130 miles west of Constantinople. The ancient Kallipolis, of which some ruins remain, it was formerly the most important commercial town on the Hellespont, and still retains considerable trade. There are two harbors, extensive bazaars, and some manufactures. The town was taken by the Turks in 1356, and formed their earliest European possession; and here the allies disembarked during the Crimean war. Pop. 20,000.

Gallipoli, Peninsula of, Turkey, a tongue of land separating the Hellespont from the Ægean Sea and the Gulf of Saros, 62 miles long, by a varying breadth of from 4 to 12 miles. Lat. between 40° 3' and 40° 38' N., lon. between 26° 10' and 27° E.

Gallipoli Oil, a coarse olive oil used in Turkey-red dyeing and for other purposes, and prepared from olives grown in Calabria and Apulia, the latter being considered the best. The oil is conveyed in skins to Gallipoli, where it is clarified and shipped in casks.

Gallipolis, găl-ĭ-pō-lēs, Ohio, city and county-seat of Gallia County; on the Ohio River, and on the Columbus, H. V. & Toledo, and the Ohio C. R.R.'s. It contains a United States Marine Hospital, Gallia Academy, the State Hospital for epileptics, Washington High School, and a private epileptic sanitarium. Pop. (1900) 5,432.

Gallitzin, găl-lĕt'sĕn, the name of a noble Russian family whose members have been equally prominent in war and diplomacy from the 16th century downward. VASILI, surnamed the Great (b. 1643; d. 1714); was the councilor and favorite of Sophia, the sister of Peter the Great, and regent during his minority. His great aim was to bring Russia into contact with the west of Europe, and to encourage the arts and sciences in Russia. His design to marry Sophia and plant himself on the Russian throne miscarried. Sophia was placed by her brother in a convent and Vasili banished (1689) to a spot on the Frozen Ocean, where he died. AMALIE, PRINCESS GALLITZIN (1746–1806), daughter of the Prussian general, Count von Schmettau. She was noted for her literary culture, her sympathetic relations with scholars and poets, but, above all, for her ardent piety, which found in Catholicism its most congenial sphere. Having separated from her husband, Prince Dimitri Alexievitch, she took up her residence in Münster, where she gathered round her a circle of learned companions. PRINCE DIMITRI ALEXIEVITCH, diplomat (b. 1738; d. 1803). He was ambassador to the court of France in 1763, and to The Hague in 1773, and was the author of several works relating to geology.

Gallitzin, Demetrius Augustine, PRINCE, American clergyman: b. The Hague 22 Dec. 1770; d. Loretto, Pa., 6 May 1840. He was a son of Prince Dimitri Gallitzin (q.v.), and became a Roman Catholic in his 17th year. He was ordained a priest in the United States in 1795; and betook himself to a bleak region among the Alleghany Mountains in Pennsylvania, where he was known as "Father Smith." Here he laid the foundation of a town called Loretto. He declined to return to Russia on his father's death, and as a Catholic priest was adjudged to have lost his right of inheritance. He was for some years vicar-general of the diocese of Philadelphia. He was austere in his mode of life, but liberal in the highest degree to others, and an affectionate and indefatigable pastor. In 1809 he resumed his original name. He wrote various controversial works, including a 'Defense of Catholic Principles' (1816); 'Letter to a Protestant Friend' (1820), and 'Appeal to the Protestant Public' (1834).

Gal'lium, a metallic element, symbol Ga, atomic weight 69.9. Gallium is a triad element. Specific heat 0.079. It was discovered by the French chemist, Lecoq de Boisbaudran by means of the spectroscope; but the Russian chemist Mendeléeff had shown in his periodic law (q.v.) that an element must exist having intermediate properties between aluminum and indium. He called this supposed element eka-aluminum. The metal is obtained by dissolving the blende in sulphuric acid and placing in the solution plates of zinc. A precipitate containing gallium as a hydrated oxide is thus obtained, and after further solution and precipitation metallic gallium is thrown down by zinc. Gallium is a hard metal, very slightly malleable, and leaves a bluish-gray trace on paper; when melted it adheres to glass; it does not tarnish in the air. Its specific gravity is 5.95. It gives a brilliant violet line in the spectrum. When heated in the air it oxidizes on the surface, and does not volatilize. It dissolves in hydrochloric acid with disengagement of hydrogen. It is scarcely attacked by nitric acid in the cold; when heated it dissolves slowly with evolution of nitrous fumes. It forms salts.

Gallium Chloride, in chemistry, $GaCl_3$ It is colorless, crystalline, and deliquescent.

Gallium Salts, salts precipitated by ammonia. If redissolved by hydrochloric acid, and again precipitated by ammonia, the precipitate is soluble in excess. If zinc is present the gallium is precipitated along with the zinc. Potassium ferrocyanide gives a yellow precipitate with strongly acid solutions of gallium chloride.

Gallon. See WEIGHTS AND MEASURES.

Gallotannic Acid. See TANNIN.

Gal'loway, Beverly Thomas, American horticulturist: b. Millersburg, Mo., 16 Oct. 1863. He was graduated from the University of Missouri, agricultural course, in 1884; was assistant in the horticultural department of the university in 1884–86, and in the United States Department of Agriculture, division of vegetable physiology and pathology, in 1887–8. In 1900 he became director of the office of plant industry. His writings include works on plant diseases, botany, horticulture, and allied subjects.

Galloway, Charles Betts, American bishop of the Methodist Episcopal Church, South: b. Kosciusko, Miss., 1 Sept. 1849. In 1868 he entered the Mississippi conference, and for several years he was pastor of various churches in that State. From 1882 until 1886 he was editor of the New Orleans 'Christian Advocate.' He was also elected president of the board of education of his Church, and published a 'Life of Bishop Linus Parker'; 'Hand-book of Prohibition'; 'Open Letters on Prohibition,' written during his controversy with Jefferson Davis on that subject; 'Modern Missions: Their Evidential Value'; and 'Christianity and the American Commonwealth.'

Galloway, Joseph, American lawyer: b. near West River, Md., about 1729; d. Hertfordshire, England, 29 Aug. 1803. He was admitted to the bar in Philadelphia, and was a member of the Pennsylvania Assembly 1757–74. He held a seat in the Congress of 1774, where he suggested a plan of government headed by a president-general to be appointed by the king and to hold office during the latter's pleasure, and a grand council elected every three years by the assemblies of the several colonies. Before the conclusion of the Revolutionary War he removed to England; and in 1788 was charged with high treason by the Assembly of Pennsylvania, which ordered his estates to be sold. He was the author of: 'A Candid Examination of the Mutual Claims of Great Britain and the Colonies: with a plan of accommodation on Constitutional Principles' (1780); 'History and Political Reflections on the American Rebellion' (1780); etc. Consult: Balch (ed.), 'Examination of Joseph Galloway by a Committee of the House of Commons' (1855); Tyler, 'Literary History of the American Revolution' (1897).

Galls and Gall-makers. Galls are unnatural plant-growths caused by various forms of insects, more particularly by the hymenopterous family of gall-flies (*Cynipidæ*). Gall-gnats (*Cecidornyiidæ*, — minute two-winged midges or flies), many species of mites, some forms of caterpillars, and the larvæ of weevils and other beetles also cause galls. The formation of a gall is due to the puncturing of any portion of a plant, the surface of the leaf, stem, roots, or bark and the deposition of an egg in the cavity formed, or by the presence of the larvæ subsequently hatched from it. Within these excrescences the larvæ feed and grow, and either eat their way out while still grubs or remain till the pupa stage is past and emerge as adolescent insects. A gall may contain a single egg and larva or many, and both external form and internal structure vary widely. Each gall-fly has its favorite or exclusive host, and usually restricts its egg-laying to some special part of the plant. While most produce true galls, some members of the family utilize galls already formed.

Fig. 1.— Bedeguar Gall of Wild Rose.

The reproductive relations of gall-flies are very interesting: in many cases parthenogenesis undoubtedly occurs; in some species, for example, of Rhodites, no males have ever been found; in other forms the males when they occur are very few in proportion to the females. It must be emphasized that many gall-wasps distinguished by entomologists as separate species or even referred to different genera have turned out to be the parthenogenetic and the sexual forms of one species. A common life-history is as follows: (*a*) Out of a summer-gall male and female forms emerge; (*b*) the females lay their fertilized eggs and give origin to winter-galls in so doing; (*c*) from these winter-galls there arise parthenogenetic females which in their egg-laying produce the summer-galls from which we started.

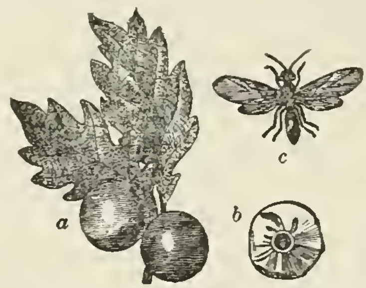


Fig. 2.— *a*, oak gall produced by *Cynips quercus-folii;* *b*, section of gall; *c*, gall-insect (*Cynips quercus-folii*).

Galls vary greatly in shape, and may be solid or spongy, and contain one or several cavities, in each of which a larva is lodged. Though galls are very generally distributed, they occur in commerce chiefly as Levantine articles of trade. The Aleppo nut-galls are spherical and tubercular: blue, black, and white varieties are recognized, the two former being picked before the escape of the larva, the latter after its exit. They are produced by a gall-fly (*Cynips galiæ-tinctoriæ*) on twigs of an oak (*Quercus infectoria*). The galls made on oak by the common British "ash-fly" (*C. quercifolia*), or by the hundred or more American species of Cynips, might serve the purpose of ink making, tanning, etc., just as well; the 70 to 80 per cent of tannin they contain is the principal element of value. Dead Sea Apples, or Mecca or Bussorah galls, or Apples of Sodom (*mala insana*, or *C. q. infectoriæ insana*), are varieties of this vegetable product. The artichoke or strobile galls consist of several pieces, and resemble the fruit (strobilus) of the hop; it is due to the abnormal development of the female involucre before fecundation; its insect is the *C. q. gemmæ*. The hairy galls, or bedeguars, or rose sponges, are chiefly found on *Rosa rubiginosa;* they are produced by *Rhodites rosæ*.

Consult Howard, 'The Insect Book' (New York, 1901), and accompanying bibliography.

Gallus, Caius Cornelius, Roman poet: b. Forum Julii (modern Fréjus), Gaul, about 66 B.C.; d. 26 B.C. He lived at Rome in intimate friendship with Vergil, Asinius Pollio, Varus, and Ovid, and was appointed by Augustus prefect of Egypt, but fell into disfavor and was banished, whereupon he ended his disgrace with his own sword. Gallus was reckoned the founder of the Roman elegy, from his four books of elegies on his mistress Lycoris, of which but a few slight fragments have come down to us. His name was adopted by W. A. Becker as the title of his well-known picture of Roman domestic life: 'Gallus: Roman Scenes from the Time of Augustus' (1838).

Gally, Merritt, American inventor: b. near Rochester, N. Y., 15 Aug. 1838. He was graduated at the University of Rochester in 1863; and later turned his attention to mechanics. His inventions include the "Universal" printing-press; a machine for making linotypes; electric, telegraphic, and philosophical apparatus; musical instruments, including the "Orchestrone," the "Black-Vent System" for tubular church organs; the "Counterpoise Pneumatic System" of the automatic musical instruments, etc.

Galois, Evariste, French mathematician: b. Bourg-la-Reine 1811; d. Paris 1832. He obtained his early education in the Collège de Louis-le-Grand and entered the Ecole Normale in 1830, while there writing a theorem on the solubility of irreducible equations of prime degree by radicals, six articles on the theory of equations and theory of numbers, and with others founded the theories of groups and functions. His works were published in Paris (1897). See EQUATIONS, GALOIS THEORY OF.

Galoparo, gäl-ō-pä'rō, or **Capo di Faro,** kä'pō dē fä'rō, the Charybdis of the ancients. It forms the whirlpool on the outside of the harbor of Messina, in the strait separating Italy from Sicily. Opposite, on the Italian coast, is the rock Scylla.

Galt, gâlt, SIR **Alexander Tilloch,** Canadian statesman: b. London, England, 6 Sept. 1817; d. Montreal 19 Sept. 1893. He was a son of John Galt (q.v.) and went to Canada while still a boy. He made a fortune in the service of the British and American Land Company; was Canadian minister of finance in 1858–62, 1864–6, and in 1867; and Canadian high commissioner to England in 1880–3. He published 'Canada from 1849 to 1859.'

Galt, John, Scottish novelist: b. Irvine, Ayrshire, 2 May 1779; d. Greenock, Scotland, 11 April 1839. In 1804 he went to London, and entered into a mercantile partnership, but the venture soon ended in bankruptcy. He then resolved to try the legal profession, and entered himself at Lincoln's Inn, but made small progress in his studies, and quitted England in 1809. He made a tour of the south of Europe and the Levant, and on his return in 1812 published 'Voyages and Travels in the Years 1809, 1810, and 1811,' and 'Letters from the Levant.' The same year appeared his 'Life of Cardinal Wolsey,' and also a volume of tragedies, which received a rough handling from the 'Quarterly Review.' Among his other literary labors of this period was the tragedy of 'The Witness,' a life of West the painter, and a romance on the legend of the 'Wandering Jew.' In 1820 and 1821 the 'Ayrshire Legatees,' a series of letters descriptive of a supposed visit by a Scottish minister's family to London, appeared in 'Blackwood's Magazine,' and attracted universal attention. Its success induced him to publish immediately afterward his 'Annals of the Parish,' which was received with no less approbation. 'The Provost,' 'The Steamboat,' 'Sir Andrew Wyllie,' and 'The Entail' appeared in rapid succession. These were all extremely popular, but his subsequent novels, 'Ringan Gilhaize,' 'The Spaewife,' and 'Rothelan,' did not sustain the reputation which he had acquired. From 1826–29 he was superintendent to the Canada Company. While in Canada he founded the town of Guelph. He wrote the novel of the 'Last of the Lairds.' After his return to England he set himself resolutely to work, however, at his literary tasks, and produced successively 'Laurie Todd'; 'Southennan'; 'Life of Lord Byron'; 'Autobiography of John Galt'; 'Literary Life and Miscellanies of John Galt,' in three volumes.

Galt, SIR **Thomas,** Canadian jurist: b. London, England, 17 Aug. 1815. He went to Canada 1832 in the employ of the Canadian Land Company, was admitted to the bar 1845 and practised in Toronto. He became Queen's Counsel 1858, Chief Justice of the Court of Common Pleas 1887, retiring in 1894. He was knighted in 1888.

Galt, Canada, town of Waterloo County, Ontario, on the Grand River, the Canadian P. and the Grand T. Rys., 25 miles northwest of Hamilton; named for John Galt (q.v.). The town is picturesquely situated on both sides of the river which is here crossed by several bridges. It is substantially built and lighted by gas and electricity; an important jobbing centre; the seat of a United States consular agent; and has manufactories of flour, axes, paper, woolens, leather, foundry products, wooden-ware, and paper. It has several churches, good schools, a collegiate institute, a public library and reading-room, banks, and daily and weekly newspapers. Pop. (1901) 7,866.

Galton, gâl'tǒn, **Francis,** English scientist: b. Duddeston, England, 1822. He was educated at King Edward's School, Birmingham; studied medicine at the Birmingham Hospital and King's College, London; and graduated from Trinity College, Cambridge, in 1844. Having in 1846 traveled in North Africa, he explored in 1850 lands hitherto unknown in South Africa, publishing his experiences in his 'Narrative of an Explorer in Tropical South Africa' (1853), which obtained the gold medal of the Royal Geographical Society, and in 'Art of Travel' (1855). His investigations in meteorology are recorded in 'Meteorographica' (1863). A member of a Meteorological Committee of the Board of Trade, he was appointed one of the committee entrusted with the parliamentary grant for the Meteorological Office. Later he specially devoted himself to the problem of heredity, publishing: 'Hereditary Genius: its Laws and Consequences' (1869); 'Experiments in Pangenesis' (1871); 'English Men of Science: their Nature and Nurture' (1874); 'Life-History Album' (1884); 'Natural Inheritance' (1889); 'Finger Prints' (1893); 'Fingerprint Directory' (1895), etc. He was general secretary of the British Association in 1863–8; president of the Anthropological Section in 1877 and 1885; and president of the Anthropological Institute in 1885–6.

Galuppi, Baldassare, bäl-däs-sä-rä gä-loo'pē, Italian composer: b. island of Burano, near Venice, 18 Oct. 1706; d. Venice 3 Jan. 1785. He was sometimes called «Il Buranello.» From 1722 he was an organist in Venetian churches, and he early wrote an opera, 'Gli amici rivali.' After study of advanced composition as a pupil of Lotti, he again turned to writing, and achieved notable success with more than 70 comic operas, among them: 'Il mondo della luna,' and 'Il mondo alla rovescia.' He has generally been considered the originator of comic opera (opera buffa) in Italy. From 1741 he was for some time resident and active in London, in 1762 became maestro di capella at St. Mark's and director of the Conservatorie degli Incurabili, and in 1765–8 was in Russia as court composer and director of music. He wrote also some sacred works, but none of his compositions is known to-day save a harpsichord sonata which finds place in Pauer's 'Alte Klaviermusik.' He is apostrophized by Browning in 'A Toccata of Galuppi's.'

Galva, Ill., town in Henry County, on the Chicago, B. & Q. and the Rock I. & P. R.R.'s; 45 miles southeast of Rock Island and 48 miles north-northwest of Peoria. It is in a rich agricultural and coal region, on one of the highest points of the dividing ridge between the Mississippi and Illinois river-basins, and besides coal-mining, has considerable manufacturing interests. It has two banks and two weekly newspapers. Pop. (1900) 2,682.

Galvani, Luigi, loo-ē'jē gäl-vä'nē, Italian physiologist; the discoverer of galvanism: b. Bologna 9 Sept. 1737; d. there 4 Dec. 1798. He studied medicine, and in 1762 entered on the practice of his profession. His favorite studies were anatomy and physiology. He soon received the appointment of professor of anatomy in the celebrated institute of his native city, and published a treatise on the urinary vessels of birds. While engaged in these pursuits he was fortuitously led to the discovery which has immortalized his name. His wife, the daughter of Galeazzi, a medical professor under whom he had studied, and a woman of superior intelligence, having observed that the contact of the inanimate body of a skinned frog with a scalpel lying on the table produced in the frog a series of remarkable muscular convulsions, the knife being in contact with an electric machine, informed her husband of the fact, who instituted a series of experiments, and formed conclusions which led to a controversy with Volta. On a journey to Sinigaglia and Rimini he was so fortunate as to trace the cause of the electric appearances which are observed in the torpedo, and wrote a learned treatise on this subject. The loss of his beloved wife in 1790 rendered him inconsolable. Having refused to take the oaths to the Cis-Alpine Republic, he was deprived of his chair, and refused to resume it, when the government, in consideration of his celebrity, offered to allow him to do so unconditionally. In Rome a medal was struck with his effigy.

Galvanic Batteries. See PRIMARY BATTERIES.

Galvanism. See ELECTRICITY; GALVANIZATION, TREATMENT OF DISEASE BY.

Galvaniza'tion, Treatment of Disease by. Of the different forms of electricity used in medicine the galvanic current is perhaps the most widely employed. It may be administered either locally or centrally; local galvanization is used especially for the relief of pain. It is applied to the brain, eye, ear, sympathetic nervous system, spinal cord, urethra, bladder, and chest, either by what is known as «stabile» application, in which both electrodes are kept in a fixed position, or by «labile» application, in which one or both electrodes are slid over the surface, but not lifted from the skin. It is found that a greater sedative influence is obtained if the galvanic current is not interrupted. Labile and stabile interrupted currents are generally preferred for the galvanization of muscles of the head, spinal cord and nerve-tracts. Stabile continuous currents, either uniform or increasing, give the best results. When the galvanic current is interrupted it causes, as is well known, pronounced muscular contraction. This is of service as a tonic to poorly nourished and atrophied muscles.

By «central» galvanization is meant that mode of treatment by the galvanic current by which the entire central nervous system may be brought under the influence of the electrical fluid. In order to accomplish this, one electrode, usually the negative, is placed over the solar plexus, at the pit of the stomach, while the other is firmly pressed to the top of the head and passed gradually over the back of the head and along the inner border of the strong muscle that pulls the neck to one side, the sternoclidomastoid. From here the electrode is passed down the spine. It is thought to increase the electrical excitability of the central nervous system, inducing sleep and relieving general tire. It is a method, however, that should be used with great caution, as it may do more harm than good. See ELECTRICITY, MEDICAL USES OF.

Galvanized Iron, sheets of iron coated with tin by a galvanic process, and with a second metal, zinc, which is effected by preparing a bath of fluid zinc covered with sal ammoniac mixed with earthy matter. When the tin-coated sheet is plunged into this preparation the zinc is precipitated with a crystal-like diaper upon the tin. The term is sometimes improperly applied to sheets of iron which have been coated with zinc without recourse to the use of galvanism. The iron, after being thoroughly cleaned from all trace of oxydization, by a dilution of sulphuric acid, is then plunged into a bath of melted zinc and other substances such as sal ammoniac, or mercury and potassium.

Galvanocau'tery, the use of a cautery knife, loop, point, or blade heated by the passage of a galvanic current. It is of value wherever a limited cautery action is desired, and particularly valuable in being easy to control.

Galvanometer, an instrument for measuring the intensity, direction or length of duration of an electric current. The many types of indicating instruments such as voltmeters and ammeters, where the pointer is held at zero by some directive force, such as the earth's field, a spring or weight or a permanent magnet, come under this head. With very few exceptions, all galvanometers may be classed under two heads: (1) Those having a magnetized needle suspended so as to move freely in a horizontal plane, the needle being normally held at zero position by means of the earth's field or an external field produced by auxiliary magnets placed to accomplish this result. The needle is suspended on a pivot or a quartz fibre or fibre of silk or other appropriate material. (2) Those having a coil of wire in place of the needle in the first class. This is the type usually called the d'Arsonnal type, and has the coil suspended by means of a fine wire, which provides a way for leading current to the coil, and has another wire underneath the coil for conducting the current from it. The coil, with the conducting wires, is then suspended between the poles of a magnet, its axis being normally at right angles with the lines of the field. The second class of galvanometers, those having a moving coil, are to be preferred for most classes of work, all except those requiring the very greatest delicacy, for the following reasons: The readings are but very slightly affected by the presence of an external field or by magnetic substances in vicinity of the instrument, and are practically independent of the variable influence of the earth's field; this form of instrument may easily be made dead-beat, on account of the strong field in which the coil moves; many forms are portable, and much less affected by vibrations than those of the first class.

The figure of merit of a galvanometer may be expressed either as the current necessary to cause a deflection of one scale division, or as the resistance through which one volt will cause a deflection of one scale division when such resistance is inserted in the circuit. Such an expression of the delicacy of a galvanometer should be accompanied with the following data: The resistance of the instrument, the scale distance and size of one division of the scale. The sensitiveness of a galvanometer is expressed as the difference of potential across the galvanometer terminals necessary to cause a deflection of one scale division; and to be exact, should be accompanied with the same data as for the figure of merit. Of the moving needle class of galvanometers the tangent galvanometer and the Thomson astatic galvanometers are probably in most general use. The tangent galvanometer is constructed so that the inside diameter of the coil which surrounds the needle is at least 12 times the length of the needle. Under these conditions, the needle being held at zero by the earth's field, the current strength will vary directly as the tangents of the angle of deflection; hence the name of the instrument. Although at one time much used for the absolute determination of current strengths, it has of late been replaced by other types, on account of its many correction factors, some of which are of uncertain magnitude, a prolific cause of error being the necessity of knowing the exact value of the horizontal component of the earth's magnetism, which quantity is subject to continual change and is affected by large masses of iron or heavy electric currents in the vicinity.

The Thomson Galvanometer.— This type was designed by Lord Kelvin, and to him we are indebted for the most sensitive instruments as yet made. The moving system consists of a slender quartz rod to the centre of which is fastened a small mirror of glass. Above and below the mirror at each end of the quartz rod is fastened a complex of carefully selected magnetized needles, minute in size, placed parallel to the plane of the mirror. In the upper complex the north poles of the needles are all placed in one direction, and in the lower complex the north poles of the needles are placed in the opposite direction, the combination forming an astatic system, on which the earth's field exerts a very slight directive force. This directive force exerted by the earth's field would be zero if the two complexes could be made exactly equal in magnetic strength. Each complex of needles is enclosed by two coils, thus making four coils in an instrument. These coils are provided with binding posts for series or parallel connection, and are connected so that the current flowing through them will cause the magnetized needles to be deflected in the same direction in each complex. An adjustable magnet mounted on top of the instrument provides a directive action on the needles which may be modified to any extent, a weak directive force increasing the sensitiveness greatly, and also increases the period of oscillation, so that in the best instruments the sensitiveness is limited largely to the patience of the observer.

Moving Coil Galvanometers.— This type is most familiar in the d'Arsonnal galvanometers, and is to be preferred for most purposes within the limits of its sensitiveness. Its preference lies in the fact that it may easily be made dead-beat, and the readings are practically independent of the earth's field or magnetic substances in its vicinity. The construction also adapts itself to a portable type of instrument, and it may be so constructed as to be very slightly affected by vibrations. The sensitiveness of this class of galvanometers may be further increased by substituting an electro-magnetic field for that produced by permanent magnets. Consult: Nichols, 'The Galvanometer.'

J. E. Taylor,
Western Electric Company, Philadelphia.

Galveston, Texas, city, port of entry and county-seat of Galveston County, on Galveston Island, at the mouth of Galveston Bay. It is on the Southern Pacific, the Missouri, K. & T., the Gulf, C., & S. Fe, the International and Grtat Northern, the Galveston, Houston & Henderson, and the Gulf & Interstate Railroads. The city, which includes Pelican Island, has a total area of 13 square miles.

Trade and Commerce.— Galveston is the natural entry port for the great Southwest. The trade year beginning 1 September, showed for the year of 1902–03 the breaking of many records. Comparative figures are as follows: Cotton receipts (1902–03) 2,093,070 bales; (1901–02) 2,090,710 bales. Bank clearings $413,185,000, an increase of $40,946,200. Galveston has advanced from fourth to third place in its rank among exporting ports of the United States. The total value of foreign exports and imports for the trade year (1902–03) was $105,632,087; (1901–02) $97,691,312. Total value of goods handled over the Galveston wharves (1902–03), $447,910,707; (1901–02) $246,567,246. Cash receipts at the custom-house from all sources (1902–03), $448,519; (1901–02) $220,321. The total value of foreign exports (1902–03) $104,121,087; (1901–02), $96,181,423. The foreign imports for 1902–03, were $1,511,334; (1901–02), $1,192,758. The total value of foreign goods imported over the Galveston wharves during 1902 was $3,233,039. A statement of the total tonnage entered or cleared at the port for 1902 shows 1,340 vessels with a tonnage of 3,094,903, compared with a total of 1,042 vessels, with a tonnage of 2,222,928 for 1901. The coastwise trade during the year 1902–03 more than doubled that of the previous year. Galveston has 53 lines of steamships to foreign ports. There are two regular lines of coastwise vessels to New York and 9 lines of coastwise vessels to points in the gulf. During 1902–03 over 90,591 loaded cars were handled in the yards of the Galveston wharf company by the various railroads, compared with a total of 77,139 loaded cars handled during 1901–02. The domestic exports are cotton, wool, hides, oil cake and oil meal, cottonseed oil, fish oil, cement, and poultry. The domestic imports are drugs, boots and shoes, hats, dry goods, chemicals and like commodities. The foreign exports are cotton, cottonseed oil, oil cake and meal, wheat, corn, flour, copper and iron ores, cattle, lumber and timber, and provisions. The foreign imports include fire brick, tiles, chemicals, cement, liquors, earthenware, prepared vegetables, and fancy woods. There are four export grain elevators, with a storage capacity of 4,000,000 bushels and one clearing and conditioning elevator. There are six miles of completed wharfage covered with sheds and a complete railroad trackage system which covers about 50 miles.

Public Buildings.—Galveston has 31 churches for white people and 12 churches for colored people, two orphan asylums, a home for homeless children and a home for aged women; the School of Medicine of the State University, 12 private or sectarian schools, a Roman Catholic university, two Roman Catholic academies, a business college and public high school and five graded schools for white children. One high and two graded schools for colored children; a library building which cost $150,000 endowed with a fund of $400,000; a Masonic temple and a Scottish rite cathedral.

Finances and Industries.— The city has eight private and two national banks, 21 building, loan, abstract and real estate corporations. The waterworks, fire department, sewer system and street electric-light plants are owned by the city. The waterworks plant is valued at $1,550,000. The supply of water comes from artesian wells on the mainland and is piped under the bay. Two daily papers and eight weekly papers are published here. The city has two thoroughly equipped hospitals; 12 hotels; a large jobbing trade; bagging mills, rope mills, brewery, cement and pipe works, ice plants, iron works, sash, door and blind manufactories, cotton presses, clothing, cotton oil, flour, meal, coffee, baking powder, spices, extracts, pickles, preserves, macaroni and mineral water manufactories, and rice-mills.

Here is the recognized finest beach in the world, 30 miles long, sea-bathing, fishing, boating, driving and riding facilities unsurpassed and semi-tropical winters and balmy summer breezes offer a delightful climate the year round. Annual average temperature 69 degrees. Average temperature for July 84 degrees. Average temperature for January 53 degrees. Average annual rainfall 46 inches. The rate of taxation for the city is $1.70 on the $100 and for the State and county $1.44⅔. Total tax rate $3.14⅔ on the $100. The assessments of the city for 1903 were $20,574,000 and for the county $21,895,950.

Government.— The State legislature in 1901 placed the city under a commission. This government has proved most satisfactory and is being run on a basis of about $100,000 a year cheaper than the previous municipal administration. The State legislature also provided for the refunding of the bonded floating indebtedness of the county and for grade raising bonds. Authority was also granted to issue bonds on the approval of two thirds of the tax-paying citizens for breakwater purposes. The city commission appointed a board of engineers and plans for protection calling for an expenditure of $3,505,000 were adopted. The bonds were voted almost unanimously and more than $1,000,000 of the $1,500,000 voted for breakwater purposes were subscribed for by Galveston people. The State legislature granted Galveston for a period of 17 years the State's portion of taxes on city property. This amounts to about $80,000 per year. The money thus derived is to be used for the purpose of raising the grade of the city.

The Sea Wall.— Work on the Galveston sea wall was begun in October, 1902. Half the work on the structure was completed in September 1903. The wall will be 17,593 feet long, 16 feet wide at the base and 17 feet high. (See GALVESTON SEA-WALL.)

History.—About the year 1782 a Spanish fleet made an examination of the coast of the Gulf of Mexico west of the Mississippi River, and named Galveston Bay and island in honor of Conde de Galvez, then governor of Louisiana. The explorers found on the island one white man who subsisted by hunting and fishing. Galvez was governor of Louisiana from 1780 to 1785. Until the year 1816 Galveston island remained in its primeval state, a low island formed in process of time by the sea throwing up sand and shells. The conjecture that La Salle visited Galveston island during his brief stay in Texas is without reasonable foundation. The island was long a favorite hunting ground for the Caroñkawas, the once powerful and warlike tribe which inhabited so much of the coast of Texas. Francisco Zavier Mina, a young Spanish soldier, resolved to lend the patriotic cause in Mexico his sword and aid the people of that country in their struggle for liberty. He determined to make Galveston island his base of operations. He worked in co-operation with Don Luis Aury, a naval officer. His plan was approved by Herrara, commissioner of the Mexican revolutionary or Morelos government to the United States. Herrera, with Aury, landed on Galveston island with an expedition in September 1816. A government was organized, Aury was made civil and military governor of Texas and Galveston island and took the oath of fealty to the Republic of Mexico. In November 1816, Mina arrived at Galveston with a few small vessels and about 200 men. Mina and Aury abandoned the island in March 1817. Just about the time they left Galveston island we have the first account of Lafitte coming to the island. The pirate is supposed to have reached Galveston late in 1816. He held letters of marque from the revolutionary government of Venezuela authorizing him to prey upon the commerce of Spain. He had a number of vessels and quite a force of adventurers. He also assumed to be governor of Texas under the revolutionary government of Mexico, probably having received some such authority from Herrera, the Mexican commissioner in New Orleans. Lafitte's purpose was to capture Spanish vessels sailing under the flag of the Mexican republic. By the close of the year 1817 the population of Galveston had increased to nearly 1,000. The United States and Spain found cause for complaint against the pirates, but Spain feared the United States would claim the island if the pirates were dispersed by the American naval establishment, and the United States did not feel called upon to take action, owing to the attitude assumed by Spain, consequently Lafitte was left undisturbed. In 1820 an American vessel was taken by Lafitte's men. The United States government then dispatched an armed vessel under Lieut. Kearney to break up the establishment at Galveston. Lafitte left Galveston for good, but continued his depredations upon Spanish shipping until 1826. In 1820 Dr. James Long visited Galveston island to induce Lafitte, who was about leaving Galveston, to co-operate with him in the establishment of a government at Nacogdoches. Lafitte referred to the failure of all previous attempts to invade Texas and refused to join Long. Before Long left Bolivar Point a French sloop freighted with wine stranded on Galveston island. Caroñkawas to the number of 200 were encamped in the vicinity. They attacked and butchered the crew, plundered the sloop and engaged in a drunken jollification. Long determined to chastise them. After nightfall with 30 men he passed over to the island in small boats. In the fight the Caroñkawas outnumbered the whites seven to one. Long was compelled to retreat. Three of his men were killed; 32 Indians were left dead on the field.

Little is heard of Galveston island after Long's expedition until just previous to the battle of San Jacinto. The island was practically abandoned from 1820 until along in the thirties, when the Mexican government established a custom-house on the island. On the occasion of the preliminary meeting at Brazoria to declare the independence of Texas in 1835 there was no representative present from Galveston. The same is true of the more formal declaration of independence which was made on 2 March 1836, at Washington on the Brazos. Just prior to the battle of San Jacinto the new Texas government retreated from Washington to Harrisburg. As Santa Anna and his army approached Harrisburg, President Burnet and his cabinet sailed down to Galveston island, narrowly escaping capture. The news of the victory at San Jacinto reached President Burnet on Galveston island 26 April 1836. The provisional government of Texas under Governor Smith in 1835 had granted letters of marque and reprisal and had provided for the establishment of a small navy. The Liberty, one of the vessels of this navy, was at Galveston at the time of the battle of San Jacinto. Several prizes were taken by the Texas navy and brought into Galveston Bay. During the hostile period following the battle of San Jacinto the Mexican government proclaimed a blockade against the ports of Texas and in attempting to enforce it interfered with vessels of the United States. In 1837 the Texas navy was increased and several vessels were stationed at Galveston. The third congress of the Texas republic assembled at Houston in November, 1838. The County of Galveston was represented for the first time in the third house of representatives by Moseley Baker. After the annexation of Texas and the outbreak of the Mexican War the first Texas regiment to join General Taylor was composed of six months' men raised and organized in Galveston, commanded by Albert Sydney Johnston. Galveston County was created 15 May 1838. The battle of Galveston during the Civil War, occurred 1 January 1863. The first railroad begun in Texas was at Harrisburg in 1852. The Galveston, Houston and Henderson road was begun at Virginia Point in 1855. Trains were first run from Virginia Point to Houston in 1859 and in that year a contract was let for the first Galveston bay bridge, which was completed and trains were run into Galveston in 1860.

The jetties at Galveston were completed in 1896, since which time the water at the point where the bar existed has been slowly deepening. (See Galveston, Jetties at.) Galveston wharves are only one hour from the deep sea for a laden steamer. Galveston wharf and terminal facilities, as a system, have few equals in the country, being excelled in no particular except size.

In December, 1836, Colonel Michaël B. Menard purchased of the Republic of Texas for the sum of $50,000 one league and labor of land on the east end of Galveston island. He associated with him a number of persons and they formed a joint stock company known as the Galveston City Company, which was incorporated in 1841. This company is still in existence, although its present holdings of real estate are not large. The city of Galveston was incorporated in 1839. The first mayor was John M. Allen.

Galveston has had three noted philanthropists. George Ball gave the city the Ball High School, which cost $100,000 and has been added to since his death by his widow and son. He also left $50,000, the interest of which is to be used for the poor and deserving of the city. John Sealy presented the city with the Sealy hospital, which has cost over $100,000. Henry Rosenberg left $30,000 for an orphans' home, $30,000 for Grace church, $30,000 for a home for aged women, $65,000 for a Y. M. C. A. building, $50,000 for a monument to the heroes of the Texas revolution of 1836, $30,000 for drinking fountains, $150,000 for a library and $400,000 with which to endow the same. He also presented the city before his death with a $100,000 school building, which is known as the Rosenberg school.

The property loss at Galveston occasioned by the storm of 8 Sept. 1900, was $17,058,275. The loss of life on the island is estimated at 6,000. The total cash receipts of donations made to flood sufferers amounted to $1,243,495.

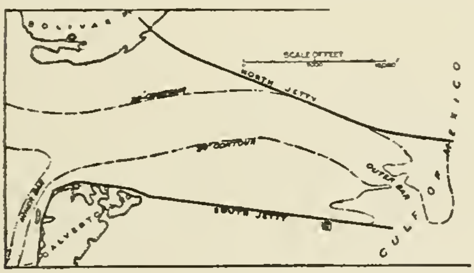
Population.— (1880) 22,248; (1890) 29,084; (1900) 37,789. The population of Galveston,

according to the City Directory for 1903-04 is 32,745.
R. G. Lowe,
Vice-President of the Galveston News.

Galveston Bay, an inlet of the Gulf of Mexico, extending northward from Galveston about 35 miles.

Galveston Island, an island off the coast of Texas on the northeastern end of which is Galveston. Length, about 28 miles.

Galveston, Texas, Jetties at. The entrance to Galveston harbor was originally obstructed by an inner bar upon which the depth of water was 9½ feet and an outer bar with a depth of 12 feet. The Federal government adopted the jetty system for improving the entrance to this harbor. Two jetties have been constructed of sandstone riprap and are covered with granite blocks weighing from 5 to 12 tons each. The south jetty is 35,603 feet in length and the north jetty 25,907 feet in length. They are to be built to a height of 5 feet above mean low tide and are from 12 to 15 feet in width at the top with a slope of about 1½ feet to each vertical foot in depth. The distance between the shore ends



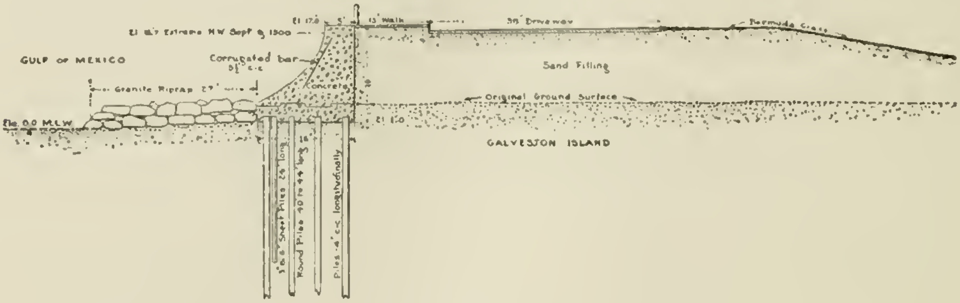
of the jetties is about two miles, they converge until their sea ends are about 7,000 feet apart. There had been expended to 30 June 1902 on this work $8,519,684.42. The jetties, by confining the water, has increased the tidal scour and secured a depth of over 26 feet at mean low tide on both bars. These works were damaged by the hurricane of 8 Sept. 1900, but have been repaired with granite blocks of ten tons weight. There is every assurance of securing, when this work is completed, not less than 30 feet of water at mean low tide.
Walter Gresham.

Galveston, Military and Naval Operations at. In the summer of 1862 Farragut sent several light squadrons to cruise along the coast of Texas, and a blockade was maintained against Galveston, which was abandoned by the Confederate military forces, and 8 October surrendered by its civil authorities to Commander Renshaw of the United States Navy. Six United States vessels lay in the bay, commanding the city. 7 November Lieut. Jouen, with two launches, captured and burned the privateer Royal Yacht, carrying one heavy gun, and took 13 prisoners, with a Union loss of two killed and seven wounded. On 24 December, 260 men of the 42d Massachusetts regiment were landed and encamped on the city wharf. At daybreak, 1 Jan. 1863, Gen. Magruder, the Confederate commander in that department, made a combined naval and land attack upon the Union fleet in the bay and the military in the city. He secured four steamers from the adjacent rivers, used cotton-bales for armor, mounted them with guns and filled them with sharpshooters, and attacked the six United States vessels. The Westfield was blown up and destroyed by her officers to prevent capture; the Harriet Lane was boarded, and surrendered after her captain and executive officer had been killed. One of Magruder's boats went to the bottom in its encounter with the Harriet Lane. The land force was attacked by a largely superior force and, after a stout resistance, in which it had 20 men killed and wounded, surrendered. Magruder reported his loss as 26 killed and 117 wounded. The other United States vessels then abandoned the blockade, but Farragut quickly restored it, soon after which, 11 January, a strange vessel was seen outside and the Hatteras was sent to overhaul her. She proved to be the noted Alabama, and after a short and hot fight she sunk the Hatteras, saving her crew. Ten days later the Union gunboats Velocity and Morning Light, blockading Sabine Pass, were attacked by Confederate steamers, driven out to sea, and captured, with guns, prisoners, and a large amount of stores. Galveston remained in Confederate possession until the close of the war. Consult: 'Official Records,' Vol. XV.; Mahan, 'The Gulf and Inland Waters'; Maclay, 'History of the Navy,' Vol. II.; Lossing, 'Field Book of the Civil War,' Vol. II.; the Century Company's 'Battles and Leaders of the Civil War,' Vol. III.
E. A. Carman.

Galveston Sea-wall. The date 8 Sept. 1900, in Galveston, Texas, will be referred to by its inhabitants for generations to come. The appalling loss of life and the destruction of property on that date, due to the terrific West Indian hurricane which drove the waters of the Gulf of Mexico over the oleander city, shocked the civilized world. Over 6,000 lives were sacrificed to satisfy the storm king's anger, and over $17,000,000 worth of property was completely destroyed. The city of Galveston is located on the east end of an island about 30 miles in length and from one to three miles in width. The entire south side of the island fronts on the Gulf of Mexico, while the north side fronts on Galveston Bay. As to the frequency of hurricanes, and the probability of Galveston being visited again, is a matter of mere conjecture. This city was settled in 1847, and since that time has been visited by six storms, none of which, however, caused the loss of exceeding three lives. In September 1875 a hurricane swept over the island, causing considerable damage to property. At this time the convention was in session which framed the present Constitution of the State of Texas. The impression produced by this hurricane led to the insertion of Sections 7 and 8, in Article XI. of the Constitution, granting all counties and cities bordering on the coast of Mexico the right to issue bonds and construct sea-walls, or breakwaters. Judge Wm. P. Ballinger, one of Galveston's most honored citizens and a lawyer of marked ability, was a member of this constitutional convention, and the author of the sections before named. On 28 Aug. 1886, having in mind a storm which swept the city on the 20th day of that month, Judge Ballinger addressed an open letter to the citizens of Galveston, calling to their attention this constitutional provision and warning them of the great necessity for the construction of a sea-wall as a means of protection. This letter was a strong appeal, and while it provoked much newspaper discussion, no active steps were taken to carry out the plan offered. When the people of Galveston awoke from their night of death in September 1900, Judge Ballinger's plan was again brought to light, and, although the author had long since passed away, it required no new appeal to spur the then thoroughly aroused people to the point of action.

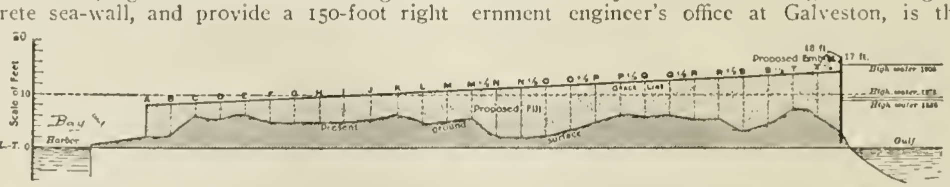
On 22 Nov. 1901, the Board of Commissioners of the city of Galveston appointed a Board of Engineers, consisting of Brig.-Gen. H. M. Robert, U. S. Army (retired), Alfred Noble, and H. C. Ripley, engineers of national renown, to devise a plan for the protection of Galveston against destructive overflows. On 25 Jan. 1902 this board submitted a plan calling for the construction of a solid concrete sea-wall and the raising of the city's grade. The raising of the grade was not only intended to furnish a solid backing for the sea-wall, but also to prevent the water from the Gulf, in the severest storms, from ever reaching a depth in the city dangerous to life or property. The plan for protection submitted by this engineering board was accepted as the best that could possibly be devised. The county of Galveston, through the commissioners' court, agreed to construct the granite concrete sea-wall, and provide a 150-foot right of way and filling for the same, with the understanding that the city proper, with aid from the State of Texas, would undertake the task of raising the grade.

Construction of the Sea-Wall.— This wall is now nearing completion. Its total cost, including the 150 foot right of way, will be $1,500,000. Its top is seven and one half feet above the extreme high water mark of September 1875, the highest ever known, excepting on 8 Sept. 1900, and it is one and three tenths feet higher than on that unprecedented occasion. The sea-wall, when completed, will be 17,593 feet in length, and is constructed on a piling foundation driven 43 feet in the ground, below mean low water, with a double thickness of sheet piling on the Gulf side. The wall is 16 feet at the base, 16 feet high, and 5 feet wide at the top, curving from the top to the base, as shown in sketch. The concrete is composed of one part of cement, three parts of sand and six parts of crushed granite. At intervals of three and one half feet, there is placed in the wall one and one half inch square, corrugated steel reinforcing rods 10 feet long. The rip rap in front of, or on the Gulf side of the wall is 27 feet wide, and from three to seven feet in thickness, and is composed of granite. The contract for constructing the wall was let to J. M. O'Rourke & Company, of Denver, Colo., on 9 Sept. 1902, with the provision that the work be completed in 15 months from date of contract.



CROSS SECTION OF GALVESTON SEAWALL & FILLING..

Raising the Grade.— In order to carry out the plan for raising the grade, the legislature of the State has authorized the city to issue bonds to the amount of $2,000,000 at a rate not to exceed five per cent. In order to aid the city in caring for these bonds the State has granted it $70,000 per annum for a period of 17 years. The management, control and direction of this work is in the hands of three commissioners appointed by the Governor, and known as the "Grade Raising Board of the City of Galveston." This board is composed of Capt. J. P. Alvey, chairman; John Sealy, and E. R. Cheesborough. Capt. C. S. Riche, U. S. Army, of Chicago, who for six years was in charge of the government engineer's office at Galveston, is the consulting engineer. The grade is to extend from the Bay eight feet above mean tide to seventeen feet at the sea-wall, thus forming a rise of one foot in 1,500 from the Bay to the Gulf. With this protection carried out, the city so protected will not be exposed to any danger from the waters of the Gulf.



Geo. W. Boschke,
Engineer in Charge of Sea-Wall Construction.

Galvez, gäl'vāth, **Bernardo**, Count de, Spanish colonial administrator: b. near Malaga 1755; d. Mexico City 30 Nov. 1786. He entered the Spanish army in the Walloon guards, served also in the Cantabrian regiment of France (1772–5), and later fought with distinction under Gen. O'Reilly in the war against Algiers. In 1776 he became lieutenant-governor of Louisiana, in the same year governor; and during the Revolutionary War, particularly after the Spanish declaration of hostilities against England in 1779, was of much service to the American cause. His capture of Pensacola and with it the Florida west coast (19 May 1781) was celebrated in verse by de Poydras. In 1783-5 he was captain-general of Cuba, and in 1785 was appointed viceroy of Mexico. His construction of a fortress-palace on the site of the castle of Montezuma at Chapultepec caused him to be misrepresented to the Spanish government as plotting the establishment of an independent Mexican kingdom. He improved the mines, increased the revenue, and alleviated the famine of 1785. He was one of the ablest of Spanish officials in the New World.

Galway, Ireland, a municipal and parliamentary borough, a seaport, and county of itself at the mouth of the river Corrib, on the north shore of Galway Bay, 50 miles north-northwest of Limerick. The old town is poorly built and irregular. The new town consists of well-planned and spacious streets, and is built on a rising ground which slopes gradually toward the sea and the river. Galway is the see of a Roman Catholic bishop, but is in the Protestant Episcopal diocese of Tuam. The principal buildings are the cruciform church (Episcopal) of Saint Nicholas (1320); St. Augustine's Roman Catholic church (1859), monasteries, nunneries, the county court-house, barracks, prison, infirmary, and Queen's College (1849). Galway has flour-mills, a distillery, a foundry, extensive salmon and sea fishing, a good harbor, with docks that admit vessels of 500 tons, and a lighthouse. During 1858-64 a line of steamers plied between Galway and the United States, but the service was abandoned in the last named year. The exports consist mainly of agricultural produce, wool, and black marble. It was taken by Richard de Burgh in 1232. From the 13th till the middle of the 17th century it continued to rise in commercial importance. In 1652 it was taken by Sir Charles Coote, after a blockade of several months; and in July 1691 it was compelled to surrender to General Ginkell. Pop. (1901) 13,244.

Galway Bay, a large bay on the west coast of Ireland, between County Galway on the north and County Clare on the south, about 30 miles in length and from 20 to 7 miles in breadth. Across its entrance lie the Aran Islands, and there are numerous small islands in the bay itself.

Gáma, gä'mä, **Antonio Leon de,** a Mexican scientist: b. City of Mexico 1735; d. 12 Sept. 1802. He was secretary to the supreme court for a number of years, and subsequently was a professor at the School of Mines. He is best known for his study of the celebrated Aztec calendar stone which was discovered in his time.

Gama, José, Basilio da, Brazilian poet: b. in the district of Rio-dos-Mortes, Brazil, 1740; d. Lisbon, Portugal, 31 July 1795. Educated by the Jesuits, he joined their order; but about 1786 renounced his allegiance to it, and published the poem 'Uruguay' to expose the alleged Jesuit design of forming an independent state among the Uruguay Indians. He was elected a member of the Academy of Lisbon. He also published 'Lenitivo da Sandade do Principe D. José' (1788), and 'Quitubia' (1791).

Gama, Vasco da, väs'kō dä, Portuguese navigator: b. Sines, Portugal, 1450; d. Goa, India, 24 Dec. 1524. He was the first navigator who made the voyage to the East Indies by the Cape of Good Hope. Bartholomew Dias, a Portuguese explorer, having visited the cape, which he called Cabo Tormentoso, or stormy cape, brought back such interesting accounts of his discoveries that the Portuguese sovereign Emanuel, following the policy of his predecessor, John II., determined to urge discovery beyond the point where Dias left it, and if possible to reach by sea the countries of the Indies. Accordingly an expedition was placed under the command of Vasco da Gama, a gentleman of the king's household, and a skilful and experienced mariner. The fleet consisted of the San Gabriel, flag-ship of 120 tons, the San Rafael of about 100 tons, a caravel of 50 tons, and a store-ship, with a total force of 160 men. The king presented Gama with the flag of the military order of Christ (a white cross within a red), also the journal of Covilham the navigator, who had 10 years before gone to India by way of the Red Sea, and with letters to all known potentates, and to the mysterious Prester John. On 8 July 1497 Gama's expedition departed from Lisbon for the Cape Verde Islands, whence it set sail on 3 August southward along the African coast. For three months the voyagers pursued their way, harassed, as an early English narrator says, with torments of wind and rain. On 7 November they put into a bay called St. Helena, near the cape, where they found the natives «lyttle men, ill favored in the face and of color blacke, and when they did speake it was in such manner as though they did alwayes sigh.» Departing on the 16th, they encountered a succession of tempests such as had gained for the southern promontory of Africa the name of the Cape of Storms. The courage of Gama's companions failed, and they besought him to put back, which he not only refused to do, but put the ringleaders of the movement in irons, and held on his course into the stormy sea. When they were beating about off the promontory, Gama fancied that he saw the spirit of the cape. Camoens has sung this incident as a fact, while moderns, less poetical, say that the apparition could have been nothing more than that peculiar cloud whose sudden envelopment of the cape is the forerunner of a storm. On Wednesday, 20 November, they doubled the Cape of Storms, or rather, as Emanuel himself had named it ere the expedition set out, the Cape of Good Hope. Proceeding along the coast, they touched at various points, among others at Natal. Further north they discovered Mozambique, and came upon a country which exhibited a high stage of commercial advancement, the inhabitants having regularly built ports, with mosques. The natives were Mohammedans, carrying on a trade in pearls, rubies, silver, linen, and spices with Arabia and India. Gama took with him a pilot from this place. On 1 April the explorers discovered the island of Açoutado, which Gama so named from a flogging he gave to his pilot there; and on the 7th the island of Mombassa, where the people who inhabited it were bravely apparelled in silken stuffs and jewelry. As these men tried to cut his cable, Gama seized a boat containing 17 of them, and carried them off to Melinda, 3° south of the equator, where the king of the place entered into the most friendly relations with the Portuguese, and gave them a pilot to conduct them across the Indian Gulf. Melinda was described as a regularly built city, with wide streets and houses of more than one story. The Melindese pilot is reported to have been acquainted with the astrolabe, compass, and quadrant. Under his guidance the voyagers steered 750 leagues across the open sea. In 23 days they arrived off the Malabar coast, and on 20 May 1498 they reached Calicut, the object of their search. Their mission was thus accomplished, and a new route to the East established. Gama's relations with the ruler of Calicut, who was called the Samoudri-rajah (abbreviated to Zamorin) were not of a cordial nature; and therefore, leaving the Indian coast on 15 October, Gama returned to Lisbon, calling at Melinda on the way to take on board an ambassador to Emanuel's court, and arriving in the Tagus September 1499, after an absence of two years and two months. He brought back only 55 men and one ship, a caravel which he had chartered at Cape Verde. The San Rafael had been lost on the coast of Africa, the store-ship burned according to Gama's instructions, the San Gabriel condemned at Cape Verde, and Nicolao Goelho had slipped away with the remaining vessel in order to be the first to tell the great news in Portugal. The king received Gama splendidly, and permitted him to bear the high-sounding title of "lord of the conquest of Ethiopia, Arabia, Persia, and India."

Emanuel immediately fitted out a second fleet of 13 ships, with 1,200 men, under the command of Pedro Alvarez Cabral, to establish trading posts; but failing in its ends, another fleet of 20 ships was placed under command of Gama. This expedition, which was warlike in its character, sailed early in 1502. On reaching Calicut, Gama immediately bombarded the town, enacting deeds of inhumanity and savagery too horrible to detail, and equaled only by the tortures of the Inquisition. From Calicut he proceeded in November to Cochin, "doing all the harm he could on the way to all that he found at sea," and, having made favorable trading terms with it and other towns on the coast, he returned to Lisbon in September 1503 with richly laden ships. He and his captains were welcomed with great rejoicings; "but to Dom Vasco the king gave great favors, and all his goods free and exempt; he granted him the anchorage dues of India, made him admiral of its seas forever, and one of the principal men of his kingdom." Soon after his return Vasco retired to his residence in Evora, and for 20 years took no part in public affairs, either from pique at not obtaining, as is supposed by some, so high rewards as he expected, or because he had in some way offended Emanuel. During this time the Portuguese conquests increased in the East, and were presided over by successive viceroys. The fifth of these was so unfortunate that Gama was recalled from his seclusion by Emanuel's successor, João III., created count of Vidigueira, and nominated viceroy of India, an honor which in April 1524 he left Lisbon to fill. Arriving at Goa in September of the same year, he immediately set himself to correct, with vigor and firmness, the many abuses and evil practices which had crept in under the rule of his predecessors. He was not destined, however, to prosecute far the reforms he had inaugurated, for on Christmas eve following his arrival he died, and was buried in the Franciscan monastery there. In 1538 his body was conveyed to Portugal and entombed in the town of Vidigueira, of which he was count, with all the pomp and honor due to one who had been the king's representative. The important discoveries of Vasco da Gama had the result of enriching Portugal, and raising her to one of the foremost places among the nations of Europe.

Gama'liel ("God is a reward"). Two persons of this name are mentioned in Bible history. The first, Gamaliel, the son of Pedahzur, in the book of Numbers, i. 10; ii. 20; vii. 54, 59; x. 23, as prince or head of the tribe of Manasseh. The other and better known Gamaliel is mentioned twice in the Acts of the Apostles. In both passages he appears as a learned doctor of the law, of the sect of the Pharisees. From the one we learn that he was the preceptor of St. Paul, who was brought up in Jerusalem, "at the feet of Gamaliel." In the other we find him advising the council of Sanhedrim in regard to their treatment of the apostles, and it is the advice given on this occasion which has rendered him famous. "If this counsel or this work," he said, "be of men it will come to naught, but if it be of God ye cannot overthrow it, lest haply ye be found to fight even against God." Ecclesiastical tradition makes Gamaliel become a Christian, and relates that he was baptized by St. Peter and St. Paul; but the story does not appear to be supported by any evidence. He has been identified by scholars with Gamaliel, the son of Simeon and grandson of Hillel, president of the Sanhedrim under Tiberius, Caligula, and Claudius.

Gamarra, gä mär'rä, **Augustin**, Peruvian general; b. Cuzco 27 Aug. 1785; d. Yngavi 20 Nov. 1841. He fought in the Spanish army in 1809–21, then joined the patriots, marched into Bolivia (1827), and effected the Treaty of Pisagua (1828). From 1829 to 1833 he was provisional president of Peru, and later was variously identified with the political disturbances of the time. In 1837 he took a leading part in Chilean opposition to the Bolivia-Peru confederation, and upon the conclusion of a successful campaign became president of Peru (1839). He was killed in battle during an invasion of Bolivia.

Gamba, a stringed instrument of the viol sort, called also viola da gamba, with six strings, weaker in tone and smaller in size than the violoncello, so called because it was held between the knees of the player, as distinguished from viola da braccia, played on the arm. Also an organ stop, the pipes of which are, in continental organs, generally cylindrical, of small scale, and well cut up, but sometimes conical in shape. Its tone is pungent, and not unlike that of a violin or violoncello.

Gambado, or **Gambade**, a leather legging for equestrians; it is wrapped round the leg, reaching from the knee to the foot, and is fastened at the side by clasps.

Gambetta, Léon Michel, lā-ôn mē-shĕl gän-bet-tä, or găm-bĕt'tă, French statesman: b. Cahors, France, 3 April 1838; d. Sevres, France, 31 Dec. 1882. He was of Genoese extraction; was educated for the Church; but finally decided in favor of the law; and going to Paris became a member of the metropolitan bar in 1859. In November 1868 he gained the leadership of the republican party by his defense of Delescluze, a noted republican. In 1869, having been elected by both Paris and Marseilles, he chose to represent the latter city; and in the Chamber of Deputies showed himself an irreconcilable opponent of the empire and its measures, especially of the policy which led to the war with Prussia. On the downfall of the empire, after the surrender of Sedan in 1870, a government for national defense was formed, in which Gambetta was nominated Minister of the Interior. The Germans having encircled Paris, he left that city in a balloon, and set up his headquarters at Tours, from which, with all the powers of a dictator, he for a short time organized a fierce but vain resistance against the invaders. After the close of the war he held office in several short-lived ministries, and in November 1881 accepted the premiership. The sweeping changes proposed by him and his colleagues speedily brought a majority against him, and after a six weeks' tenure of office he had to resign. The accidental discharge of a pistol caused his death. See Reinach, 'Léon Gambetta' (1884); Harrison, 'Leon Gambetta, a Positivist' (1892); Tournier, 'Gambetta' (1893).

Gam'bia, (1) A British colony in West Africa, occupying portions of territory at the mouth of the river Gambia, some of its islands, and about six miles of land on either bank for a distance of 250 miles from the sea, and the navigable waters of the Vintang Creek. It thus forms a narrow strip running through French territory; total area, about 2,700 square miles. The principal settlement is Bathurst, at the mouth of the river. There is comparaively little fertile land, and agriculture is primitive. Gambia differs very little from the other West African settlements in point of unhealthiness. The position of Bathurst, the seat of government, is very unhealthy in the rainy season. There are a number of Anglican, Roman Catholic, and Wesleyan schools in the colony. Cotton cloth is manufactured to some extent by the natives, who also prepare palm-oil, build boats, etc. The principal exports are groundnuts, rubber, beeswax, ivory, hides, gold and palm-oil. The value of imports in 1900 was over $1,385,000 and the exports amounted to $1,410,000. Gambia is a crown colony under an administrator, who is assisted by an executive and a legislative council. The population of the entire region in 1901 was about 90,000, including about 200 whites, the remainder being chiefly negroes. (2) A river flowing through the above colony and giving to the colony its name. Rising in the mountains of Senegal, after a course of about 700 miles it expands into a broad estuary and at Bathurst enters the Atlantic Ocean. For nearly 300 miles it is navigable by seagoing vessels.

Gambier, găm'bēr, **James,** Baron. English naval officer: b. New Providence, Bahamas, 13 Oct. 1756; d. near Uxbridge, England, 19 April 1833. He entered the navy, and off Ushant fought with distinction as commander of the Defence under Lord Howe in 1794. As admiral he commanded the British fleet at the bombardment of Copenhagen in 1807, and was rewarded with a peerage. At the action in Basque Roads in 1809 he refused to act on the advice of Lord Cochrane, was tried by court-martial, and acquitted. He attained the rank of admiral of the fleet in 1830.

Gambier, Ohio, village of Knox County, on the Cleveland, A. & C. R.R., 50 miles north of Columbus. It is noted for its educational institutions, including Kenyon Episcopal College (q.v.), Kenyon Military Academy, Bexley Theological Seminary, and the Harcourt Female Seminary. Pop. (1900) 751.

Gambier Islands, a group of small islands of the South Pacific, about lat. 23° 8' south, and lon. 134° 55' W. The natives are a well-formed race, and have made some progress in civilization. On Mangareva, the largest of the group, some French missionaries settled in 1834, and the islands now belong to France. The total population is about 1,200.

Gambir, găm'bēr, or **Gambier,** called also *Terra japonica,* an astringent substance obtained from the *Uncaria gambir,* a tree of the family *Cinchonaceæ,* cultivated in Sumatra and other islands of the Malay archipelago. It is obtained from the leaves by boiling or infusing them in water, inspissating the resulting fecula, and forming into cakes. The Chinese use it for chewing, and in the western world, principally in Great Britain, it is employed in dyeing and tanning, also medicinally. It is mostly exported from Singapore. It is often considered as one of the articles of catechu (q.v.).

Gamble, Hamilton Rowan, American statesman: b. Winchester, Va., 1798; d. 1864. He was admitted to the bar in Virginia, settling in Missouri 1818, and being elected Secretary of State of that commonwealth 1823. Practising law at St. Louis he became judge of the Supreme Court and was elected a member of the Constitutional Convention 1861 and appointed by it governor, in place of C. F. Jackson, who had become a secessionist.

Gambling, or **Gaming,** the practice of playing for a money stake games depending solely on chance, like roulette, for instance, or those other games into which the element of skill enters, as in the cases of whist or billiards. Strictly speaking, gambling may be understood as gaming in its worst sense, and as implying professional play for a money stake by men who are unscrupulous adepts at so-called games of chance. Gambling has been common among most nations, civilized and uncivilized. The practice of civilized communities in regard to these acts has been far from uniform. The odium of gambling has sometimes been attached to games perfectly innocent in themselves, and these games have been prohibited to the manifest prejudice of the law, which has thus been brought into dishonor and contempt. At other times, governments, tempted by the facilities of sharing in the dishonest gain, have openly and shamelessly encouraged gambling by licensing gaming-houses, or instituting lotteries under their own authority. See Lottery. In England gambling was early made the subject of penal enactments. Statutory restrictions upon games and gaming go back as far as Richard II. In France, public gaming-tables were suppressed from 1 Jan. 1838. Previous to the formation of the new German empire gambling was encouraged by official countenance in several of the principalities of Germany. Baden-Baden, a watering-place in the grand-duchy of Baden, and Homburg, then in the landgravate of Hesse-Homburg, were until comparatively recent times the two most famous resorts in Europe of the frequenters of gaming-tables. Since the suppression of gambling in these places, after the formation of the empire (31 Dec. 1872), the principality of Monaco in Italy has become the last public resort of this species of gambling in Europe.

In the United States the keeping of a gambling-house is indictable at common law as injurious to morals; and most States and Territories have passed laws against gambling, some of them severe and stringent. Yet till 1880 gambling was common and open in many parts of the United States; and it was left largely to societies for the suppression of vice, especially in New York, to stir up the authorities to put the laws in force. In 1881–4 prosecutions and convictions were very numerous; in 1885 almost all the chief cities in the Union followed the example of New York, and since that time the progress of legislation on this subject has been noteworthy in many of the States. Always there is difficulty in legally defining gambling and distinguishing in judicial practice between acts which violate the gambling laws and those which, while presenting some questionable appearances, are yet not obviously to be classed in the same category. As in so many other matters of public policy, there is also a loss of power to the regulative sentiment of the people through want of uniformity or any considerable degree of identity among the laws of various States and sections. Therefore it is scarcely strange that, in spite of all prohibitive legislation and repressive influences brought to bear by public opinion, gambling should, either through connivance of the authorities or by secrecy and evasion, continue to be practised in many of the large cities of the United States. As in all other matters of public interest, the moral sentiment of the community steadily seeks and no doubt gradually finds a controlling expression through its official representatives in the legislative field and in local and general administration. Consult: 'Encyclopædia of the Laws of England'; Brandt, 'Games, Gaming, and Gamester's Law'; Ashton, 'History of English Lotteries'; Bishop, 'On Statutory Crimes' (1901).

Gamboge, găm-bōj' or -booj', a gum-resin derived from *Garcinia hanburyi*, a member of an extremely large family of the eastern tropical countries. The gamboge tree itself is a native of Siam, Cochin-China, Cambogia, from which places the drug is imported to Europe and to the United States. Other forms of gamboge are found in India, China, and the Asiatic Islands that are rarely seen in the American market. The gum-resin is obtained by cutting or wounding the trunks of the trees causing a bright yellow juice to flow. This is collected, usually in bamboo joints and hardens naturally, or is dried over a fire, until a solid mass results, which generally takes the shape of the collecting vessel. In the drug market pipe gamboge, press gamboge, and cake gamboge are recognized. Pipe gamboge is preferred because it is usually clean. As a pigment for painting, gamboge has been known for centuries, and as a purgative it has been used in China as long as history gives any definite information.

The gum-resin contains a large amount of gum, 15 to 20 per cent, and 70 to 80 per cent of a yellow resin-gambogic acid, on which its purgative properties depend. Taken into the body in doses of from two to five grains, it acts as a very active hydragogue cathartic, producing numerous watery stools, with much griping. It is principally valuable when combined with some other drug that tends to diminish the pain, and it is one of the most important ingredients in the compound cathartic pill of the United States Pharmacopœia, which contains one quarter of a grain of the resin. Overdoses cause violent poisoning with intense prostration.

Gam'brell, James Barton, American Baptist minister and editor: b. Anderson County, S. C., 21 Aug. 1841. He was graduated at the University of Mississippi, and served as a captain of scouts in the Confederate army during the Civil War. He was ordained to the ministry in 1867 and held several pastorates. He served as editor of the 'Southern Baptist Record' for many years, and was elected president of Mercer University, Georgia, 1893.

Gambrinus, găm-brī'nŭs, a mythical king of Flanders, inventor of beer, said, probably incorrectly, to have an original in Jan Primus (or Jan I.), duke of Brabant. He is represented in Germany as Saint Gambrinus, patron of drinking. His figure is familiar in German beer-cellars, often seated astride a cask, a foaming tankard in his hand.

Game-fowls. See COCK-FIGHTING; POULTRY.

Game Laws, are legislative enactments adopted by nations and states to prohibit or regulate the killing of wild animals, birds, and fishes. In Great Britain the game laws are a relic of the forest laws, which in the time of the Norman kings were so oppressive; it being under the Conqueror as great a crime to kill one of the king's deer as to kill one of his subjects. A certain rank and standing, or the possession of a certain amount of property, were for a long time qualifications indispensably necessary to confer upon any one the right of pursuing and killing game. By the Game Act of William IV., the game laws were greatly modified, the necessity for any qualification except the possession of a game certificate being then abolished, and the right being given to any one to kill game on his own land, or on that of another with his permission. Every uncertificated person selling game is also required to take a yearly license. The animals designated as game by this act are hares, pheasants, partridges, grouse, heath-game, or moor-game, black-game, and bustards. These animals (with the exception of hares) are not allowed to be killed at all times, there being a certain season of the year — the close season — during which all and sundry are prohibited from killing game. By an act of 1880 every occupier of land has a right, as inseparable from and incident to the occupation of the land, to kill and take ground game (hares and rabbits) thereon, concurrently with any other duly authorized person, all agreements in contravention of this right being declared void. Game laws of greater or less strictness are in force in many other countries. In Canada the chief restrictions are in regard to killing wild animals during the breeding season.

In the United States wild game whether of forest, field, or stream is perhaps better protected than in any other country in the world. Although there are certain general national laws, 28 States have passed game laws of their own, and as many States have organized societies for the protection and preservation of game. There are 8 national organizations, the most important being the League of American Sportsmen; G. O. Shields, president, New York. The others are: the American Ornithological Union, the National Sportsmen's Association, the National Bird, Game and Fish Protective Association, Bird Protective Society of America, Boone and Crockett Club, International Forest, Fish, and Game Association and North American Fish and Game Protective Society. Nearly every State in the Union has now a Game and Fish Commission and numerous game wardens.

The national game law, known as the Lacey Law, passed by the Congress in 1900, gave to the Department of Agriculture certain powers, by which among other provisions no importation of wild animals, birds, or fishes could be made without a permit from the secretary of agriculture.

Two important Federal laws relating to game were passed during the year 1902: (1) An act amending the tariff act so as to permit the importation of the eggs of game birds for propagation, and (2) an act protecting game in Alaska. The Alaska act, which is the first general game law of the Territory, fixes close seasons and prohibits export and sale, though permitting shipment of specimens and trophies for scientific purposes under regulations made by the secretary of agriculture. Legislative sessions were held in less than one third of the States and Territories, but in nearly every case some changes were made in laws for the protection of game. General game laws were enacted by Kentucky, Louisiana, and Ohio. The adoption of non-export provisions in several States reduces the number of States which permit unlimited export of game to three, all in the South. Three States — Kentucky, New Jersey, and Ohio — adopted the license system, by which non-residents are required to secure licenses to hunt, fixing fees of $10 in New Jersey and $25 each in Kentucky and Ohio. Non-resident licenses at rates ranging from $5 to $40 are now required in half the States and Territories and in nearly all the Provinces of Canada. Arkansas and Oregon, however, require licenses only for market hunting, and New York only from residents of States which demand similar licenses from residents of New York. Louisiana and Missouri do not permit non-residents to kill game within the State. Additional restrictions on the sale of game were adopted in South Carolina, and a statute allowing dealers to hold their game under bond during the close season was passed in New York.

The movement toward securing uniform laws for the protection of song, insectivorous, and other non-game birds made substantial progress during 1902. Alaska, Kentucky, and Ohio extended protection to birds other than game, increasing the number of States which now have a practically uniform law of this kind to 19. A similar law was adopted for the Northwest Territories, Canada, and the legislature of Maryland passed a law of like character for Washington County.

New York in 1902 raised the number of its game protectors from 38 to 50, and New Jersey has given its wardens additional powers to make searches and seizures. In Oklahoma the territorial authorities seized several large consignments of game en route to eastern markets contrary to law, and have taken steps to secure a more stringent enforcement of the non-export laws.

Under the Lacey Act numerous seizures were made of game shipped from the West and Southwest, and proceedings were instituted in a number of cases in State and Federal courts. In some of the cases in Iowa and South Dakota convictions were secured with penalties ranging from $150 to $200. The inspection of foreign birds at the port of New York was made more effective, and special inspection service was established in Hawaii and extended in scope so as to prevent the introduction of noxious reptiles into the islands.

Even more important than the enactment of new game laws has been the work of game commissions and voluntary organizations interested in the practical protection of birds and game. In 1902 important changes were made in the game commissions of Ohio and Vermont, and a new territorial warden was appointed in Oklahoma. Several sportsmen's game and fish protective associations were added to the large number already existing, and new Audubon societies were organized in Louisiana, Nebraska, North Carolina, Oklahoma, and Oregon. Thirty-two States now have Audubon societies, which are formed primarily for the protection of birds other than game. The committee of the American Ornithologists' Union on the protection of birds extended its work along the coast, and now maintains supervision of all the breeding colonies of sea birds on the Atlantic coast from Eastport, Me., to Chesapeake Bay, as well as at some points in Florida.

Practically all the State game laws passed by the various State legislatures prohibit the export of game, hunting, or fishing for commercial purposes, and hunting big game with dogs. In a few States the netting of minnows for bait is also prohibited. The killing of song birds is forbidden in most of the States, but this law does not apply to the hawk, owl, crow, blackbird, and English sparrow. Hunting and fishing in the national Yellowstone Park is prohibited.

While the close and open season for hunting and fishing are well defined in all the States, there is no general statement which can cover the question, the seasons and conditions varying so widely. In Alabama, for instance, deer may be shot for four months only (September to January) in Indiana all the time, and in Illinois no deer can be shot until 10 May 1906. All State game laws are peculiarly adapted to local conditions. See AUDUBON SOCIETY; FISHING; HUNTING.

Game Preserves, or Game Parks, are large reservations of land, usually including mountain and forest, set aside by the government or individuals, for the propagation and preservation of game. Game preserves have been well known in Great Britain and on the Continent for upward of five centuries. Henry VIII. established a royal deer park near Hampton Palace in 1526, and the Duke of Sutherland at the present day owns the largest game preserve in the world. Game preservation in the United States first attracted attention just prior to the Civil War and later when the rapidly increasing settlement of the States threatened the extinction of all kinds of wild game.

The United States government took up the question of game preservation almost as soon as the individual, and the establishment of the Yellowstone National Park in the Rocky Mountains, and the Yosemite National Park in California had as much to do with the protection of big game as in the preservation of forests. In these two reservations the government ranges have endeavored to preserve and protect such large game as the buffalo, elk, and moose. In 1902, President Roosevelt, himself a hunter of big game, declared no less than 12 new national forest reserves, which while largely important to forestry, will greatly assist in the protection of big game. These new reserves have a total area of 14,276,476 acres, which makes a grand total of government parks and reservations of 60,162,525 acres. The new reserves added in 1902 were as follows:

	Acres
The San Isabel, Colorado	77,980
The Santa Rita, Arizona	337,300
The Niobrara, Nebraska	123,779
The Dismal River, Nebraska	85,123
The Santa Catalina, Arizona	155,520
The Mount Graham, Arizona	118,600
The Lincoln, New Mexico	500,000
The Chiricahua, Arizona	169,600
The Madison, Montana	736,000
The Little Belt Mountains, Montana	501,000
Alexander Archipelago, Alaska	4,506,240
The Absaroka, Montana	1,311,600

Of private game parks in the United States, the first of record was that of Judge J. D. Caton, of Ottawa, Ill., the author of 'Deer and Antelope in the United States.' This he established in 1860, for sport and study, bringing together on his large estate many varieties of game animals native to America. In 1889, Austin Corbin enclosed the largest preserve in the United States, and next to that of the Duke of Sutherland, the largest in the world. It is known as Blue Mountain Forest and is situated near Newport, N. H. It contains over 36,000 acres, and is surrounded by a wire fence, 8 feet high, forming an oblong tract 12 by 5 miles, and which is crossed by a mountain range, the peaks of which are 3,000 feet high. Here are miles of wooded slopes, dense forests, and broad meadows, giving food and shelter to all kinds of game animals, from the buffalo, elk, and moose to the smaller species. The experiment has been most successful, nearly all of the animals thriving and increasing rapidly in numbers. In 1870, F. S. Giles laid out the Grove Park reservation, containing 17,000 acres, and this experiment was followed by Dr. W. Seward Webb with a preserve of 9,000 acres at Nebasane, N. Y., in the Adirondacks, and another preserve at Shelburne, Vt. The Litchfield Park at Tupper Lake, N. Y., in the Adirondacks, was established in 1893, with 9,000 acres, and in 1900 hundreds of herds of large game were roaming the mountain forests within this tract. In the same region the Adirondack Timber Company has a park of over 30,000 acres, well stocked with animals. George W. Vanderbilt at his Carolina estate of Biltmore, has 80,000 acres, 6,000 acres of which are enclosed and well stocked with game. A small army of men are engaged here as keepers. In many of the smaller parks particular attention has been paid to game birds, such as the English pheasant, prairie chicken, and wild turkey. A lover of birds imported large numbers of Japanese pheasants for his preserve in Oregon in 1893, the experiment proving a great success. E. C. Benedict, of Greenwich, Conn., has established extensive fish preserves in Long Island Sound, which are the largest and most successful of their kind in this country. Near Plattsburg, N. Y., Paul Smith owns an immense preserve around St. Regis Lake of 40,000 acres. Large numbers of elk were brought here from the West in 1903. William C. Whitney of New York has been active in stocking the Adirondack region with big game, and in conjunction with Dr. F. E. Kendall, of Saranac Lake, has restocked the forests with elk and deer. At Delaware Water Gap, Pa., on the New Jersey side of the Delaware River, Barclay Warburton, of Philadelphia, established in 1902 an extensive deer park, which is one of the most successful in that section of the country.

In Canada there are several large game preserves, prominent among which is the Caughnawaga reservation on the Maquacippi River. The Roberval Club, which has a membership of 300, including both American and Canadian, owns a big game preserve containing 500 square miles, located in the Laurentian Mountains. Henri Menier occupies as a game park the whole of Anticosti Island, in the Gulf of St. Lawrence.

Games. Games are an expression of the play instinct, a distinct species or form of play. A study of them includes a definition of games as distinguished from play; and a consideration of games from historical, educational, and recreative viewpoints. While the term play includes games, so that we "play games," it is technically applied to informal play activities, such as playing horse, playing house, and playing in the sand. In such play there are no fixed rules, no formal mode of procedure, and generally no climax to be achieved. The various steps are spontaneous, not predetermined, and are subject to individual caprice. In games, on the contrary, as in blindman's buff, prisoner's base, or football, there are prescribed acts, subject to rules, generally penalties for the infringement of rules, and the action proceeds in a formal evolution until it culminates in a given climax; which generally consists of a victory of skill, speed or strength. This definition applies to games that require considerable bodily activity, such as those mentioned, and to so-called quiet games, as dominoes, cards, jackstraws, chess, checkers and other board games. Our concern in this article is chiefly with active games.

Among the simplest of active games are singing games, in which the action is mainly a repetition of dance movements, or of some dramatic or descriptive motions, as when the farmer sows his seed or London Bridge falls down upon its victim. More strenuous are the games of chase, such as tag, cat and rat, and

Red Rover; or competitive games of skill, strength or speed, illustrated by relay races and athletic contests. Highest of all, both in their organization and their demands upon the varied powers of players, are team games, of which baseball and football are popular examples. Team games are peculiar to the Anglo-Saxon race; nearly all games of the other classes are of very ancient origin and of wide distribution among the races and nations of men. Indeed, the games of children form a distinct branch of anthropology, ethnology and folklore, and throw much light on early customs from which they are descended; for they come trooping out of the past unconsciously bearing the relics of primitive civilizations, of old religious rites and grim superstitions, of marriage and May-time festivals and «battles long ago.» «Oats, peas, beans, and barley grows» had its origin in a religious rite intended to increase the fertility of the fields; «London bridge,» in the offering of a human sacrifice at the building of a bridge; «Here we go round the mulberry bush» is the survival of a custom, still practised by some of the European peasantry, and known to have existed at least as far back as the early Greeks, of celebrating May day or spring time with the gathering of flowers and marching in procession. This usage prevailed among the American colonists, and from it have come our May basket and May pole customs. Indeed, most of these singing games and many other active parlor games now played by children, such as stage coach, and going to Jerusalem, were used instead of the dance by the young people of the Puritan era. Among the games of religious or superstitious origin tag should be mentioned, which, in its earliest form of iron tag, represented flight from an evil spirit, against whose influence iron was a protection. The little kindergarten game, «I put my right hand in,» is very ancient, and with its chorus «Looby loo» gives evidence of having been part of a religious rite to some deity. In time it became a stately court dance, which rank it held a century ago. From the superstitious customs of divination by lot have come the doggerel «counting out» rhymes used by children the world over for choosing the principal players in games. Familiar are the stanzas of this kind beginning «Ena, mena, mina, mo,» and «Onery, twoery, tickery, tee.» Of similar derivation is the custom of assigning parts by «holders,» in which one child holds a pebble in the closed hand, and another guesses which hand contains it. Courtship and marriage customs are perpetuated in «Round and round the village» and «Little Sallie Waters.» Still other games, for example, «Uncle John is very sick,» come from the ballad days when a versified narrative was sung and acted at the same time;—days when to «sing a dance» and «dance a song» were interchangeable terms.

Athletic games, or competitive trials of individual strength, speed or skill under fixed rules, are probably pre-historic. The mention of them takes one's thought at once to «the glory that was Greece and the grandeur that was Rome.» The Greek games have been immortalized in literature and art; prominent examples of which are the Iliad and Odyssey, Pindar's ‹Odes of Victory,› and, in sculpture, the discobolus or discus thrower, and the wrestlers. These Greek games were played at four stated festivals, the greatest being the Olympic, which became a national festival about 776 B.C., and recurred every four years at Olympia in Elis. The importance of the Olympic festival in Greek national life may be judged from the fact that time came to be reckoned in Olympiads. The Pythian games were celebrated in the third year of each Olympiad, the Nemean games in the second and fourth years of each Olympiad, and the Isthmian games in the first and third years of each Olympiad. All were held in honor of some god. In Homeric times the events in athletic games were chariot racing, boxing, wrestling, foot racing and javelin throwing. The Olympic contests, which came later, were probably confined at first to foot racing; to this other events were gradually added until the pentathlon came into existence, about the 18th Olympiad, and boxing and chariot racing were added in the 23d Olympiad. The pentathlon consisted of leaping, spear throwing, discus pitching, running and wrestling. It thus called for «all-over» work, thereby preventing inharmonious development by over-specialization. A competing athlete was obliged to enter for all five contests and was considered a victor only upon winning at least three of the five events. The best modern athletic games embody these principles in what are called group contests. For instance, in the pentathlon of the Young Men's Christian Association, the 100-yard dash is equivalent to the Greek foot race; throwing the 12-pound hammer is equivalent to discus throwing, the running high jump to leaping; pole vaulting for height is a substitute for hurling the spear, and the one-mile run for wrestling. The prizes for the Greek games had no intrinsic value and were merely symbols of honor, as wreaths or palm branches. The prestige and indirect advantages accruing to a victor, however, became in time so great that contestants spent all of their time training for the games. The entrance of this professional and commercial spirit led to the decadence of the games. A similar degeneration occurred much more quickly in Rome. In these latter days we have had the dramatic spectacle of the revival of the Greek games as international contests, the first of these occurring in Athens in 1896. The countries represented by the contestants in these international games included: Germany, England, Austria, France, Italy, Switzerland, Sweden, Hungary, Denmark, Greece, Australia, and the United States.

No mention of the Greek games would be adequate that did not include the balanced relation which they held to the intellectual, artistic and ethical interests of the time. The contestants were examples of balanced culture, and the festivals drew together the greatest poets, philosophers, orators, and artists whose achievements were there displayed. The tournaments or jousting bouts of the age of chivalry may be cited as a further example of athletic contests of great popularity in which the concern for physical prowess was blended with higher interests. It is notable that the modern organizations which have made physical training most popular, the German Turnverein, the Young Men's Christian Association, and the colleges, also combine these varied elements.

Ranking higher as games than individual contests, because more complicated in their organization and demands, are team games in which opposing groups contest, each as a unit against the other. Each player on such a team has his assigned part or duties, differing from many of the others, but as an individual he is subordinate to the interests of his team. Games of this class are an expression of the fighting instinct, and undoubtedly are a development from the simpler fighting games played by young boys, such as stealing sticks (Scots and English), and prisoner's base, which in turn are supposed to have originated in border warfare. Between these simpler games and the highly developed team games there exists the same differences of organization as between primitive and modern warfare. The former was merely a series of individual combats, the parts enacted by the various contestants being homogeneous, and, the fight once on, very largely a matter of individual initiative. In modern warfare there is greater differentiation of duties, and the individual is subordinated to the organized whole. The team games most popular in the United States are baseball, football, basket ball, cricket, and hockey. Baseball has been called the national game of the United States, as cricket and Rugby football are distinctive of England, golf of Scotland and hand ball of Ireland. Basket ball bears the unique distinction of being the only game of wide and enduring popularity which was deliberately invented. Dr. James Naismith devised the game about 1892, as a result of studying the principles involved in successful games. Though invented for and played by men, it is the only team game that has become popular with women. Competitive adult games largely in vogue, which depend upon skill, rather than upon a combination of skill and organization, are tennis, golf and croquet.

The anthropological tenet, that in his development the child passes through the stages which the race has gone through before him, finds strong confirmation in children's plays and games. "The work of adults in one age of human history becomes the play of children in another." While the play of civilized children, as of savage, shows imitations of current adult activities, nearly all of the games of civilized children would seem to take their players through the primitive culture epochs. Just what this, or the lack of it, may mean for individual development we cannot say; but it may be inferred from the direct training of power which games provide. The value of this training assumes a clearer position in the light of one of the fundamental concepts underlying the science of education, that of the meaning of the long period of human childhood. Prof. John Fiske pointed out in his 'Outlines of Cosmic Philosophy,' and President Nicholas Murray Butler elaborated in 'The Meaning of Education' the significance of the long interval between birth and maturity in the human species as compared with animals. This significance lies in the importance of adaptation to environment as an element of survival. The animal that lives in a comparatively simple environment, and for which reflex actions are sufficient to maintain life, as the chicken that pecks for food, has but a brief period between birth and maturity. The more complicated environment of the human species, intellectual, industrial, sociological, aesthetic, ethical and spiritual, in which intelligence takes the place of reflex action, calls for a much longer period for adaptation.

The function of education is to assist in this adaptation, and it needs not to be said in an age of the kindergarten that play is one of nature's great means of education, and therefore of adaptation. "Animals play," says Karl Groos, "not because they are young: rather they have a period of youth because they need to play." And the same may be said of children. Physically, mentally, morally, socially, play develops the child, and in that development games have an important and often a unique part. All of the games here passed in review give expression to simple instincts which are basic to strong and effective character and therefore help to develop those instincts. Prof. William James says, "All simple, active games are attempts to gain the excitement yielded by certain primitive instincts, though feigning that the occasions for their exercise are there. They involve imitation, hunting, fighting, rivalry, and acquisitiveness, combined in various ways."

Physical development would obviously result from playing active games. Especially in all running games are strength and endurance of heart, lungs, and related organs cultivated. Neuro-muscular development becomes apparent in agility and skill, from the stumbling child who learns to dodge quickly and skilfully to the expert ball player. Sense organs become more acute. Various powers of the mind are likewise developed and strengthened by the demands made upon them. Sense perceptions gain in rapidity and accuracy, so that a player sees or hears more quickly that which comes in his direction or takes place around him; feels more quickly the touch upon the shoulder that makes him "it." Reactions become quicker and more exact, whether they be the simple reactions of ball catching, or the complicated ones involving reason and judgment, as when one grasps the shifting conditions of a rapid game with many players, and with swift decision adapts his own movements to them. For socionomic training games have peculiar potency; they develop power of co-operation; the sense of, and ability for, social relations, for taking a part in a social whole. Selfishness gives way to generous recognition of ability, and acknowledgment of superior ability, in others; and, highest of all, self is subordinated to the interests of a group. This self-subordination is a distinctive feature of team games, and perhaps does more than anything else to give them high rank in the hierarchy of games. It frequently happens in such games that a player must lose an opportunity to make a brilliant display of his own powers for the sake of a larger advantage to his team. True team play of this character does not appear until adolescence, the games common to an earlier age calling for individual play, or the competitive element, or the homogeneous social characteristics of the folk games. The training of the will is another strong educational feature of games. The timid, hesitating child, who at first shrinks from exposed positions or an aggressive part, gains courage and self-reliance; defeat becomes, instead of a discouragement to all effort, a spur to greater; and the inhibitive control required to obey rules and regulations, especially under strong excitement, touches another of the well springs of character. So, from the first, clumsy, timid efforts of the little child, to the skilful team work of the college athlete, at once aggressive and self-controlled, games afford a means of development and training for body, mind and character. Were any of these results objects of conscious endeavor on the part of the players, the recreative element of games would be lost. But their unique power lies in the fact of this recreation — this objective interest which holds the attention involuntarily and renders the training incidental, unconscious and natural. Because of this psychological distinction, the expression "gymnastic games," which is frequently heard, is a contradiction in terms and a misnomer. A mistake also is an occasional tendency to discard gymnastic exercise in favor of games, and *vice versa.* While each is an important part of physical training, psychologically and physically there are essential differences between the two forms of exercise. Gymnastics are taken for the purpose of bodily development, and the mind is continually in the unnatural attitude of consciously directing the automatic processes of muscular co-ordination; games are played for the frolic or the victory, without subjective or utilitarian end. This psychological difference is exactly that between work and play. Physically, gymnastic exercise may be more closely adapted to individual powers and needs than the exercise of games; it can afford more vigorous exercise in a brief time to large numbers in limited space; and it is corrective of posture — of faulty neuro-muscular habits. Games, on the other hand, offer a more natural form of exercise, have a larger emotional content, and in their social and psychological training are not approached by gymnastics.

The recreative element in games, the sheer fun and frolic spirit, and the engrossing interest that springs from primitive instincts, cannot be too highly valued as a relief from the pressure which modern civilization brings to bear upon both children and adults. Especially under city conditions should this be fostered. The paucity of childish play and normal youthful sport in cities, owing to lack of space, is not only pitiable, but tragic in view of all that it may mean for the healthful, balanced development and life of the individual. The growth of indoor games as basket ball and indoor baseball, is admirable because making a virtue of necessity; but the movement to provide playgrounds is still better, for gangs of youthful criminals and depredators are found to melt away before them, and the play and games which they foster belong by inherent right to the open sky and the free air. See Baseball; Basket Ball; Foot-ball; Folklore; Hockey, Etc.

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Gammer Gurton's Needle, a drama by John Still, supposed to have been the first play acted at an English university, is also one of the two or three earliest comedies in our language. In 1575, nine years after it was staged at Christ's College, Cambridge, it made its appearance in print. The plot is very simple. Broad jokes, extravagant language, and situations depending for their fun on the discomfiture of one or another of the actors, gave this play great popularity in its day. Readers of the present time who penetrate behind its quaint and uncouth language will find in it an interesting picture of 16th-century village life.

Gamp, Mrs. **Sairey,** in Dickens' 'Martin Chuzzlewit' (1843–4), a stout and elderly professional nurse with a watery eye and a fondness for spirits. She is loquacious and confidential, and continually refers to the opinions of a fabulous being, "my friend Mrs. Harris." Her amorphous umbrella has furnished the name "gamp" for that type of impedimenta.

Gamtoos (gäm'tōs) **River,** Cape Colony, South Africa, which rises in the plateau of Great Karoo and empties into the Indian Ocean.

Gam'ut (Italian, *gamma;* French, *gamme*), the name given in the system of Guido d'Arezzo to the entire series of musical tones in the natural order of ascent or descent. The musicians of the 11th century made use, to distinguish a succession of tones of several octaves, of the following scale: *A, B, C, D, E, F, G, a, b, c, d, f, g, aa, bb, cc,* etc. *A* represented the lowest note in their instruments; a lower note having been introduced the Greek gamma (Γ) was taken to represent it in order not to repeat any of the previous signs. The gamma being thus the first note of the scale, its name was taken to represent the whole. The *ut* is the first word of a Latin hymn formerly used in singing the scale.

Gananoque, gä-nä-nōk', Ontario, Can., a port of entry of Leeds County, 18 miles northeast of Kingston, on the St. Lawrence River, at the point where it flows from Lake Ontario. It is opposite the Thousand Islands, and has long been popular as a summer resort. It has a fine insular public park, and manufactures machinery and farming implements. Pop. (1901) 3,526.

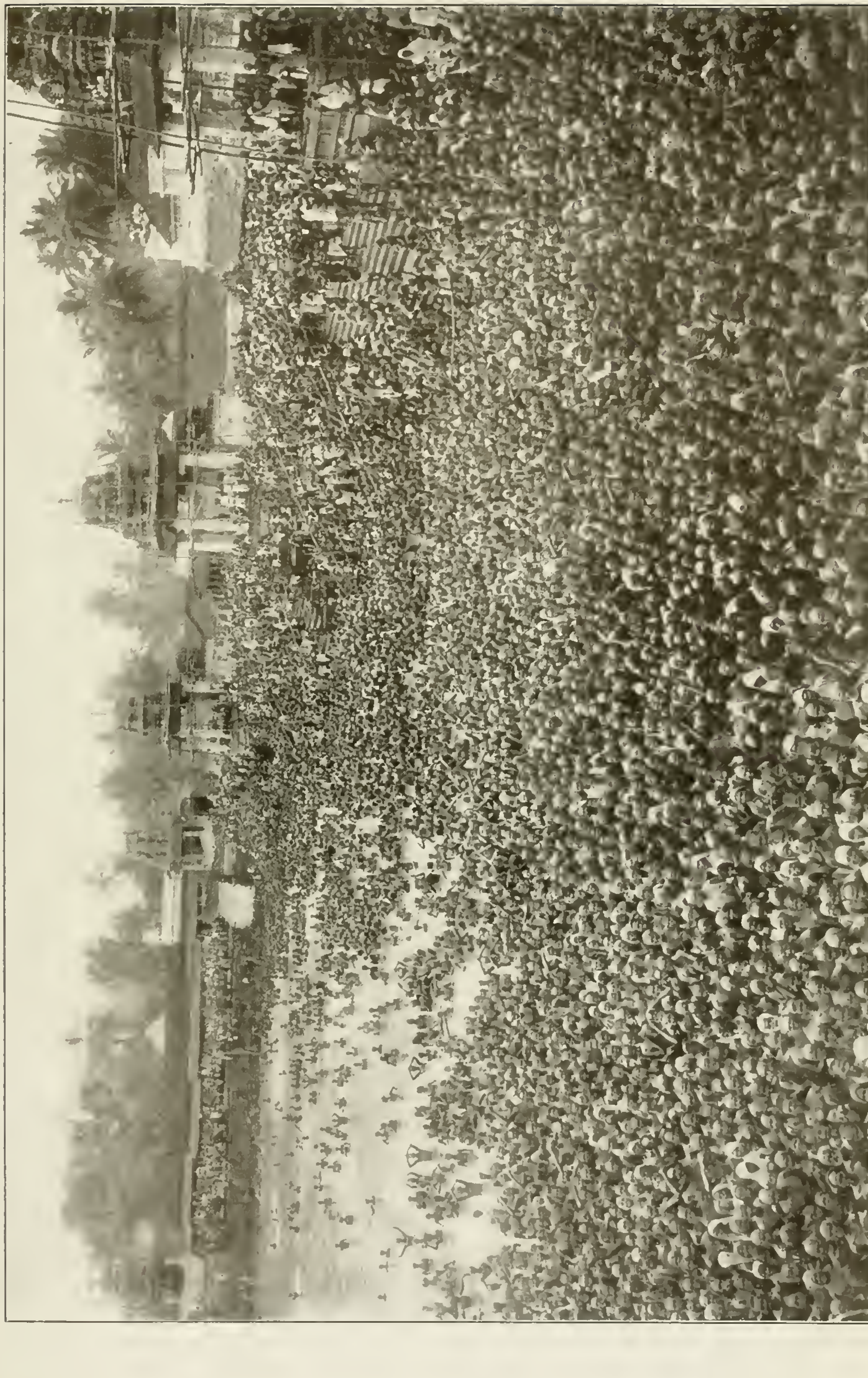
Gándara, gän'dä-rä, Philippines, a pueblo of the island of Samar, situated in the western part of the island on the left bank of the Bachao Bañgahón River. In 1900 it was almost entirely destroyed during an engagement with insurgents; before that it had a large trade. A United States military station and depot for stores is situated eight miles by river from Gándara. Pop. 15,600.

Gando, gän'dō, Africa, a kingdom of the western Sudan, intersected by the Niger, and inhabited chiefly by Fellatahs, with a capital of the same name. It is a most fertile district, the rain being plentiful. Mohammedanism is the prevalent religion. Gando is now comprised partly in British and partly in French territory. Pop. estimated at 5,000,000.

Ganges, gän'jēz, one of the greatest rivers of Asia, and "the sacred river of the Hindus," rises in the Himalaya Mountains, in the province of Garhwal, northern India. It is formed by the junction of two head streams, respectively called the Bhagirathi and the Alaknanda, which unite at Deoprayag, 10 miles below Srinagar, 1,500 feet above the level of the sea. The Bhagirathi which flows from an ice cave in a snow field, 13,800 feet above sea-level, is usually considered the source of the Ganges from its being a sacred stream in Hindu mythology; but the material claims of the Alaknanda are preferable, as it flows farther and brings a larger volume of water to the junction. At Hardwar, about 30 miles below the junction of the head streams, and about 120 miles north-northeast of Delhi, the river is only 1,000 feet above sea-level. Here it enters the great valley-plain of Hindustan, and flows in a southeast by south direction until it discharges itself by numerous mouths into the Bay of Bengal, a distance exclusive of windings of fully 1,100 miles. Its length, with deviations, is calculated at about 1,500 miles. During its course it is joined by a number of large rivers, the principal of which are the Jumna and Son, joining on the right bank; the Ramganga, Gumti, Gogra, Gandak, and Kusi, on the left bank. Some of the principal cities on the Ganges and its branches, descending the stream, are Cawnpore, Allahabad, Benares, Patna, Behar, Murshidabad, and Calcutta. The Ganges is navigable for boats of large size nearly 1,300 miles from its mouths. It is a great feeder of irrigation and navigation canals. (See GANGES CANAL.) Its utmost breadth is about three miles, with a maximum depth of about 30 feet in the dry season, and 60 feet in the wet. Its descent is computed at four inches per mile; its current in the dry season is less than three miles an hour; in the wet season five or six. The quantity of water discharged into the ocean is estimated at 500,000 cubic feet per second during the flood season, and 100,000 during the remaining eight months of the year. Its current brings down a great quantity of mud, which in the course of ages has contributed to form the wide delta which belongs to it in common with the Brahmaputra. The delta, intersected by numerous branches, extends from east to west from 80 to 200 miles, and commences about 200 miles, or 300 by the course of the river, from the sea. A part of it is an uninhabited region called the Sundarbans, overgrown by jungle, infested with tigers and crocodiles. The westernmost deltaic branch of the Ganges called the Hugli, is the only branch commonly navigated by ships; and vessels drawing 26 feet are safely piloted up to Calcutta; the construction of embankments, and continuous dredging, are necessary to keep a clear channel. The Ganges, as the Padna, continues eastward until it joins the Jamuna, the main branch of the Brahmaputra, which flows through the estuary of the Megna, the deltaic boundary on the east, into the Bay of Bengal. The periodical inundation of the Ganges commences about the end of April with the tropical rains. It rises gradually till it attains, near the commencement of the delta, a height of 32 feet above its ordinary level. By the end of July, the flat country of Bengal is overflowed to the extent of 100 miles in breadth, leaving visible little but tops of trees and villages, which are often built on artificial mounds above flood mark. After the middle of August the water begins to recede, and decreases till the period of the next inundation.

That part of the Ganges which lies between Gangotri, the first temple and pilgrim resort on its banks, 10 miles from its source, and Saugor Island, below Calcutta, is held particularly sacred. Wherever the river runs from south to north contrary to its usual direction, and at the junction of its affluents, it acquires a more peculiar sanctity. Its junction with the Jumna at Allahabad (q.v.) forms the most venerated place of Hindu ablution. The Hindus believe that this river rises immediately from the feet of Brahma, and that it possesses great and miraculous cleansing powers on account of its divine origin. There is a scientific basis for this universal faith among Hindus, repeated and careful experiments showing that the river possesses extraordinary but hitherto inexplicable antiseptic qualities.

It is an imperative duty of the Hindus to bathe in the Ganges, or at least to wash themselves with its waters, and to distribute alms, on certain days. Whoever dies on its banks, and drinks of its waters before his death, is thought to be exempted from the necessity of returning into this world and commencing a new life. Whenever, therefore, a sick person has been given over by the physicians, his relations hasten to carry him to the bank of the Ganges, in order that he may drink of the holy water, or be immersed in the river. Such as live too far from the river to admit of this, always preserve some of the precious water, as a sacred treasure, in a copper vessel, that it may be given them in the hour of death. This water is, therefore, a considerable article of commerce in India. It is also customary, after the dead have been burned, to preserve the remains of the bones and the ashes until an opportunity offers of throwing them into the Ganges.



BATHING IN THE GANGES

The name Ganges is derived from *gam*, a Hindu verb signifying "to go." In Hindu mythology the river is personified as the goddess Gangā.

Ganges Canal, The, in India, an important irrigation work and navigable channel, the older portion called the Upper Ganges canal, opened in 1854, and extending, on the right of the Ganges (q.v.) from Hardwar to Cawnpore and Etawah, with a main canal 440 miles long, navigable throughout; and with 2,634 miles of distributaries. The Cawnpore and Etawah terminal lines are now absorbed in the Lower Ganges canal, commenced in 1873, and which continues in its main branch for 260 miles to Allahabad, drawing its supply from the river at Narora, in the Aligarh district. The weir and headworks at Narora include a solid wall, 3,800 feet long, with 42 weir sluices, founded on huge square blocks.

Gan′glion, connective tissue membranes enclosing small amounts of clear synovial fluids. They are usually found where tendons or muscles glide over bony parts, or where the skin, muscles, or fascia are subjected to pressure or to friction. The number, size, and location of these structures are subject to much individual variation. One of the commonest is found on the back of the hand, at the wrist, particularly in people who stretch their fingers widely, as piano players, or as librarians who handle many books, grasping several at a time. In this form is a firm and painless swelling, liable to be caused by any excessive exercise of the wrist, as in playing tennis, golf, etc. This swelling gives the impression that there is fluid beneath the skin, and grandmother's advice to break it with the family Bible or the dictionary is often followed, sometimes with serious results. This forceful method of reduction is foolish, as most of the swellings disappear with rest and the application of heat. If they persist, a surgeon should be consulted. Another very persistent variety of this trouble is found in the knee — causing housemaid's knee, or miner's knee. Obviously the breaking of these tumors by force is out of the question. There are many places in the body in which similar collections of fluid may accumulate, but these rarely cause much inconvenience unless they become infected through some knock or cut. In this event prompt surgical treatment is advisable, and aseptic surgery should be insisted on. A careless and unclean surgeon may render a limb useless.

Gangotri, gän-gō′trē, a square temple, about 20 feet high, erected on the right bank of the Ganges (q.v.), which here forms a small bay, about 10,319 feet above the level of the sea. This spot is regarded by pilgrims as the source of the holy stream, here called the Bhagirathi, which, however, rises 8 miles higher up. The water here is peculiarly sacred, but few pilgrims come so far, and the only dwelling-house in the locality is occupied by the officiating Brahmins, by whom flasks of the holy element are sealed for conveyance to the plains.

Gangrene, găn′grēn, the term applied to death of soft tissue in masses large enough to be seen. There are two forms, differing in causation, appearance, and progress. Dry or senile gangrene results from the gradual occlusion of arteries, the venous return being unimpaired. For weeks or months the toes and feet, the parts most frequently affected, may feel cold or numb, or be actually painful, then gradually the skin becomes dry, then purple and black. The spread is usually very slow. It is particularly a disease of old age, due to the tendency at that period of life toward thickening and stiffening of the arterial walls.

Moist gangrene results from sudden stoppage of the arteries, obstruction of veins, mechanical destruction of the tissues, or from specific infection by germs. This form shows a soft, boggy, bluish mass covered with blisters and emitting the odor of putrefaction. In both forms of gangrene there may be a zone of inflammation between the dead and the living tissue, called the line of demarcation.

Hospital gangrene was formerly very prevalent in military hospitals; a wound becoming infected would quickly change to a gray slough, which in a few hours might involve the entire limb unless prompt removal of the tissue was undertaken. Aseptic surgery has made this fatal disease a thing of the past.

Spreading gangrene is due to infection by a specific germ, the bacillus of malignant œdema, so called from the fact that it generates a gas that puffs up the tissue affected. The spread is rapid, and life is sometimes saved by amputation far above the wound. The treatment of gangrene is usually a matter of amputation, well beyond the affected part. Careful aseptic dressing is imperative, particularly where the condition of the patient is apt to contra-indicate radical cure.

Gangue, găng (Ger. *Gang*, a vein), the matrix or veinstone of ores. These are always included in some stony matter, which forms the principal portion of the veins or beds which are worked for the sake of their metalliferous contents. Quartz is the most common veinstone, and has been called the mother of ores. Calcareous spar is also a frequent predominant material of veins. Sulphate of barytes or heavy spar, and fluor spar, are also often found as gangues.

Gan′ister, a name originally given in England to a particular clay high in silica, used in the manufacture of fire-brick. In this country the term is used more loosely and includes non-plastic rocks that are not clays at all but approach sandstones in character. Ganister may, therefore, be defined as highly silicious material used in the manufacture of fire-brick, more particularly what are known as silica-brick, for lining blast-furnaces, Bessemer converters, etc. The manufacture of such brick is an important industry in Western Pennsylvania. See Clay.

Gannal, gä-näl, **Jean Nicolas**, French chemist: b. Saarlouis, Prussia, 28 July 1791; d. Paris January 1852. He is noted for his invention of the method of embalming by injection.

Gannets, large sea-birds constituting the family *Sulidæ*, of the order *Steganopodes*, characterized by having all the toes connected by webs, the absence of external nostrils and a very short tongue. They are closely related to the pelicans and cormorants, have large powerful bills and feed upon fish, frequenting the sea-coasts of various parts of the world. The common gannet

(*Sula bassana*), to which the name properly refers, is restricted in the breeding season to a few rocky islets on the coast of the British Isles and Iceland — notably the St. Kilda group, and to Bird Rock in the Gulf of St. Lawrence; and their numbers have been much diminished by the fishermen who gather their eggs for food. They nest in colonies among the crevices and ledges of the rocks, and each bird lays a single large chalky white egg. When the young are on the wing they all leave together and scatter widely in search of food, extending their range on our coasts as far as the Gulf of Mexico. In the southern hemisphere are two closely related gannets. *S. serrator* of Australia and *S. capensis* of South Africa. Eight other somewhat smaller species, called «boobies» (q.v.), breed on various tropical islands. The common gannet is pure white with black outer wing-feathers and a buffy suffusion on the head. The young are mottled grayish brown. The other species are similar, many of them with red and blue coloring on the bare skin of the throat and around the eye.

Gan'nett, Ezra Stiles, American Unitarian clergyman: b. Cambridge, Mass., 4 May 1801; d. near Boston 25 June 1871. He was graduated from Harvard in 1820, in 1824 became assistant to W. E. Channing at the Federal Street Church, Boston, and later succeeded to the pastorate. In the Unitarian controversies of 1825–35 he took a prominent though conservative part. He was the first secretary of the American Unitarian Association, its president 1847–51, and president of the Benevolent Fraternity of Churches 1857–62. He was also founder and editor of the 'Scriptural Interpreter,' and an editor of the 'Christian Examiner,' and the 'Monthly Miscellany of Religion and Letters.'

Gannett, Henry, American geographer: b. Bath, Maine, 24 Aug. 1846. He was graduated at the Lawrence Scientific School in 1869; became geographer of the United States Geological Survey in 1882; was geographer of the 10th, 11th, and 12th censuses, and of those taken by the war department in Cuba and Porto Rico in 1899. His publications include: 'Manual of Topographic Surveying'; 'Statistical Atlases 10th and 11th Censuses'; 'Dictionary of Altitudes'; 'Commercial Geography'; etc.

Gannett, William Channing, American Unitarian clergyman: b. Boston, Mass., 1840. He is a son of E. S. Gannett (q.v.). He has held Unitarian pastorates at St. Paul, Minn., and other cities, and has been for some years pastor at Rochester, N. Y. He is the author of: 'A Year of Miracle'; 'Memoir of Ezra Stiles Gannett'; 'The Thought of God in Hymns and Poems' (with F. L. Hosmer).

Ganodonta, a group of primitive mammals regarded as ancestral to the edentates, whose remains are found in the lowest Eocene formations of the western United States. These remains are not numerous nor complete, but plainly exhibit a progressive relationship toward modern Edentata (q.v.). The earliest known is *Hemiganus*, from the Puerco beds of New Mexico, which was as big as a medium-sized dog. A later genus of similar size is *Psittacotherium*; and a still later (Lower and Middle Eocene) is *Stylinodon*. In reviewing the series, says Beddard, we see a gradual diminution of the incisors, a gradual loss of enamel on the teeth generally, and the production of hypsilodont teeth growing from persistent pulps, all of which are features of the later edentates. The progression is gradual, but the forms seem to be a continuous series culminating in the ground-sloths. See PALÆONTOLOGY.

Gan'oid Fishes, an order of fishes founded by Agassiz on the character of the scales of certain fossil fishes, which are bony and lustrous, now regarded as a group-name for a rather heterogeneous series of low and chiefly extinct teleost or «true» fishes. (See ICHTHYOLOGY.) The ganoids were most numerous in Palæozoic and early Mesozoic times, and few and diverse are the surviving forms, which include the paddle-fishes and sturgeons, the gar-pikes, the mud-fishes of African rivers and a few others, all elsewhere described. In this group fall some of the most famous fossil fishes of palæontology, described by Hugh Miller in his 'Old Red Sandstone' and otherwise introduced long ago to the public. The *Pteraspis* and *Cephalaspis* of the Upper Silurian and Lower Old Red Sandstone strata had the head covered with a bony shield, which in form somewhat resembled the carapace of some crustaceans; the body of *Cephalaspis* had bony scales. The berry-bone (*Coccosteus*), the seraphim (*Pterichthys*), and the *Asterolepis* also had a bony shield, the flexible trunk having scales in *Pterichthys*, being naked in *Coccosteus*. The anterior limbs, or pectoral fins, of *Pterichthys* were long, covered with closely fitted plates, and had a complex joint connecting them with the thorax. The garpikes of the American lake region, are the modern representatives of the *Lepidotus*, *Æchmodus*, etc., of Mesozoic strata, and of the Carboniferous *Palæoniscus*. *Polypterus*, the type of this group, is confined to the Nile, and a few other African rivers. The group is most abundant in the Palæozoic strata, *Dipterus*, *Osteolepis*, *Holoptychius*, *Phaneropleuron*, being Old Red Sandstone genera; *Rhizodus*, *Megalichthys* with rhomboidal scales, *Strepsodus* with cycloid scales, Carboniferous. The cœlacanths range from the Carboniferous to the Chalk formations, and are the only members of the order in which the tail is homocercal.

Gansevoort, găns'voort, **Peter**, American officer: b. Albany 17 July 1749; d. 2 July 1812. In 1775 he joined the army which under Montgomery invaded Canada, and in 1776 he was appointed to the command of Fort George. In 1777 he was placed in command of Fort Stanwix, which he gallantly defended against a vigorous siege of 20 days by British and Indians under St. Leger, and received the thanks of Congress for having thereby prevented the co-operation of that general with Burgoyne, and contributed to the defeat of the latter. In 1781 the State of New York raised him to the rank of brigadier-general, which he held till the termination of the war. He afterward filled various important offices under the Federal government. He was successively commissioner of Indian affairs, commissioner for fortifying the frontiers, and military agent. In 1809 he was appointed brigadier-general in the United States army.

Gan'ymede (Gk. Γανυμήδης; Lat. *Ganymedes*), in Greek mythology the son of Tros and of Callirrhoë, a daughter of the Scamander. Zeus sent his eagle from heaven, which carried him off from Mount Ida to the seat of the gods, where he discharged the office of cupbearer to the immortals, Hebe having rendered herself unworthy of this office. This fiction has afforded, both to poets and artists, an inexhaustible supply of subjects. Numerous paintings, statues, cameos, and intaglios, masterpieces of ancient art, have descended to us, upon which this youth, scarcely past the years of boyhood, is represented as of great beauty. The representations of Ganymede are to be recognized by the Phrygian cap and the eagle, which is either standing beside him or carrying him in its talons to Olympus.

Gapán, gä-pän', Philippines, a pueblo of the province of Nueva Ecija, Luzon, situated four miles east of San Isidro, the capital. It is at the junction of several roads, and is the largest town in the province. Pop. 20,200.

Gaper, ga'- or gā'per, a name given to many animals who have great mouths, or in some other way suggest gaping. Thus it is one of the British names for the European soft clam (*Mya truncata*) in reference to the wide separation of the shells, as is characteristic of deeply burrowing bivalves; and it is applied to relatives on the Pacific coast of the United States. Among birds, the broadmouths (q.v.) are called gapers; and among fishes some of the sea-bass, which open their mouths in dying to the widest extent.

Gapes, a disease of young poultry, caused by a parasitic nematode worm in the throat. See Poultry, Diseases of.

Gar, Garfish, or **Gar-pike**, one of two sorts of fish, both long and slender, with a prolonged spear-like snout filled with teeth, and hence bearing such local names as «bill-fish,» «needle-fish,» «bony-pike,» etc.; and «greenbone,» because of the greenish tinge on the bones. The group originally called «gar» was that of the family *Belonidæ* (or *Esocidæ*), allied to the sauries and flying-fish, the type of which is the common European *Belone belone*. This is a swift, voracious fish which darts along the surface picking up little fishes, and especially playing havoc in shoals of young mackerel. It is usually about two feet in length, is often brought to the London market, and forms a wholesome dish, in flavor somewhat like mackerel. The young forms have at first jaws of a normal size, but in growth the lower outstrips the upper. Very similar, but larger, are the «silver» gars, «agujas,» or «needle-fish» of American tropical waters, which offer good sport by their speed and strength, but are hated by practical fishermen whose nets they frequently destroy or damage by their effort to get at imprisoned prey. There are several species, all of the genus *Tylosurus*.

Both these kinds, as well as their Oriental representatives, are often called «gar-pikes» from their pike-like form and voracity; but in the United States this term is suitably reserved for a very different kind of gar, not known in the Old World, and a relic of the ganoid tribe prevalent in the palæozoic seas. This gar-pike represents the family *Lepidosteidæ* (see Ichthyology), and has a long almost cylindrical body encased in an armor of white, bony, enameled rhomboid plates, which are imbricated in oblique rows running downward and backward. The jaws are long, narrow, and furnished with sharp teeth, each of which fits into a depression in the opposite jaw; and are covered with a granulated shagreen-like integument. They have the air-bladder subdivided and used in respiration; no spiracle; strong fins; a heterocercal tail; swim well, and prey upon small fishes. Their own flesh is not edible and they interfere with fishing, and therefore are destroyed freely. They inhabit the rivers and lakes of North America, where the commonest species is the long-nosed gar (*Lepidosteus osseus*). Another, more southerly, is the short-nosed gar (*L. platystomus*); and a great and powerful subtropical species (*L. tristœchus*), reaching 8 or 10 feet in length, and called «manjuari» in the West Indies, is known as «alligator-gar» in the lower Mississippi district. Another species occurs on the west coast of Central America; and another in the rivers of China.

All these gar-pikes frequent shallow, reedy, or grassy places, basking in the sun like the pike, and devouring living prey with great voracity. The manner of seizing prey differs from that usually observed in fishes, and resembles that of reptiles; instead of taking their food at once with open mouth and swallowing it immediately, they approach it slily and sideways, and then, suddenly seizing the fish or other animal, hold it until by a series of movements it is placed in a proper position for being swallowed, in the manner of alligators and lizards; the ball of food is also seen to distend the body as it passes downward, as in snakes.

Gar-pike. See Gar.

Garabit, gä-rä-bē, France, in the department of Lozère, is a picturesque locality on the railway from Marvejols to Neussargues, where the line spans a gorge of the Truyère River, about 10 miles south of Saint Flour. The viaduct planned by M. Eiffel is 1,852½ feet long, and is built partly of girders and partly of masonry. Where it crosses the river at a height of 401 feet, it is supported by an arch, with a span of 541 feet 4 inches. Consult: Eiffel, 'Le Viaduc de Garabit' (1889).

Garancine, găr'an-sĭn, is prepared from the ground root of *Rubia tinctorum* or madder (in French *garance*) by washing it with 8 or 10 times its weight of water acidulated with sulphuric acid, 1 part of acid being used for 100 parts of powder. After digesting for 7 or 8 hours the fluid is run off, and the paste is boiled for 2 or 3 hours by steam with more acid, and then the mass is thrown into cold water contained in a large trough with a perforated bottom covered with cloth to act as a filter. Here it is washed till all the acid is got rid of, and the paste is afterward pressed, dried, and ground to fine powder. It is used for dyeing, and has the advantage over madder (q.v.) of containing a large proportion of coloring matter. It is preferable to madder for mixing with other dyestuffs to produce chocolate and some other shades.

Garay, Juan de, hoo-än' dā gä-rī', Spanish soldier: b. Badajoz 1541; d. South America 1584. About 1565 he went to South America, where he became secretary to the governor of Paraguay, was sent on a voyage up the Paraná, discovered a vast territory, and founded near the river the town of Santa Fé de Vera Cruz. He defeated the Charruas Indians not far from the Uruguay, received the commission of lieutenant-general, and was appointed (1576) governor of Asuncion. In 1580 he re-founded the city of Buenos Ayres on its previous site, and subsequently did much to improve the condition of neighboring native tribes. Having landed in an unfamiliar region on a journey up the Paraná to Asuncion, he was there killed by hostiles.

Garbage is kitchen refuse and table waste, offal, or discarded material from the preparation and use of human food. Assembled, it is an ever-varying mixture of animal and vegetable food waste, the nitrogenous or proteids being largely in excess of the non-nitrogenous properties. Garbage decomposes rapidly in the open air and becomes offensive, especially in warm weather. When thrown upon the ground and allowed to decompose, or when used as a fertilizer in a raw state, it may contaminate sources of water supply, and thus become a menace to public health. In country districts and in most towns and small cities it is used as food for domestic animals, and when fresh no more proper disposition of it can be made. When the material is allowed to become partially decomposed before feeding, and where caustic solutions are used for the cleansing of cooking utensils, etc., the mortality caused thereby, particularly among hogs, is so serious as to preclude its use. American cities produce from one half pound to one pound per day for each person. European cities produce less than one half of this amount for each person. Analysis of American city garbage shows moisture 70 per cent to 80 per cent; grease, 2 per cent to 3 per cent; and solids, principally wood fibre, 18 per cent to 28 per cent. Garbage from European cities contains more of solids and less of moisture and grease.

Compared with the garbage of New York city, British garbage contains about 25 per cent and German about 50 per cent less water. Practically, France has no garbage.

No other problem so far encountered has so troubled city officials and boards of health as the disposal of garbage. The thoughtless citizen throws it in the street, or leaves it in his back yard until his neighbors rebel, or he burns it in his range or furnace and has more trouble with his neighbors. He puts it with ashes and other refuse and it is dumped on a vacant lot, or a depression in the ground is filled with it, and injunction proceedings are brought by near-by residents; protests and complaints of every description are made to councilmen, heads of departments, and boards of health. Newspapers take it up, and everyone who can possibly be held accountable is abused. The first attempts at collection and disposal are crude and imperfect. All kinds of household wastes are put together in boxes or barrels and teams are hired to cart it away. In some cases the city owns the horses and wagons required for the work. This lasts until there is no longer a dumping place within hauling distance. In a few instances it has been taken to sea in scows and dumped in deep water. This is found objectionable, as the lighter portions float to shore. Total destruction of the material is the next resort. Inventors and promoters take advantage of the situation, and it is proposed to burn or utilize the material at huge profit. Corporations are formed, stock is sold, and plants are built for final disposal. Then there are indignation meetings and injunction proceedings. No one wants a garbage-disposal plant near his property. Should it be completed and started, it is generally closed within a year, either by injunction or owing to the lack of funds for its operation. The country is strewn with such wrecks. From one to a half dozen can be found in almost every city. Many are so utterly worthless in practice as to approach very nearly to the ridiculous. Others are admirable in design and construction, but fail on account of insufficient returns or excessive cost of operation. Much has been learned, however, through these failures.

It has been found that when garbage is mixed with ashes, paper, and other household waste, final disposal is rendered very difficult, the mass being unfit for filling, fuel, or fertilizer. Leading American cities separate household waste into three parts, namely, "food waste," "combustible waste," and "non-combustible waste." By this means final disposal is more readily effected, each class of waste having properties of commercial value when kept separate from the others. Most European cities do not attempt a separation, excepting it be at the plant where final disposal is effected. In some cases the whole mass is passed through what are termed "destructors," burning the unconsumed carbon found in the ashes, and the combustible portions of other household waste. This system of final disposal has not been found satisfactory in American cities, and has been equally unsatisfactory in some European cities, particularly on the Continent, where, as in America, it is found that much additional fuel is required in order to maintain a proper temperature in the furnaces. Many of them have, therefore, been abandoned altogether, and attention has been turned to some form of utilization as being more reliable and less expensive.

Engineers have struggled manfully with the problem, and have been ably seconded by men of means and energy. It would scarcely be possible to name in this connection all those who have contributed to the development of principles, systems, and apparatus which go far toward the practical solution of this difficult problem. Much impetus was given to effective practical development of the principle of utilization by the determined efforts of the late Col. Geo. E. Waring, New York's indomitable commissioner of streets. After a most exhaustive investigation of the whole subject, and a thorough inspection and test of every system of disposal then in existence, both in Europe and America, Col. Waring became thoroughly convinced that utilization was right in principle and practice, and proceeded at once to have the garbage of the city of New York disposed of in this manner.

Prior to this time there were successful utilization plants in Philadelphia, Pa., St. Louis, Mo., and Detroit, Mich. The system adopted by Col. Waring, and which is now in use in many of the principal cities of the United States, is first, thorough sterilization by subjecting the material to the action of live steam in enclosed vessels, condensing all vapors and passing insoluble gas through flame. By this treatment the structure of the material is broken down,— even bones are disintegrated,— the liquids carrying the oils and greases being separated from the solids by mechanical means. The further preparation of the ingredients, by which they are put in commercial form or finally disposed of, varies greatly in the different plants. In some cases the liquids are evaporated, in others they are allowed to run into sewers or water courses. In a number of the plants the solid portions are used for fuel; in others they are acidulated or dried and prepared as a base for commercial fertilizers. The greases are sometimes extracted by the use of a solvent, and reclaimed by evaporation, the solvent vapors being condensed and also reclaimed to be used again. The principles involved are not new, having been applied for many years to the treatment of slaughter-house waste. In its application, however, to the greater subject of garbage disposal, much new apparatus has been invented, and the plants have been equipped to handle very promptly a vast amount of the material; the plant which disposes of the entire garbage of the Greater New York having a daily capacity of more than 2,000 tons, and the plants located in Philadelphia, Pa., Boston, Mass., Newark, N. J., Baltimore, Md., Washington, D. C., Detroit, Mich., St. Louis, Mo., Cleveland, O., and in some of the smaller cities, are of sufficient capacity to dispose of all the garbage produced in the respective cities within 12 hours of delivery at the plant. It is this prompt and effective disposal that has rendered the utilization systems so popular in the large American cities. The entire work of collection and disposal is, in most cases, done by contract. The plants are owned by contractors, the cities in some cases collecting the garbage and delivering it upon the contractors' cars or boats for transportation to the place of final disposal. The contractors have expended vast amounts of money in perfecting the systems, and certain features, processes, etc., are kept secret. As they are private enterprises, no statement can be made as to returns from the sale of the products, but it is known that reasonable dividends are paid, and that the contracting companies are in a sound condition financially, while the citizen who notes carefully the service rendered is well satisfied with the results.

The state of the art as to final disposal would seem to preclude the utilization systems in cities having a population of less than 50,000, excepting where a combination plant can be used, thus disposing at one plant of all garbage, dead animals, slaughter-house waste, butchers' scrap, etc. Where this cannot be effected, it has been found that burning is the only safe and effectual means of disposal.

Many of the failures, both in incineration and utilization, are due to the improper location of plants. While it should be perfectly clear to everyone that such plants should be so located as to cause the least possible property loss or inconvenience to the people, yet it should be recognized that every city must have a place for final disposal of its waste, and, once properly located, it must be recognized as such. Though plants for final disposal, when properly designed and operated, have not proved a nuisance to near-by residents, nor a menace to public health, yet the assembling at one point of the material is objectionable and should be restricted to a section for such purposes. See Wastes, City, Disposal of.

Much has been written on the subject by both European and American engineers, principally in the form of papers read before some of the engineering societies, and published in engineering journals. Valuable information can be obtained from the files of such journals. Very little of such material, however, has been put in book form. In a small volume published in 1897, entitled, 'Street Cleaning and Its Effects,' by Col. Geo. E. Waring, interesting and valuable data is assembled, a portion of which bears directly on this subject, and in an English publication entitled 'The Economic Disposal of Towns' Refuse,' W. Francis Goodrich gives a very good description of European and American burning methods, with illustrations, plans, and tables well arranged. His data on the subject of utilization is, however, inaccurate and misleading and does not correctly set forth the true state of the art at the present time. A most comprehensive treatise on the subject is 'The Wastes of a Great City' by John McGaw Woodbury, commissioner of street cleaning, New York, in Vol. XXIV., p. 387, 'Scribner's Magazine' (1903).

Charles Edgerton,
President Sanitary Product Company.

Garborg, gär'bôrg, **Anne**, Norwegian novelist: b. island of Time, Jæderen, 25 Jan. 1851. He was educated at Christiania, published anonymously in 1873 his essay, 'Ibsen's "Emperor or Galilean,"' in 1877 founded the 'Fedraheimen,' a liberal journal which he edited until 1882, and in this as well as 'Den syttende Maj,' another periodical, urged the adoption of a national language for Norway. On this subject he wrote also: 'The New Norwegian Language and the National Movement' (1887). His best-known work was done in his stories, originally written in the popular tongue and largely rendered into Swedish and Danish. They are of the realistic vein so common to Scandinavian writers, and include: 'A Freethinker' (serially in 'Fedraheimen' (1878); 'Men' (1886); 'Weary Souls' (1891); 'Fred' (1893).

Garção, Pedro Antonio Correa, pā'drō än-tō'nē-ō kōr-rā'ä gär-sän', Portuguese poet: b. Lisbon 29 April 1724; d. there 10 Nov. 1772. As a lyric poet he stands very high; while his satires, odes, and epistles,— upon the models of Horace,— are dainty and spiritual. He also wrote successful dramas. The Portuguese esteem him for the perfection with which he employed their language in his works. The 'Hymn to Dido' is one of his most popular productions. He was arrested for a personal satire, and died in prison after a long captivity.

Garcia, Diogo, dē-ō'gō gär-sē'ä, Portuguese navigator: b. Lisbon 1471; d. Madrid 1529. In 1526 he sailed with three vessels from Cape Finisterre for South America, in the employ of the company established at La Coruña for the spice trade. He explored the Uruguay (1827), and the Paraná to 27° S., defeated the Indians who had besieged Sebastian Cabot on the latter river, and in 1528 left for Spain. About 1532 he is said to have made a voyage to the East Indies. His account of his Brazilian explorations appeared in Vol. XV. of the 'Revista do instituto histórico é geográfico do Brasil.'

Garcia, gär-thē'ä, **Manuel del Popolo Vicente**, Spanish vocalist and composer: b. Seville, Spain, 22 Jan. 1775; d. Paris 10 June 1832. After acquiring a considerable reputation as a tenor singer in Cadiz and Madrid, in 1808 he obtained great success at the Italian opera in Paris, and afterward proceeded to Italy, where he was received with equal favor. From 1816 to 1824 he was constantly engaged as a singer, either in Paris or London. In 1825, with a select operatic company, composed in part of members of his own family, he crossed the Atlantic and visited New York and Mexico. On the road between Mexico and Vera Cruz he was robbed of all his money; and after his return to Paris was compelled to open a class for singing, as his voice had become greatly impaired by age and fatigue. Many of Garcia's pupils reached a high degree of excellence, but none equaled his eldest daughter Maria, afterward Madame Malibran (q.v.). He was less successful as a composer, though several of his works, such as 'The Caliph of Bagdad,' were much admired.

Garcia, gär-thē'ä, **Manuel**, Spanish professor of singing in England: b. Madrid, Spain, 17 March 1805; d. London, England, 1 July 1906. He was a son of the preceding. He invented the laryngoscope, and published: 'Memoire sur la voix humaine' (1840): 'Traîte de la Chant' (1841) ; 'Hints on Singing'; etc.

Garcia y Iniguez, gär-se' ä ē-nē'gēs, **Calixto**, Cuban patriot: b. Holguin, Cuba, 14 Oct. 1836; d. Washington, D. C., 11 Dec. 1898. In 1868, with Donato del Marmol and Carlos Manuel Cespedes, he organized the revolution known as the "Ten Years' War." In the early part of the struggle he won the battle of Santa Maria and recaptured Jiguani. In recognition of his services Garcia was appointed brigadier-general under Gomez (q.v.), and subsequently succeeded that officer as commander-in-chief of the Cuban army. In 1873 he was captured and carried as a prisoner to Spain. In 1879 he returned to Cuba to start "The Little War," but was again captured and kept in Spain under police surveillance for 15 years. In 1895 he escaped and came to New York, where he fitted out a filibustering expedition, which failed to reach Cuba on account of the wreck of the vessel. Later he was successful in landing in Cuba with arms and supplies. He was given the command of the forces in Camaguey and Oriente, where he held almost complete possession, and in 1898 gave valuable aid to the American forces at the capture of Santiago. At the close of the Spanish-American war he was made chief of the commission to discuss with President McKinley the future of Cuba.

Garcia Moreno, gär-sē'ä mō-rā'nō, **Gabriel**, Ecuadorean politician: b. Guayaquil, Ecuador, 1821; d. Quito 6 Aug. 1875. He was educated at Quito and in Europe, became professor of chemistry in the University of Quito, and in 1857 its rector. In 1859, upon the overthrow of the Roble's government, he was chosen a member of the provisional government, and in 1861 president for a term of four years. He declared himself dictator in 1864, subsequently relinquished the title and office, though he maintained virtual control of affairs, in 1869 led a revolution, and became again dictator, and in 1875 was elected president for a six-years' term. Before his inauguration he was fatally wounded by assassins.

Garcia de Quevedo, gär-sē'ä dā kā-vā'dō, **José Heriberto**, South American author: b. Coro, Venezuela, March 1819; d. Paris June 1871. Educated in France and Spain, he settled in Paris, and was killed in the communard insurrection of 1871. Among his poems are: 'To Columbus'; 'To Liberty'; 'To Pius IX.'; 'Frenzy'; 'The Life to Come'; and 'The Proscript.' His dramas were well received. He wrote the novels 'The Love of a Girl' and 'Two Duels Eighteen Years Apart.'

Garcilaso de la Vega, gär-thē-lä'sō dā lä vā'gä (properly Garcias Laso de la Vega), Spanish poet: b. Toledo 1503; d. Nice 14 Oct. 1536. According to an account given in the 'Historia de las Guerras Civiles,' the Garcilasos received their surname from their combats with Moorish heroes, in the great valley of Granada, called *La Vega*. Garcilaso soon found his proper sphere. His genius was kindled by the study of the ancients, particuarly of the Romans. Boscan had already begun to transplant the versification of the Italians into Spanish poetry. Garcilaso followed his example, and succeeded so well that he is still ranked among the best Spanish poets. Most of the events of his life may be learned from his own works. He lived for a long time in Italy, and afterward traveled through part of Germany, in the service of Charles V. In 1529 he was engaged in the expedition against Soliman, and in 1535 in that against Tunis. In the latter he received a wound in his arm, after which he remained some time in Naples. In 1536 he commanded 30 companies of infantry, and accompanied the imperial army against Marseilles. Spanish poetry is highly indebted to him; for without his aid Boscan, a foreigner, would never have succeeded in his innovations, more particularly as he had a formidable adversary in Christoval de Castillejo. His writings consist of eclogues, epistles, odes, songs, sonnets (in which he imitated Petrarch), and some smaller poems. An edition of his works, with notes, appeared in 1765, and Herrera's commentary (1580), with notes by Azara (1765).

Garcilaso (Garcias Laso) de la Vega, surnamed the Inca, Spanish historian: b. Cuzco, Peru, 1540; d. Spain 1616. He was the son of Garcilaso de la Vega, one of the conquerors of Peru, and Elizabeth Palla, a princess of the race of the incas. His mother taught him the Peruvian language, and is said to have inspired him with the idea of writing the history of his ancestors. His great work on the history of Peru is in two parts: the first bearing the title of 'Historia de las Antiquedades y Conquista de Piru; Primera Parte de los Comentarios Reales que tratan del Origen de los Incas, etc.' (1609); the second being the 'Historia general del Peru' (1616). He wrote also 'Historia de la Florida (1609).

Garcin'ia, so called after Laurent Garcin (d. 1752), a Franco-Oriental traveler, is the botanical name for a genus of guttifers, the typical one of the tribe *Garcinieæ*. It consists of opposite leaved trees, with a yellow resinous juice, and generally unisexual flowers with four sepals, four petals, many stamens in from one to four bundles, and a 2 to 10-celled ovary with a single seed in each cell. The fruit of *G. mangostana* is the highly-prized mangosteen. The fruits of *G. pedunculata, G. cornea,* and *G. kydiana* are also eaten, but are not greatly valued. The *G. kola* of tropical Africa yield fruit and seeds similar in properties to the kola-nut. *G. cambogia* and other species of the genus furnish Gamboge (q.v.).

Garda, gär'dä, or **Benaco, Lake,** the Italian *Lago di Garda,* and the *Benacus Lacus* of the Romans, is an extensive and beautiful lake in north Italy, 33 miles long from north to south, by 3 to 11 miles broad, and 213 feet above sea-level. It forms part of the boundaries of the provinces of Verona, Mantua, and Brescia, while its north extremity enters the Austrian territory of Trent, in the Tyrol. It receives the Sarca, almost its only affluent, at its north end, and is drained by the Mincio, which issues from its southeast end near the fortress of Peschiera, and conveys its waters to the Po. Storms are not infrequent, and are sometimes violent. It is well stocked with excellent fish including salmon-trout, trout, eels, and pike. Garda is the largest lake in Italy, and attains a depth of over 1,000 feet in many places. Its shores are covered with villas and steamboats ply on it regularly between the ports of Riva, Desenzano, and Peschiera, which with Gardone-Riviera, Garda, Malcesine Salo, and the beautiful promontory of Sirmione are its most popular resorts.

Garde Nationale, gärd nä-sē-o-näl, a guard of armed citizens instituted in Paris 13 July 1789 for the purpose of preserving order and protecting liberty. At first it numbered 48,000 men, but was increased to 300,000 when it was organized throughout the whole country. Acting as a royalist and reactionary force, it was crushed by Napoleon in 1795. It was reorganized by the Directory and by Napoleon and again under the Bourbons, to whom, however, it was a source of such disquietude that it was dissolved by a royal ordinance in 1827. Under Louis Philippe it was resuscitated in its old form and contributed to his overthrow. In 1851 the national guard was again reorganized, but in 1855 it was dissolved. In 1870 the national guard of Paris was again formed for the defense of the city against the Prussians. The resistance of a section of the guard to the decree of disarmament issued under M. Thiers led to the communal war, at the close of which the guard was declared dissolved by the National Assembly (1871).

Garden, Alexander, Scottish scientist: b Charleston, S. C., about 1730; d. London 15 April 1791. He was graduated from Aberdeen; became a professor in King's College, New York (now Columbia University), and in 1755 established himself in medical practice at Charleston. From 1783 he was in London, where he became vice-president of the Royal Society. The botanical genus *Gardenia* (q.v.) was named in his honor by Linnæus. He wrote various papers on topics of botany and zoology.

Garden, Alexander, American soldier: b. Charleston, S. C., 4 Dec. 1757; d. there 29 Feb. 1829. He was for a time aide-de-camp to Gen. Greene. He wrote 'Anecdotes of the Revolutionary War in America, with Sketches of Character of Persons the most distinguished in the Southern States for Civil and Military Services' (1st series, Charleston, 1822; followed by a second series), which is one of the authorities for the history of the period, containing information hardly to be found elsewhere.

Garden. The earliest known gardens are those of Solomon which are described as having been of quadrangular form, surrounded by high walls. They contained aviaries, wells, and streams of water. The gardens of Cyrus and other Persian monarchs were of great extent, and generally laid out in romantic situations. They were also distinguished for the great diversity of their uses and products. The first allusion to terraces in gardens is to be found in the description of the celebrated hanging gardens of Babylon, anciently reckoned among the wonders of the world. Their construction is variously ascribed to Queen Semiramis and to Nebuchadnezzar. Diodorus and Strabo have given descriptions of them. They are said to have formed a square with an area of nearly four acres, and rose in terraces, supported on masonry arches, to a height of 75 feet. They were irrigated from a reservoir built at the top, to which water was lifted from the Euphrates by a screw. Fountains and banqueting-rooms were distributed throughout the numerous terraces; groves and avenues of trees, as well as parterres of flowers, diversified the scene; while the view of the city and neighborhood was extensive and magnificent. Most of the elements of a modern architectural garden are alluded to in connection with those of Babylon. The grove of Orontes, described by Strabo, must be regarded as a park or large garden in the picturesque style; it was nine miles in circumference.

In ancient Greece, gardening was rather a neglected art at first, but in process of time great advance was made. The vale of Tempé, the Academus at Athens, and other public gardens, were extremely elegant, and were ornamented with temples, altars, tombs, statues, monuments, and towers. The Greeks copied their gardening from the Persians; and the Romans, in their turn, copied that of the Greeks. Little is known of the early style of Roman gardening; the vast edifices projecting into the sea, and the immense artificial elevations, are apparently ridiculed by Cicero and Varro. About this time, however, began the cultivation of odoriferous trees and plants; and the planting of trees adjoining each other, whose odors assimilated, was then as much a study with the gardener as the harmonious blending of colors at the present day.

The early French and Dutch gardens were evidently adopted from the description of Pliny's garden. The use of glass in the construction of conservatories was early known to the Greeks and Romans; and the "Gardens of Adonis," mentioned by some of their most eminent authors, were probably of this kind. Gardening, like all the other arts, languished during the Dark Ages, but with the revival of learning, the invention of printing, and the Reformation, it began again to flourish. The art was revived and patronized by the family of the Medici in Italy; and their gardens which were of the geometric and architectural style, long served as models for most of Europe. It continued to be imitated in France, Germany, and Great Britain till the introduction of the English or natural style. In garden architecture very little progress, as far as hothouses are concerned, has been made in southern Europe, the warmth of the climate rendering them all but useless. There are, however, plant houses in many places in Spain and Portugal. The French and Dutch gardens resemble each other closely; symmetry and profuse ornament are the characteristics of both. The Dutch style is eminently adapted to the nature of the country, where there are no inequalities of surface, as in England. The French style seems to have arisen about the middle of the 17th century, during the reign of Louis XIV. The most celebrated gardener of the period was Le Nôtre, who laid out the famous gardens of Versailles. Le Nôtre's style spread rapidly into other countries. The first erection of hothouses in France occurred toward the end of the reign of Louis XIV., by M. Fagon, in the Jardin des Plantes. The first magnificent attempt at hothouse building was that of Francis I., of Austria, in 1753. They were in five ranges, extending altogether to the length of 1,290 feet, many of them being 30 feet high. From about 1760 landscape gardening, and the adoption of the English style, rapidly spread into France, Germany, and Russia, where it still prevails. See FLOATING ISLAND; FLORICULTURE; GREENHOUSE; HORTICULTURE; BREEDING, PLANT; FLOWERS; CROSS-FERTILIZATION; ETC.

Garden City, N. Y., a village on Long Island in Nassau County; on the Long Island R.R.; 18 miles east of New York. It was founded by Alexander T. Stewart as a residential town. It is the seat of the Protestant Episcopal bishop of Long Island, and contains the Cathedral of the Incarnation. Here are also the Cathedral Schools of St. Mary and St. Paul. Pop. (1901) 800.

Garden of the Gods, a small region in Colorado, near Colorado Springs, in which are seen some of the most striking effects of erosion ever found upon the globe. The "Garden" covers an area of about 500 acres, within which are strangely sculptured sandstone rocks, red and white, forms of grotesque magnificence — columns, "cathedral spires," and giant figures sometimes appearing almost as if made in human likeness. To many of these shapes have been given distinctive names suggested by their various formations. The road into the "Garden" enters through the huge "Gateway" of red rock-masses more than 300 feet in height.

Garden Snail. See SNAIL.

Garden Webworm. See WEBWORM.

Gardener, Helen Hamilton. See SMART, HELEN HAMILTON.

Gardener Bird. See BOWER-BIRDS.

Gardening, Landscape. See LANDSCAPE GARDENING.

Gardiner, gärd'nėr, **Asa Bird,** American lawyer: b. New York 30 Sept. 1839. He was educated at the College of the City of New York and New York University; during service in the Civil War attained the rank of captain and received a medal of honor for bravery; was professor of law in the United States Military Academy in 1874–9, and became district attorney of the County of New York in 1897. He has practised law in New York, and held important posts in the Society of the Cincinnati and other organizations.

Gardiner, Frederic, American Protestant Episcopal clergyman: b. Gardiner, Me., 11 Sept. 1822; d. Middletown, Conn., 17 July 1889. He was graduated from Bowdoin College in 1842, from the General Theological Seminary, New York, in 1845; was rector of Trinity, Saco, Me., 1845–7; rector of churches at Bath (1848–53) and Lewiston, Me. (1855–6); and in 1865 became professor of the literature and interpretation of Scripture in the Gambier (Ohio) Theological Seminary. In 1867 he was appointed professor of the Old Testament language and literature in Berkeley Divinity School (Middletown, Conn.), and in 1883 of New Testament interpretation and literature in that institution. He founded (1880) the Society of Biblical Literature and Exegesis, and published: 'The Island of Life' (1851); 'Diatessaron' (1871); 'The Old and New Testaments in their Mutual Relations' (1885).

Gardiner, John, American lawyer: b. Boston 1731; drowned off Cape Ann 15 Oct. 1793. He was a son of Sylvester Gardiner (q.v.). He studied law at the Inner Temple, London, and was admitted to practice at Westminster Hall. He formed an intimacy with Churchill and Wilkes, and was junior counsel of the latter at his trial in 1764, and also appeared for Beardmore and Meredith, who for writings in support of Wilkes had been imprisoned on a general warrant. In 1766 he procured the appointment of attorney-general in the island of St. Christopher, where he remained until after the American revolution, when he returned to Boston. After residing there a few years, he removed to Pownalborough, Me., which place he represented in the Massachusetts legislature until his death. As a legislator he distinguished himself by his efforts in favor of law reform, particularly the abolition of special pleading, and the repeal of the statutes against theatrical entertainments. In connection with the latter subject he published a 'Dissertation on the Ancient Poetry of the Romans,' and an accompanying speech. The abolition of the law of primogeniture in Massachusetts was due to his efforts. He was one of the most influential of the early Unitarians of Boston, and participated in the change of King's Chapel from an Episcopal into a Unitarian Congregational Church.

Gardiner, John Sylvester, American Episcopal clergman: b. Haverford West, South Wales, England, June 1775; d. Harrowgate, England, 29 July 1830. He was a son of John Gardiner (1731–93) (q.v.); accompanied his father to the West Indies, and subsequently studied in Boston, and in England under the celebrated Dr. Parr. Returning to America, he became a candidate for orders in the Protestant Episcopal Church, and in 1797 was ordained. In 1805 he became rector of Trinity Church, the chief Episcopal parish in Boston, with which he remained connected until his death. He was an accomplished scholar, and a forcible preacher. In the establishment of the 'Boston Anthology and Monthly Repository,' for which he was a frequent writer, he contributed materially to the dissemination of literary taste and culture in Boston. He was also one of the founders of the Boston 'Athenæum.' He wrote the ‹Jacobiniad,› a satire in prose and verse directed against the liberal clubs of Boston, to which, being in politics a strong Federalist, he had an antipathy.

Gardiner, Lion, English settler in America: b. 1599; d. 1633. After service in the English army, he came to America in 1635 as the representative of a land company which had a patent of territory at the mouth of the Connecticut. He built a fort to which he gave the name of Saybrook, compounded from the names of Lord Say and Sele and Lord Brook, two of the patentees, and remained in charge until 1639. He made on an island, called by him the Isle of Wight (now Gardiner's Island, township of Easthampton), the first English settlement within the limits of what is now the State of New York, and there he lived in baronial style.

Gardiner, Samuel Rawson, English historian: b. Ropley, Hampshire, 4 March 1829; d. Sevenoaks, Kent, 23 Feb. 1902. He was educated at Christ Church, Oxford, studied also at Edinburgh and Göttingen; was professor of history at King's College, London, in 1871–85, historical lecturer for the University Extension Society in 1880–94, and examiner in the Oxford final history school in 1886–9. He was elected to a research fellowship by All Souls, Oxford, in 1882, and to a similar fellowship by Merton in 1894. On Froude's death (1894) he declined appointment to the Oxford regius professorship of modern history. It is for his work of research in the history of England from 1603 to 1660 that he is best known. The results were published in instalments later assembled in various collective editions. In the course of his investigations he examined minutest details with extraordinary care. He inspected the scene of most battles which he described; he thoroughly familiarized himself with the state papers of the Record Office, and, for the study of the state papers foreign and the contents of other national archives, learned six continental languages. It is stated that he was the only one that ever read the entire collection of Thomasson tracts in the British Museum. Though himself a Liberal in politics, his writing was wholly judicial and impartial. Perhaps no other English historian ever labored more enthusiastically for historical truth. His style is clear and well-ordered, and in later volumes vigorous and often impressive. He was the first to describe in full the period of Commonwealth and Protectorate from an unprejudiced viewpoint, and he was also the first satisfactorily to explain the beginnings of the Cavalier party and the rise of the civil war. He was fortunately enabled to utilize many newly discovered sources. His work was not at first popular, but its worth was later fully recognized. In 1882 he received a civil-list pension of £150. The titles of the larger divisions of his great undertaking are: ‹History of England from the Accession of James I. to the Disgrace of Chief Justice Coke› (1863); ‹History of England from the Accession of James I. to the Outbreak of the Great Civil War› (1883–4); ‹History of the Great Civil War› (1886–91); and ‹History of the Commonwealth and Protectorate› (1894–1901), in three volumes, a fourth to be completed by Firth. He wrote also ‹Cromwell's Place in History› (1897); ‹Oliver Cromwell› (1899); and other works, including: ‹The Thirty-Years' War› (1874); ‹The First Two Stuarts and the Puritan Revolution› (1876) ‹Introduction to the Study of English History› (with Mullinger, 1881); ‹Constitutional Documents of the Puritan Revolution› (1889); ‹Student's History of England› (1890–2); ‹School Atlas of English History› (1891); ‹What Gunpowder Plot Was› (1897).

Gardiner, Sylvester, American physician: b. Kingston, R. I., 1717; d. Newport, R. I., 8 Aug. 1786. He studied medicine in London and Paris, subsequently practised his profession in Boston, and opened there a drug establishment, from which the New England colonies were chiefly supplied. He was one of the early promoters of inoculation for the smallpox, and a liberal contributor for the erection of King's Chapel, Boston. He became possessed of large tracts of land in Kennebec County, Maine, and about the middle of the century was instrumental in establishing there the settlement of Pittston, a portion of which was subsequently set off into a separate town, under the name of Gardiner, where he built and endowed Christ Church. He retired from Boston on its evacuation by the British troops, but returned to the United States at the close of the Revolutionary War, and passed the rest of his life there.

Gardiner, Me., a city in Kennebec County, on the Kennebec River, and on the Maine C. R.R., six miles from Augusta. It has admirable water-power, valuable manufacturing interests, and an assessed property valuation of $4,000,000. The ice-cutting industry employs 1,000 people, with an annual output valued at $75,000. Pop. (1900) 5,501.

Gardiner's Island, N. Y., an island in a bay of the same name at the northeastern extremity of Long Island. It is part of the township of East Hampton, Suffolk County, and has an area of 3,300 acres, mostly undulating pasture land. It was colonized by an English family of the name of Gardiner in 1639 and is in possession of lineal descendants of the original settlers. Captain Kidd (q.v.) buried part of his treasures on the island in 1699, but they were recovered in the same year by the colonial authorities.

Gardner, Elizabeth Jane, American artist: b. Exeter, N. H., 1842. She was a pupil at Paris of Bougereau, Merle, and J. J. Lefebvre, and has exhibited much in the United States and foreign countries. Among her works are several portraits: ‹Cinderella›; ‹Fortune-Teller›; ‹Moses in the Bulrushes.›

Gardner, Ernest Arthur, English archæologist: b. London 1862. He was educated at Cambridge University, and was director of the British School of Archæology at Athens, 1887–95. From 1884 he has been engaged in archæological researches in Athens, Paphos in Cyprus, Megalopolis, and elsewhere, and has lectured and written much upon Greek art and archæology.

Gardner, Eugene C., American architect: b. Ashfield, Mass., 28 March 1836. He was principal of the Academy at Tallmadge, Ohio, 1852–62. He then removed to Northampton, Mass., where he resided 1863–8, engaged in architectural work, going to Springfield, Mass., in the latter year, editing ‹The Builder› 1885–7, and writing for the ‹Springfield Republican.›

In 1901 he was elected a member of the Massachusetts House of Representatives. Among his works are: 'Homes and How to Make Them'; 'Illustrated Homes'; 'Home Interiors'; 'The House that Jill Built'; 'Town and Country School Houses'; and 'Common Sense in Church Building.'

Gardner, George Clinton, American engineer and railway official: b. Washington 1834; d. Richmond Hill, L. I., 12 Aug. 1904. He studied at Columbia for a time, in 1850 became connected with the survey establishing the United States and Mexican boundary from the Gulf of Mexico to the Pacific. In 1856 he was commissioned by the government assistant astronomer and surveyor of the Northwest boundary, and in this survey, for establishing and marking the 49th parallel, he gained considerable distinction. His determinations along this line form the initial points of the United States land surveys. He resigned in 1869, and subsequently was prominently identified with various railway interests. He was general manager of the Mexican National Construction Company, the Mexican National Railroad Company, and the Texas-Mexican Railroad Company, constructing much of these lines, and was connected also with other railways.

Gardner, Percy, English archæologist: b. Hackney, Middlesex, 24 Nov. 1846. He was educated at Cambridge University, was Disney professor of archæology there in 1880, and has been professor of classical archæology at Oxford from 1887. Among his publications are: 'Samos and Samian Coins' (1882); 'The Types of Greek Coins' (1883); 'New Chapters in Greek History' (1892); 'Manual of Greek Antiquities,' with Jevons (1895); 'Sculptured Tombs of Hellas' (1896); 'Exploratio Evangelica' (1899); 'Historic View of the New Testament' (1901); 'A Grammar of Greek Art' (1905).

Gardner, Mass., a town in Worcester County, including the villages of Gardner Centre, South Gardner, and West Gardner. It is situated about 25 miles north of Worcester, on the Fitchburg division of the Boston & M. R.R., two branches of which pass through the town, intersecting at the station in Gardner Centre. Gardner is the trade centre of an agricultural region, and has a large chair-manufacturing industry, with establishments employing about 3,000 people. Almost every known kind of chair is made here, and the products of this manufacture are shipped to all parts of the United States and to many foreign countries. The town has two good parks and an excellent public library. Pop. (1900) 10,813.

Garefowl, or **Great Auk**. An extinct auk (*Plautus impennis*), much like the existing razor-bill, but larger (nearly the size of a goose), with a larger bill and relatively smaller wings. It was black above and white below, with a conspicuous white patch in front of the eye. It was an expert swimmer and diver, but unable to fly on account of the very small size of its wings. The habits of the garefowl were those of auks generally, but its range was limited on the American coast to the vicinity of Newfoundland. It seems never to have lived north of the Arctic Circle; but its bones in shell-heaps testify to its former occurrence, at least in migrations, southward as far as Florida. These birds bred on small islands off the coast of Iceland, and on the Orkneys and Hebrides. Early in the 19th century they disappeared from these haunts, mainly through the persecution of fishermen and sailors who had for years killed them for food, bait, and feathers; but they lingered somewhat longer in the gulf of Saint Lawrence. Cartier's vessels visited Funk Island in 1534, and the crews easily filled two boats with the birds which they knocked down with sticks; and their abundance was mentioned as one of the inducements for settlers to come to Newfoundland. For many years the colony was ruthlessly harried, yet a few pairs survived until about 1840. A small breeding-place remained in Iceland until 1844, when the last few pairs were killed as museum specimens. The skins of this auk have been sold for $650, and an egg for $1,500. Seventy-eight specimens of the bird were preserved in museums throughout Europe and America in 1903. Consult: Newton's 'Dictionary of Birds,' article 'Garefowl,' and articles by F. A. Lucas in 'Report United States National Museum for 1887–8,' and for 1888–9.

Garfield, James Abram, twentieth President of the United States: b. Orange, Cuyahoga County, Ohio, 19 Nov. 1831; d. Elberon, N. J., 19 Sept. 1881. On his father's side he was of English Puritan descent; on his mother's, Huguenot. The father, a native of New York, settled in the "Western Reserve" in 1830, and died in 1833, leaving his widow with four small children, James being the youngest. Garfield's boyhood was passed amid the harsh but by no means destitute conditions of frontier life. He worked hard on the farm, helped in the support of the family, attended school three months each winter, and read and re-read every book which fell in his way. For a short time he was a driver and steersman on the Ohio Canal. Supporting himself chiefly by teaching, he studied successively at Geauga Seminary 1849, Eclectic Institute, Hiram, Ohio (now Hiram College), 1851–4, and Williams College, Mass., entering the junior class in 1854 and graduating with high honors in 1856. Returning to Ohio, he taught the classics at Hiram Institute 1856–7, and became its president 1857–9. Coincident with his teaching he studied law, was admitted to the bar in 1859, and, resigning his presidency, was elected to the Ohio State senate. The Civil War breaking out, he threw himself enthusiastically into the Northern cause, was commissioned lieutenant-colonel of the 42d Ohio, and given command of a brigade, with orders to operate as an independent force in eastern Kentucky, December 1861. With a force of 1,100 men and no artillery he signally defeated 5,000 Confederates under the veteran general, Humphrey Marshall, driving them from fortified positions of their own choosing, 10 Jan. 1862. For this exploit Lincoln promoted him brigadier-general. Subsequently he took part in the battle of Shiloh, in the operations around Corinth, and served with distinction on several courts-martial at Washington, one being that of Gen. Fitz-John Porter (q.v.). Appointed chief of staff to Gen. Rosecrans, February 1863, his notable services at Chickamauga (see CHICKAMAUGA, BATTLE

JAMES ABRAM GARFIELD.

TWENTIETH PRESIDENT OF THE UNITED STATES.

OF) caused Lincoln to make him a major-general, 19 Sept. 1863. In 1862 his home district had elected him to Congress. Thus, within six years he had been president of a college, State senator, major-general, and representative-elect, a combination of honors without parallel in the national annals. Upon the advice of Lincoln and Stanton he resigned his major-general's commission 5 Dec. 1863 and took his seat as a representative on December 7. In this field his talents and genius found their true sphere. He stepped to the front at once, taking a prominent part in every debate of importance, and becoming an authority on questions of finance, tariff, education, and constitutional rights. Always the champion of sound money, his speech in March 1866 clearly outlined the policy which resulted in the resumption of specie payments 1 Jan. 1879. An eminent contemporary has well said of Garfield's speeches that they are a compendium of the political history of the time, and would give a connected history and complete defense of the important legislation of the 17 eventful years that comprised his legislative career. He was eight times re-elected to Congress, serving on such important committees as those on military affairs and on ways and means, and was the first chairman of the committee on banking and currency. In the Reconstruction period he steadily opposed the theories of President Johnson (see JOHNSON, ANDREW); in 1876 he went to New Orleans at President Grant's request to watch the counting of the Louisiana vote, and in 1877 was chosen by acclamation one of the two members of the Electoral Commission allotted to the House of Representatives. In the 45th Congress Garfield displayed masterly qualities as a leader of opposition. His speech at Faneuil Hall, Boston, in 1878 on the national finances was circulated by thousands as a campaign document. On 13 Jan. 1880 the Ohio legislature unanimously elected him United States Senator to succeed Hon. Allen G. Thurman (q.v.), and his last speech in Congress was delivered 23 April 1880. At the Republican National Convention at Chicago, 2–8 June 1880, he headed the Ohio delegation, nominated John Sherman (q.v.) for the Presidency, opposed the nomination of Gen. Grant for a third term, and was himself nominated on the 36th ballot as a compromise candidate. Contrary to all precedent, Garfield himself took part in the campaign that followed, making some 70 speeches in all, chiefly extemporaneous. At the November election he received 214 electoral votes to 155 given his Democratic opponent, Gen. Hancock. The first months of Garfield's administration were disturbed by the opposition of the New York senators to certain of his appointments. Senators Conkling and Platt claimed the right to control the Presidential appointments in their State. This the President refused to concede. The senators resigned and appealed to their legislature to vindicate their attitude by a re-election, but failed to get it. On the morning of 2 July 1881, while in the Baltimore & Potomac station at Washington, on his way to New England, where he intended to deliver the commencement address at Williams College, President Garfield was shot by Charles Jules Guiteau (q.v.), a disappointed office-seeker For weeks he lingered between life and death, suffering the greatest agony but bearing it with a magnificent fortitude that won the admiration and sympathy of the civilized world. A removal to Elberon, N. J., in the hope that the sea air might benefit him was of no avail. Blood poisoning set in on 15 September, and he died on the 19th at 10:30 P.M. In February 1882 an impressive memorial service was held in the House of Representatives, the Hon. James G. Blaine delivering a commemorative address, which, for eloquence, dignity, and truth, has rarely been equaled on such occasions. Garfield's body lies in a beautiful cemetery in Cleveland, Ohio, a stately monument marking the spot. His life was the fullest realization of the opportunities of American citizenship. Rising from nothing, by his own exertions he won high places in various spheres and filled them all adequately and with dignity.

No definitive 'Life' has yet appeared, the biographies of Garfield by J. M. Bundy, C. C. Coffin, and J. R. Gilmore (all 1880) being incomplete and unsatisfactory. His 'Works' have been edited by Prof. B. A. Hinsdale (1882–3).

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Gargano, gär-gä'nō (ancient Garganus), a mountainous peninsula, the «spur» of Italy, in the province of Foggia, jutting out into the Adriatic Sea, and attaining in Monte Calvo a height of nearly 4,000 feet. Bee-keeping is yet as generally engaged in as in the time of Horace. The district is visited mainly by pilgrims to a shrine of Saint Michael on Monte Saint Angelo. It is about 50 miles long and 27 miles broad.

Garguntua, gär-gan'tū-ä, the hero of Rabelais' satire, so named from his father exclaiming «*Que grand tu as!*» «How large (a gullet) thou hast!» on hearing him cry out, immediately on his birth, «Drink, drink!» so lustily as to be heard over several districts. It required 900 ells of linen for the body of his shirt, and 200 more for the gussets, 1,100 cow hides for the soles of his shoes, and he picked his teeth with an elephant's tusk.

Gargoyle, Gargoil, or **Gurgoyle** (French *gargouille* = the weazand of the throat), in architecture, a quaintly-formed head of a man or animal, employed as a decorative spout for the rain-water from a roof. The most common form was that of a dragon projecting from the roof-gutter, but the varieties are innumerable. They were used in all styles of architecture, and are many of them of a most hideous appearance.

Garfield Monument, a monument erected as a memorial to President Garfield, in the Lakeview Cemetery at Cleveland, Ohio. See CLEVELAND.

Garibaldi, Giuseppe, joo-sĕp'pĕ gä-rē-bäl'-dē, Italian patriot: b. Nice, France, 4 July 1807; d. island of Caprera, Italy, 2 June 1882. His father being a poor fisherman, he received little education, and for a number of years was a sailor on various trading vessels. In 1834, being condemned to death for his share in the schemes of Mazzini, he escaped to Marseilles and finally went to South America. In the service of the Republic of Rio Grande against the Brazilians he became known as a brilliant leader, and with his famous Italian legion he subsequently gave the Montevideans such effective aid against Buenos Ayres as to earn the title of "hero of Montevideo." In 1848 he returned to Italy, raised a band of volunteers, and harassed the Austrians till the re-establishment of Austrian supremacy in Lombardy. In the spring of 1849 he proceeded to Rome to support Mazzini's republic. He was appointed to command the forces, but the odds were overwhelming, and after a desperate defense of 30 days Garibaldi escaped from Rome with 4,000 of his followers. He reached the United States, and was for several years in command of a merchant vessel. He then purchased a part of the small island of Caprera, off the north coast of Sardinia, and made this his home for the rest of his life. Latterly the subscriptions of his admirers enabled him to become owner of the whole island.

In the war of 1859, Garibaldi and his Chasseurs of the Alps did splendid service; and on the revolt of the Sicilians in 1860 he crossed to the island, wrested it after a fierce struggle from the king of Naples, recrossed to the mainland and occupied Naples, where he was proclaimed dictator of the Two Sicilies. He readily acquiesced in the annexation of the Two Sicilies to Italy, and declining all honors retired to his island farm. In 1862 he endeavored to force the Roman question to a solution, and entered Calabria with a small following, but was taken prisoner at Aspromonte by the royal troops. He was soon released, however, and returned to Caprera. In 1864 he received an enthusiastic welcome in Great Britain. In 1866 he commanded a volunteer force against the Austrians in the Italian Tyrol, but failed to accomplish anything of consequence. Next year he attempted the liberation of Rome, but near Mentana was defeated by the French and pontifical troops, and was again imprisoned by the Italian government, but soon pardoned and released. In 1870 he gave his services to the French republican government against the Germans, and at the end of the war was elected a member of the French Assembly, but speedily resigned his seat and returned to Caprera. Rome now became the capital of united Italy, and here in January 1875, Garibaldi took his seat in the Italian Parliament. The latter part of his life was spent quietly at Caprera. After 1870 he wrote two or three novels of very mediocre quality. His autobiography was published in 1887, and translated into English with a supplementary biography in 1889.

Garibaldi (fish), a small, brilliantly colored, edible fish (*Hypsypops rubicundus*), scarlet when adult, which dwells in rocky pools along the coast of southern California, hiding and finding its food among the seaweeds.

Garigliano, gä-rēl-yä'nō, a river in southern Italy, formed by the junction of the Liri and Sacco near Pontecorvo. It flows southeast and southwest, and after a course of 40 miles falls into the Gulf of Gaëta.

Garland, Augustus Hill, American lawyer: b. near Covington, Tenn., 11 June 1832; d. Washington, D. C., 26 Jan. 1899. He opposed secession as a policy, but was afterward elected to the Confederate Senate, which office he held till the close of the War. In 1874 he was elected governor under the new Constitution of Arkansas, and in 1885 became attorney-general in the cabinet of President Cleveland.

Garland, Hamlin, American novelist: b. West Salem, Wis., 16 Sept. 1860. His works include: 'Main Traveled Roads' (1891); 'A Spoil of Office'; 'Prairie Folks'; 'Jason Edwards' (1891); 'A Member of the Third House' (1892); 'Prairie Songs' (1893); 'A Little Norsk' (1893); 'Crumbling Idols' (1894); 'Rose of Dutcher's Coolly' (1895); 'Wayside Courtships' (1897); 'The Eagle's Heart' (1901); 'Captain of the Gray Horse Troop' (1902); 'The Tyranny of the Dark' (1904); etc.

Garland, Landon Cabell, American educator: b. Livingston, Va., 21 March 1810; d. 1895. He was graduated at Hampden-Sidney College, Virginia, was professor of chemistry at Washington College in that State 1830–3, at Randolph-Macon College 1833–5, and became president of the latter in 1835. In 1847–53 he was professor of astronomy and mathematics at the University of Alabama, in 1855–66 its president; later was professor of physics in the University of Mississippi, and chancellor of Vanderbilt University.

Garlic (*Allium sativum*), a species of onion cultivated in Europe since the year 1551. The leaves are grass-like, and differ from those of the common onion in not being fistulous. The stem is about two feet high, terminated by a head composed principally of bulbs instead of flowers; the flowers are white; the root is a compound bulb, consisting of several smaller bulbs, commonly denominated cloves, enveloped by a common membrane. Garlic has a strong, penetrating odor, and a pungent acrid taste. It differs from the onion only by being more powerful in its effects. In warm climates, where garlic is considerably less acrid than in cold ones, it is much used both as a seasoning and as food. In the south of Europe, particularly in Spain, and among Italians in the United States, it enters into the composition of almost every dish, not only among the common people, but among the higher classes of society. At all times, however, while it has been prized by some nations it has been detested by others, as by the ancient Greeks. Its cultivation is easy, and it is reproduced by planting the radical or floral bulbs. Its medicinal virtues are celebrated.

Garlic, Oil of. When the leaves, seeds, or bulbs of garlic and other allied plants are distilled with steam, about 0.2 per cent of a brown oil, with acrid taste and strong disagreeable odor, passes over. By purification it is obtained as a pale yellow oil having the odor of garlic, and it is then found to consist of the sulphide of allyl $(C_3H_5)_2S$. This oil is nearly related to the pungent oil of mustard, C_3H_5NCS, an isomer of the sulphocyanide of allyl, and is of much interest chemically, but it is of no importance from an industrial point of view.

Garman, Harrison, American naturalist: b. Lena, Ill., 27 Dec. 1858. He was graduated at the State Normal University and studied later at Johns Hopkins University. He has held many professional positions, among them being entomologist and those of professor of zoology and entomology at Kentucky State College, 1892–6, and State entomologist of Kentucky since 1897.

Garman, Samuel, American naturalist: b. Indiana County, Pa., 5 June 1846. He was graduated at the Illinois State Normal University in 1870, and became assistant in herpetology and ichthyology in the Museum of Comparative Zoology, Cambridge, Mass., in 1873. His works include: 'The Reptiles and Batrachians of North America'; 'Chlamydoselachus'; 'The Evolution of the Rattlesnake'; etc.

Garner Case, 1856, the most tragic of the fugitive-slave cases. Simon Garner, his wife, and his son Robert, slaves of John Marshall of Kentucky, and Robert's wife Margaret and their four children, slaves of A. R. Gaines, ran away, crossed the Ohio on the ice, and took refuge with a Cincinnati colored man. Gaines tracked them, secured a warrant, and with a deputy marshal and a band of assistants attacked the house. After a desperate fight the fugitives were overpowered, one of the posse being badly wounded; but Margaret, who had shared in the conflict, found time before her capture to murder one of the children, severely cut the throats of two others, and considerably bruised the baby, to keep them from returning to slavery. In sympathy with them, and to establish their freedom as denizens of Ohio, a Cincinnati judge issued a writ of habeas corpus, and the grand jury indicted Margaret for the murder of her child, and her husband and his father as accessories. The United States fugitive-slave law of 1850 prevailed, however; the slaves were given back to their owners and sent down the river. On the voyage Margaret jumped overboard with the baby; she was rescued, but the child was lost, at which she expressed satisfaction.

Garnet. See GEMS.

Gar'nett, James Mercer, American philologist: b. Aldie, Va., 24 April 1840. He was graduated at the University of Virginia in 1859; served in the Confederate army during the Civil War; and was professor of English language and literature in the University of Virginia 1882–96. He is the author of: 'Translation of Beowulf'; 'Elene and Other Anglo-Saxon Poems'; 'History of the University of Virginia.'

Garnett, Richard, English poet and librarian: b. Lichfield, Staffordshire, 27 Feb. 1835; d. London, 13 April 1906. He was appointed in 1851 assistant in the printed book department of the British Museum, became superintendent of the reading-room in 1875, but resigned in 1884 to devote himself more exclusively to the printing of the 'Museum Catalogue,' of which he had had charge from its commencement. He published: 'Primula: a Book of Lyrics' (1858); 'Egypt and Other Poems' (1859); 'Poems from the German' (1862); 'Relics of Shelley' (1862); 'Idylls and Epigrams' (1869); 'Selections of Shelley's Poems' (1880); 'Letters' (1882); 'Life of Carlyle' (1887); 'Life of Emerson' (1887); 'Twilight of the Gods' (1888); 'Life of Milton' (1890); 'Iphigenia in Delphi' (1891); 'Poems' (1893); 'William Blake: Painter and Poet' (1895); 'The Age of Dryden' (1895); 'One Hundred and Twenty-four Sonnets from Dante, Petrarch and Camoens' (1896); 'Richmond on the Thames' (1896); 'Life of Edward Gibson Wakefield' (1898); 'History of Italian Literature' (1898); 'Essays in Librarianship and Bibliography' (1899); 'The Queen and Other Poems' (1901); 'Essays of an Ex-Librarian' (1901); etc. He also contributed extensively to the magazines and cyclopædias. He resigned from the Museum in 1899.

Garnett, Robert Selden, American soldier: b. Essex County, Va., 16 Dec. 1819; d. Carrick's Ford, Va., 13 July 1861. Graduated from the United States Military Academy in 1841 and made brevet 2d lieutenant of artillery, he served on the northern frontier during the Canadian border disturbances, and distinguished himself in the war with Mexico (1846–8), receiving the brevet of major for his conduct at Buena Vista. He was transferred to the Seventh infantry in 1848, fought in Florida against the Seminoles, and was commandant at West Point in 1852–4. In 1855 he was promoted major of infantry, and in 1856 commanded the expedition against the Indians of Puget Sound. At the outbreak of the Rebellion in 1861 he resigned his commission, and was made adjutant-general, with colonel's rank, to organize the Virginia forces. Shortly afterward he was appointed brigadier-general, C. S. A., and given command of the troops in the western part of Virginia. While endeavoring to retreat to Beverly, he was overtaken by the Federals at Carrick's Ford, Cheat River, and took command of a detachment with which he sought to cover the retreat. His force was routed, and he was killed during the combat.

Garnett, Kan., city and county-seat of Anderson County, on the Pottawattomie River, and on the Missouri P. and the Atchison, T. & S. F. R.R.'s, 45 miles northwest of Fort Scott. It has good educational institutions, including a United Presbyterian college. There are large manufactures of furniture, and also of cheese. Pop. (1900) 2,078.

Garnier, Jean Louis Charles, zhŏṅ loo-ē shärl gär-nē-ā, French architect: b. Paris 6 Nov. 1825; d. 4 Aug. 1898. He was a pupil of Levieil and Lebas at the Beaux-Arts, won the Prix de Rome in 1848 with his design for a conservatory of arts and industries, traveled in Italy, Turkey, and Greece, and in 1861 won the competitive prize for plans of the new Paris Opera. In 1863–74 he superintended the construction of this costly and important work, whose chief feature is its grand staircase, but which is by some thought to be overladen with accessories of painting and sculpture. In addition to this, his principal achievement, he designed buildings public and private at Paris and elsewhere. He was the author of: 'Travers les Arts' (1869); 'L'habitation humaine,' with Ammann (1892); and editor 'Le nouvel Opéra de Paris' (1876–81).

Garnier, Marie Joseph François, commonly known as FRANCIS, French explorer: b. Saint-Etienne 25 July 1839; d. Hanoi, Tongking, China, 2 Dec. 1873. He entered the French navy, served in the war with China in 1860–2, and became a civil officer in the newly established colony of Cochin-China. In 1866 he was appointed to assist Capt. Doudart de Lagrée in an exploring expedition which set out from the coast of Cambodia and proceeded through Yunnan to Shanghai, the purpose being to open a highway of trade. Garnier explored the river Mekong, and, on the death of Doudart de Lagrée, assumed command of the expedition, which he brought successfully along the Yang-tse-kiang to Shanghai. The geographical societies of France and Great Britain bestowed numerous honors upon him. He took part in the defense of Paris in 1870–1, and again undertook explorations in China. The governor of Cochin-China empowered him to negotiate a treaty with the viceroy of Tongking. Upon the refusal of the viceroy to open negotiations, Garnier captured Hanoi, the capital, and achieved further victories with a force of but 120. He was finally killed in an ambush. His 'Voyage d'Exploration en Indo-Chine pendant 1866–8' (1873) is a notable book.

Garnierite, a green, amorphous mineral, one of the most important ores of nickel. It is a hydrous silicate of nickel and magnesium, the ratio of the two metals varying widely. It is soft and very brittle and has a specific gravity of 2.3 to 2.8. It is extensively mined in New Caledonia, and also occurs in large quantities in Douglas County, Ore., and Jackson County, N. C. It was named after the French geologist, Garnier.

Garnishment, in law, a process by which a third person, in whose possession the effects of the defendant are attached, is warned not to turn over such effects to the defendant, but to appear in court and give information. This process is controlled by statute in the States where it exists, and the demands of the statutes must be fully met by any plaintiff seeking to make use of the process. The process is called in some States trustee process, in others factorizing, and in still others attachment, the more general title. The third party, who is known as the garnishee, is liable for only such property as is not encumbered by trusts and may be delivered by the officer serving said process. Virtually, the process is a secondary suit brought by the suing creditor against the third party, or garnishee, the creditor claiming the rights of the defendant in the primary action.

Garofalo, Benvenuto, bān-vā-noo'tō gä-rō'fä-lō (originally Benvenuto Tisi da Garofalo), Italian painter: b. Ferrara 1481; d. there 6 Sept. 1559. In this city and in Cremona he cultivated his talents for painting; but the masterpieces of art in Rome exercised the greatest influence upon him. In the year 1505 he is said to have returned to Rome, and to have formed a very close intimacy with Raphael, who often made use of his assistance. He afterward painted for Alfonso I., in his native city. Garofalo's works show the influence of all the schools, particularly of the Lombard, and still more so of Raphael's, whom he surpassed in coloring. Most of his works are at Rome. Several of them, however, are in the galleries of Vienna and Dresden.

Garonne (Lat. *Garumna*), a river of southwestern France, the chief one of that section; rising in the Pyrenees, at the foot of Mount Maladetta, in the Val d'Aran, within the Spanish border. It enters France at a distance of 26 miles from its mouth. The Garonne flows in a general northeasterly direction through the department of Haute-Garonne to Toulouse, whence it proceeds in a northwesterly course. Some 20 miles below Bordeaux it forms a junction with the Dordogne; it then takes the name Gironde, and enters the Atlantic Ocean by an estuary of 50 miles in length. The complete length of the river is about 400 miles. Ocean-going steamers may ascend to Bordeaux, and the river is navigable to Toulouse and beyond. From Toulouse the Canal du Midi extends to the Mediterranean. Several destructive floods have taken place, that of 1875 having caused special damage. With its 32 tributaries the Garonne offers a system of waterways navigable for more than 1,400 miles, — a total exceeding that afforded by any other French stream. The total drainage area approaches 38.000 square miles.

Garrard, Kenner, American soldier: b. Cincinnati, Ohio, 1830; d. there 15 May 1879. He was graduated from the United States Military Academy in 1851, was made brevet 2d lieutenant in the artillery, but in 1852 was transferred to the dragoons, and after service, largely in the Northwest, was made captain of cavalry in 1861. During the early part of the Civil War he was in the commissary-general's office at Washington, and in 1861–2 commandant at West Point. In September 1862 he was commissioned colonel of the 146th New York volunteers, which he commanded at Fredericksburg, Chancellorsville, and Gettysburg. For services in the last named battle he was brevetted lieutenant-colonel. In 1863 he was promoted brigadier-general of United States volunteers, and afterward he participated in the combat at Rappahannock Station and the Mine Run operations. He took part, also, in the invasion of Georgia, was brevetted colonel for services in the expedition against Covington, Ga., and from December 1864 to July 1865 commanded the second division of the Sixteenth army corps. He distinguished himself by his efficiency in the battle before Nashville, and in the operations against Mobile; led the storming column which finally captured Blakely (9 April 1865); and was in command of the district of Mobile in August–September 1865. Mustered out of the volunteer service in August 1865, he was assistant inspector-general of the department of the Missouri in 1866, and in November 1866 resigned from the army, being at that time major, with the brevet of major-general for gallant and meritorious services in the field during the Rebellion.

Garrett, Alexander Charles, American Protestant Episcopal bishop: b. Ballymot, County Sligo, Ireland, 4 Nov. 1832. He was graduated from Trinity College, Dublin, in 1855; was ordained priest in 1857; held the curacy of East Worldham, Hampshire, in 1856–9; was a missionary in British Columbia in 1859–69; rector St. James', San Francisco, in 1870–2; and dean of Trinity Cathedral, Omaha, 1872–4. In 1874 he became missionary bishop of northern Texas, and subsequently bishop of Dallas. His publications include: 'The Eternal Sacrifice'; 'The Philosophy of the Incarnation'; 'Historical Continuity.'

Garrett, Edmund Henry, American artist: b. Albany, N. Y., 19 Oct. 1853. He was a pupil in Paris of Laurens, Boulanger, and J. J. Lefebvre, and exhibited much in America and at the Paris Salon. In 1890 he received a medal at Boston. He also published: 'Romance and

Reality of the Puritan Coast' (1897); and 'The Pilgrim Shore' (1900).

Garrett, John Work, American railway official: b. Baltimore 1820; d. 1884. He studied at Lafayette College, became a director of the Baltimore & Ohio Railroad (1857), and its president, greatly developed the road, and made it during the Civil War a most important medium for the transportation of Federal supplies and troops.

Garrett, William Robertson, American educator: b. Williamsburg, Va. 12 April 1839. He was graduated from William and Mary College in 1858, studied law in the University of Virginia, served in the Confederate army, was long occupied in educational work in the South, and was State superintendent of public instruction in Tennessee 1891–3. In 1895 he became professor of American history in Peabody Normal College, and in 1899 dean of the institution. He has published 'The South Carolina Cession and the Northern Boundary of Tennessee' (1884); 'History of Tennessee,' with Goodpasture (1900).

Garrick, David, English actor: b. Hereford, England, 19 Feb. 1717; d. London 20 Jan. 1779. His grandfather was a French refugee, his father a captain in the army. He was educated at the grammar school at Lichfield. He gave an early proof of his dramatic tendency by inducing his school-fellows to act the 'Recruiting Officer,' in which he himself took the part of Sergt. Kite, being then only 12 years of age. Later he was placed with a brother under Dr. Samuel Johnson. In 1741 he joined Giffard's company at Ipswich, where under the name of Lyddal he played with uniform success.

At this time the stages of the metropolis were but indifferently supplied with leading performers, so that when Giffard, who was manager of a theatre in Goodman's-fields, introduced his accomplished recruit there, 19 Oct. 1741, the effect was immediate and decisive. He judiciously chose the part of Richard III., which did not require that dignity of person in which he was deficient, while it gave him scope for all the strong marking of character and changes of passion in which his principal excellence consisted. He at the same time adopted a natural mode of recitation, which was a daring innovation on the part of a new performer before audiences accustomed to the artificial declamation of the school which preceded him. He afterward visited Dublin, where his success was even greater than in the metropolis, and in 1745 became joint manager with Sheridan of a theatre there. In 1746 he was engaged for the season at Covent Garden, and at its close purchased Drury Lane, and opened it 15 Sept. 1747, with the 'Merchant of Venice,' to which Dr. Johnson wrote a prologue for the occasion. This period formed an era in the English stage, from which may be dated a comparative revival of Shakespeare, and a reform both in the conduct and license of the drama. In 1749 he married Eva Marie Violetti (1724–1822), and his married life seems to have been happy. The remainder of his theatrical career was an uninterrupted series of success and prosperity. He had written, while an actor, his farces of 'The Lying Valet'; 'Lethe,' and 'Miss in Her Teens'; and in 1766 he composed, jointly with Colman, the excellent comedy of 'The Clandestine Marriage.' The year 1769 was signalized by the famous Stratford jubilee — a striking proof of his enthusiasm for Shakespeare. It occupied three days at Stratford, and its representation at the theatre lasted for 92 nights. The last part which he performed was Don Felix in 'The Wonder,' for the benefit of the theatrical fund. At the conclusion of the play he addressed a brief farewell to the audience. The general feeling with which this was delivered and received rendered it truly impressive. His remains were interred in Westminster Abbey, his funeral being attended by a numerous assemblage of rank and talent. As an actor Garrick has rarely been equaled for truth, nature, and variety and facility of expression, for which his countenance appears to have been admirably adapted. Expression and the language of passion formed his great strength, as he was equaled by many of his contemporaries in the enunciation of calm, sentimental, and poetical declamation. His literary talents were respectable, but not eminent; besides the pieces already mentioned he wrote some epigrams, a great number of prologues and epilogues, and a few dramatic interludes, and made many and sometimes judicious alterations of old plays. A collection of his works was published in London (1768–98), and his correspondence 1831–2. See Knight, 'Life of David Garrick' (1894).

Gar'rigan, Philip Joseph, American Roman Catholic prelate: b. Cavan, Ireland, 8 Sept. 1840. While he was still very young the family came to America and settled in Massachusetts and in the schools of that State he received his elementary education. He afterward studied at Saint Charles' College, Maryland, later taking an ecclesiastical course at Saint Joseph's seminary, Troy, N. Y., where on 10 June 1870 he was ordained priest. He was then appointed assistant in Saint John's Church, Worcester, Mass. In 1873 he became vice-president of the Troy Seminary and after three years was recalled to the diocese of Springfield. In 1888 he was chosen vice-rector of the Catholic University, Washington, D. C., and continued to hold the vice-rectorship until 21 March 1902, when Pope Leo. XIII. selected him for the newly-created episcopal see of Sioux City. He was consecrated bishop at Springfield, Mass., 25 May 1902. Though but two years established, the diocese now (1905) has a Catholic population of 50,000; 103 priests; 123 churches; 45 parochial schools; 1 hospital, and a Young Ladies' Home.

Garrison, George Pierce, American historical scholar: b. Carrollton, Ga., 19 Dec. 1853. He was educated at Sewanee College, Tenn., and the universities of Edinburgh and Chicago; became instructor in English and history in the University of Texas in 1884, assistant professor of history in 1888, and professor in 1897. He has published: 'The Civil Government of Texas' (1898); etc.

Garrison, Wendell Phillips, American editor: b. Cambridgeport, Mass., 4 June 1840; d. South Orange, N. J. 27 Feb. 1907. After graduation from Harvard (1861), he became literary editor of the New York 'Nation' in 1865. Among his publications are: 'What

Mr. Darwin Saw in His Voyage Around the World' (1879); 'Bedside Poetry' (edited, 1887); the 'Life of William Lloyd Garrison,' his father, with his brother, F. J. Garrison (1885); 'The New Gulliver' (1898).

Garrison, William Lloyd, American reformer: b. in Newburyport, Mass., 12 Dec. 1805; d. New York 24 May 1879. He was apprenticed to a shoemaker, but eventually became a compositor on the Newburyport 'Herald,' an occupation which suited his taste; he soon made himself master of the mechanical part of the business, and when only 16 or 17 began to write for the 'Herald.' His contributions, which were anonymous, were favorably received, and he soon commenced to send articles to the Salem 'Gazette' and other papers, drawing the attention of political circles by a series of articles under the signature "ARISTIDES," with the view of removing the almost universal apathy on the subject of slavery. In 1824 he became editor of the 'Herald,' and some of Whittier's earliest poems were accepted by him, while their author was yet unknown to fame. In 1827 he became editor of the 'National Philanthropist,' the first American temperance journal, and afterward of a journal in support of the election of John Quincy Adams. With Mr. Lundy, a Quaker, he then started at Baltimore the paper called the 'Genius of Universal Emancipation' (1829). The vigorous expression of his anti-slavery views in this last paper led to his imprisonment for libel, from which he was released by Mr. Tappan, a New York merchant, who paid his fine. He now prepared a series of emancipation lectures, subsequently delivered in New York and other places. He returned to Boston, and in 1831 started 'The Liberator,' without capital or subscribers, a paper published weekly with the aid of one assistant and a negro boy, and with which his name is inseparably associated, and which he carried on for 35 years, until slavery was abolished in the United States. In 1832 appeared his 'Thoughts on African Colonization,' and in the same year he established the American Anti-Slavery Society. For several years the mail brought hundreds of letters to Garrison, threatening his assassination if he did not discontinue 'The Liberator'; the legislature of Georgia offered a reward of $5,000 to any one who should prosecute and bring him to conviction in accordance with the laws of that State; in 1835 he was severely handled by a Boston mob, and the mayor of that city was constantly appealed to from the South to suppress his paper. In spite of all, he successfully persevered. In 1833 he visited Great Britain, and again, in the furtherance of his anti-slavery opinions, in 1846 and 1848. The diverging views of the anti-slavery party, as to whether a political platform should be adopted, and as to the voting and speaking of women, rent the body for a time, but on 1 Jan. 1863 Lincoln's proclamation of freedom to the slaves as a military measure placed the civil struggle on an anti-slavery basis. In 1865, when Garrison's labors had been completely successful, and after the total abolition of slavery in the United States, his friends presented him with the sum of $30,000 as a memorial of his services.

A bronze statue has been erected to his memory in Boston. Some 'Sonnets and Other Poems' by him were published in 1847, and 'Selections from Writings and Speeches' in 1852. See Johnson, 'William Lloyd Garrison' (1882); 'William Lloyd Garrison: the Story of His Life,' by his children (1885–9); and poems to his memory by both Whittier and Lowell. The reformer's character, as revealed in the accounts of his life, shows his great humanitarian schemes to have been the inevitable outcome of a sensitive conscience, a humane spirit, and an overpowering sense of justice.

Garrote, ga-rŏt', a mode of punishment in Spain by strangulation, the victim being placed on a stool with a post or stake (Spanish, *garrote*) behind, to which is affixed an iron collar with a screw; this collar is made to clasp the neck of the criminal, and drawn tighter by means of the screw till life becomes extinct. This word, with the spelling *garrotte*, has of late years become naturalized in Great Britain and the United States as a term for a species of robbery effected by suddenly springing upon and throttling the victim, and stripping him of his property.

Garrupa, ga-roo'pa, the Spanish name, in the West Indian region adopted as generic, and also corrupted into "grouper" of the great black jewfish (*Garrupa nigrita*). See JEWFISH.

Garter King-of-Arms, the head of the heraldic establishment in England, consisting of three kings-of-arms — Garter, Clarencieux, and Norroy, and the herald of the military order of the Garter. The office of garter king-of-arms was instituted by Henry V. in 1417. The duties of the garter king-of-arms are principally to grant heraldic supporters, to arrange funerals, and to present the order of the Garter to foreign princes.

Garter, Order of the, the highest and most ancient order of knighthood in England. Two stories are told of its origin. The first is that Richard I. at the siege of Acre caused some of his officers to tie leather thongs around their legs as a distinction. The origin of the order is, however, generally attributed to Edward III., and the legend runs that the Countess of Salisbury having dropped her garter while dancing, the king restored it after putting it round his own leg, amid the jesting of courtiers, with the words, *Honi soit qui mal y pense* — "Shame be to him who thinks evil of it." The date of the foundation or restoration by Edward III. of the order is not exactly determined; 1344 is given by Froissart, while other authorities, founding on the statutes of the order, assign it to 1350. In the former year it appears that a festival was held, and a society or company instituted, called the Company of Saint George, with the design of furnishing soldiers of fortune to assist King Edward in asserting his claim to the crown of France, but it seems probable that the organization of the order as an order of chivalry was completed in 1350. The statutes of the order have been repeatedly revised. The order is said to have been founded in honor of the Holy Trinity, the Virgin Mary, St. Edward the Confessor, and St. George of Cappadocia, its special patron. Until the reign of Edward VI. its common title was the Order of St. George, which it still bears, besides that of the Garter. The original number of knights, 26, including the sovereign, its permanent head, is still retained, except that since 1786 princes of the blood are admitted as supernumerary members. The order is frequently conferred on foreign sovereigns. The vestures and insignia of the order are: The emblem of the order, the garter, a dark-blue ribbon edged with gold, bearing the motto, and with a buckle and pendant of gold richly chased; worn on the left leg below the knee; the mantle of blue velvet, the length of the train distinguishing the king; the surcoat and hood of crimson velvet, the hat of black velvet, with plume of white ostrich feathers, having in the centre a tuft of black heron's feathers, and fastened to the hat with a band of diamonds; the collar of gold consisting of 26 pieces, each in the form of a garter, with the badge of the order, called the George, pendent from it — a figure of St. George on horseback fighting the dragon — the lesser George being worn on a broad blue ribbon over the left shoulder. The star, formerly only a cross, is of silver, and consists of eight points, with the cross of St. George in the centre, encircled by the garter. A star is worn by the knights on the left side when not in the dress of the order. The officers of the order are the prelate, the Bishop of Winchester; the chancellor, the Bishop of Oxford; the registrar, Dean of Windsor; the garter king-of-arms, and the usher of the black rod. There are a dean and 12 canons, and each knight has a knight-pensioner.

Garter-snake, or Grass-snake. Names given in the United States to several small striped harmless serpents of the genus *Eutænia*, especially *E. sirtalis,* which abounds in all temperate parts of the continent from Guatemala to Canada, and is exceedingly variable. This species varies in color from light-green through olivaceous to black, marked by three stripes, but only the one along the spine is well defined, those on the sides being often obscure, broken, or altogether absent. The spaces between these may be spotted in double rows, or not at all; and the belly, usually light greenish-blue, may be darker, almost to blackness. Some varieties have a metallic lustre. The ordinary eastern specimens are olive-brown, with dull spots and stripes. It is everywhere abundant, frequenting grassy meadows, farm-fields, roadsides and gardens, where it searches for mice as the principal part of its food, but it eats insects, small toads and frogs, and the eggs and young of birds whose nests are on or near the ground, for it is not a bold climber. It is abroad by day as well as by night, and itself forms the prey of such larger snakes as the blacksnake and king-snake. In the West it eats all the young gophers and ground-squirrels it can get, and in these habits commends itself to the protection of agriculturists. These snakes are extremely active and swift, as they must be not only to capture their prey, but to avoid being caught by the larger blacksnakes, king-snakes, and the like which pursue them. They swim well and hide clearly in water, and in many habits, as in structure, resemble the water-snakes (*Natrix*); and like them they are pugnacious, and quick to bite when handled, but their teeth are minute and the bite, of course, quite harmless. Their abundance is due to these qualities, not only, but even more to their great fecundity, 25 to 40 young in a season not being an uncommon product for one mother, and an instance of 80 is recorded. These are born alive, in early warm weather, and are able to care for themselves from the start, but the mother remains near them and protects them vigorously for some time. When cold weather approaches, these serpents seek underground retreats, such as old gopher-holes, and there often gather in large numbers which hibernate entwined together in a mass; mating takes place at this season. The skin is usually shed in the spring, by creeping through some crevice and scraping off the old hide, which peels backward from the head.

Of the score or more of species the greater number are Mexican and Central American; and some are known by very few specimens. The beautiful slender ribbon-snake (*E. saurita*) of the southern States is chocolate in color with three narrow distinct stripes, and has highly aquatic habits. The common species of the plains region (*E. radix*) is peculiar in its fondness for fish, catching them constantly in the pools and seizing every dead one cast on shore. A similar fish-loving species is the subtropical *E. macrostemma,* which appears in the talons of the eagle in the coat of arms of Mexico. The common species of California is *E. elegans.* In the southern part of that State occurs a rare form (*E. infernalis*), sometimes wholly black, save a yellowish throat. For the identification of the various species of this wholly American group the reader should consult Cope's 'Crocodilians, Lizards, and Snakes of North America,' published by the Smithsonian Institution in 1900.

Gary, Elbert H., American financier: b. Wheaton, Ill., 8 Oct. 1846. He was graduated at the law school of Chicago University in 1867; admitted to the bar of the Illinois supreme court the same year, and to that of the United States Supreme Court in 1878. He early applied himself to the practice of corporation law, and became general counsel for a large number of railroad and industrial corporations. It was largely through his legal work that his talents as an organizer of large industries first came into recognition. He retired from law practice in 1898 to become president of the Federal Steel Company, which in 1901 was merged into the United States Steel Corporation, he then being chosen chairman of its finance committee.

Gary, James Albert, American statesman: b. Uncasville, Conn., 22 Oct. 1833. He was educated at Allegheny College, Meadville, Pa. In 1861 he became a member of the manufacturing firm of James S. Gary & Son, and in 1870 succeeded his father as head partner. He was defeated as Republican candidate for governor of Maryland in 1879; and was postmaster-general in 1897–8, when he resigned.

Gas. See Critical Point of Temperature; Gases, General Properties of; Gases, Kinetic Theory of; Gasometric Analysis.

Gas and Gas Making. Illuminating gas, generally speaking, is the aeriform product of the destructive distillation of a liquid or solid hydrocarbon, in some instances diluted by the admixture of other combustible gas or gases. Practically all the illuminating gas manufactured throughout the world is made from bituminous coal, or petroleum, or some of the products of the fractional distillation of petroleum. The gas made from petroleum or its products, and known as oil gas, has a very high illuminating value, and is generally mixed in the process of manufacture with hydrogen and carbonic oxide gases. The mixture is known as water gas. Upon the relative amount of hydrocarbon gas in the mixture will depend the candle-power of the final product. Gas made from bituminous coal is known as coal gas.

In the early days of the industry practically all the gas produced was from bituminous coal, but experiments were made with wood, rosin, and tar, all of them capable of producing illuminating gas, but not as satisfactorily or as economically as coal. The original works at Baltimore were constructed to make tar gas, but the attempt was a total failure, both in convenience to the consumer and profit to the manufacturer. In New York the first attempt was with oil gas, but as this was found too expensive, rosin was substituted, but subsequently abandoned, and coal used. In the Southern States pine wood and rosin have been used. When gas was first introduced its use was confined to shops and factories, a feeling being prevalent in the minds of owners of houses that it was dangerous, and productive of fires. Several delegations of citizens passed resolutions and signed memorials to various legislative bodies protesting against its use.

Water gas was first produced commercially by a Frenchman, Tessie du Motay, about the year 1865. About the same time an American, Prof. T. S. C. Lowe, who had won fame as an aeronaut during the Civil War, was experimenting in the manufacture of gas by the dissociation of steam in contact with incandescent carbon. The result of the operations of du Motay and Lowe was the development of the water gas systems which bear their names — the cupola-retort system of du Motay and the generator-superheater system of Lowe. These are the most important of all the inventions affecting the manufacture of gas up to this date. The experiments of du Motay as well as of Lowe were carried on in the United States, and the development of the water gas system is entirely American.

In all the processes of the du Motay type, the non-luminous gas is generated in cupolas, mixed with oil vapor, and passed through externally heated retorts, for the purpose of gasifying the oil vapor. The gases thereafter being condensed and purified, as are coal gas and water gas produced by other methods. The Lowe process, covered by patents dated 1872 and 1875, may be regarded as the basis of the modern water gas system. It covers, broadly, the use, in connection with a generator, in which non-luminous gas is made, of a superheater, or oil gasifying chamber, fired by internal combustion, the combustible being the carbonic oxide gas formed during the process of "blowing up" — that is, during and from the passage of air through the fuel in the generator. This air is blown through the fuel, hard coal or coke, at a high velocity, for the purpose of raising the fuel to a condition of incandescence fitting it to dissociate the steam admitted during the gas making period. The Lowe process further covers the introduction of oil, or other hydro-carbons, into the non-luminous gas, and the gasifying of this oil by passing through the previously heated superheater.

In the manufacture of gas from bituminous coal there are produced the so-called by-products, coke, tar and ammoniacal liquor, each of which finds a market, either in the raw state, or worked up into finer products for use in the various arts and manufactories. In the manufacture of so-called water gas, there is but one by-product, and that of minor importance, known as "Water Gas Tar." Its quantity and value depend in part in the kind of oil used in the manufacture of the gas, and, in part, on the care and intelligence with which the gas generating apparatus is operated. The tar contained in either coal gas or water gas exists in the form of a mist of small drops and vesicles, and is removed, in part by cooling and in part by rubbing against rough surfaces, or impinging against plates. This process is known as "condensation." The tar removed from 1,000 feet of coal gas is approximately one and one quarter gallons; the amount removed from a 1,000 feet of water gas varies between wide limits. It may be as much as one gallon. It is generally much less. The amount of ammonia that may be recovered from 1,000 feet of coal gas is approximately one half pound of ammonia gas.

Illuminating gas, whether made from coal or petroleum, contains certain impurities which must be removed before the gas is fit for consumption, or before it can yield the highest possible candle-power per foot of gas burned. These impurities are ammonia, which is present in coal gas, and sulphur compounds, which are present in both coal and water gas. Carbonic acid is also present in unpurified coal and water gas. It is of little importance, having no deleterious effect, beyond slightly reducing the illuminating value of the gas. It may be removed from the gas or its effect on the illuminating value compensated by the use of an enriching material, or it may be ignored. Ammonia is removed by bringing the gas into intimate contact with water, the water being applied either by a spray or a wetted surface of some so-called scrubbing material, which may be coke, brush, thin rough sawn boards or other material having a large surface per cubic foot of space occupied. The amount of water required per unit of ammonia removed depends upon the temperature of the water and the intimacy of the contact between the water and the gas.

Various forms of apparatus for the removal of the ammonia gas are in use, but all depend upon the principle that cold water absorbs many times its volume of ammonia gas. The process of removing the ammonia is called "scrubbing." In the process of purification from sulphur compounds, slaked lime may be used. It is placed on wooden grids in a closed box, the gas being permitted to enter from the bottom and pass upward through the lime. Through the affinity of slaked lime for sulphuretted hydrogen this impurity is removed, and the sulphide of lime so formed has power of combining with other of the sulphur compounds in the gas. The slaked lime also removes whatever carbonic acid may be in the gas. The more general practice is to remove sulphur compounds by the use of iron oxide mixed with small shavings, or planer chips, and exposed to the gas in the manner described above in referring to purification by lime. The active purifying agent in this mixture, which is called "iron sponge" or "iron mass," is hydrated ferric oxide of iron — Fe_2O_3, $3H_2O$. It possesses the property of combining with sulphuretted hydrogen, but has no affinity for other sulphur compounds. After it has been a time in use, however, it contains considerable free sulphur, which has the power of arresting some sulphur compounds other than sulphuretted hydrogen. An advantage in the use of "iron sponge" for purification is, that after it has removed from the gas all the sulphuretted hydrogen which it is capable of absorbing, it will, upon exposure to the atmosphere, absorb oxygen, giving up the sulphur, which remains in the mass as finely divided sulphur mixed through the iron sponge. The mass, having been thus thoroughly re-oxidized by this exposure, may be used again, and so repeatedly, until the amount of free sulphur in it is equal to from 40 to 50 per cent of the whole material. It is then of no further value for gas purification, but because of the large quantity of sulphur and because of its containing a considerable percentage of the ferro-cyanides, it finds a market with manufacturers of sulphuric-acid and other chemicals.

Lime, after use in purifying gas, is of no further value and must be removed from the works or used as filling. This process of removing sulphur compounds is called "purification." When gas has been purified as above, it is passed through a large meter known as the "station meter," and thence into a storage holder, and is ready for distribution.

The first step in the manufacture of coal gas is to subject the coal to a high temperature. The coal is placed (technically called "charging") in retorts which may be made of fire-clay or of iron, but are almost universally of fire-clay, and closed, except as to one outlet for the gas. From this outlet the gas passes through what are known as stand-pipes to what is known as a hydraulic main, where the gas from all the retorts mixes, passing thence to the condensing and purifying apparatus. The temperature to which the coal is subjected varies, but it is generally recognized that it is economical to have this temperature as high as is consistent with maintaining the integrity of the retorts and the enclosing furnaces. The retorts are supported by means of blocks of fire-clay in a structure technically called a "bench," and heated by means of a fire, ordinarily of coke, built in a furnace below the retorts. In modern practice the retorts are heated to what might be called a bright cherry red, and about four hours are required to drive the gas from the coal. When the gas has been driven from the coal, the remaining coke is drawn from the retorts on to the floor, or into some form of conveying machinery, collected, and removed to the yard for storage and sale, except that enough is drawn from the retorts directly into the furnaces to supply fuel for the distillation of the coal.

The construction of retorts and enclosing furnaces, with the pipe connections from the retorts to the hydraulic main, is shown, in elevation and in vertical section, in Figures 1 and 2.

Figure 1 is an elevation of what is technically known as a "bench of fives" — that is, a furnace containing five retorts. AA are the retorts, which are ordinarily D shape in vertical section, 9 feet in length and approximately 26 inches in width, and approximately 16 inches in height. Attached to the front end of each retort is a so-called "mouth-piece" which is closed gas-tight by a lid. It is cast iron.

Attached to the mouth-piece is a so-called "stand-pipe," B, which conducts the gas, as generated, from the retort into the "hydraulic main," C. This hydraulic main extends the entire length of the "stack," which is the name applied to a number of benches built adjacent to each other and within one brick structure.

The process of operation is as follows: A fire is kindled in the furnace D, Figure 2, and the products of combustion, arising from the fuel, pass around the retorts, heating them to a bright cherry red. When this temperature has been reached, coal is thrown into the retorts, the charge varying in weight with the size of the retort. A large retort may take a charge of 350 pounds. The coal having been thrown into the retort, the lid is closed. The heat destructively distills the coal and the gas so produced passes out through the mouth-piece and stand-pipe into the hydraulic main. It will be seen, from the arrangement of the hydraulic main, that the gas passing from the stand-pipe bubbles through the water in the hydraulic main, the presence of the water preventing the return of the gas when the lid is again opened to draw out the coke resulting from the distillation of the coal, and to throw in a new charge.

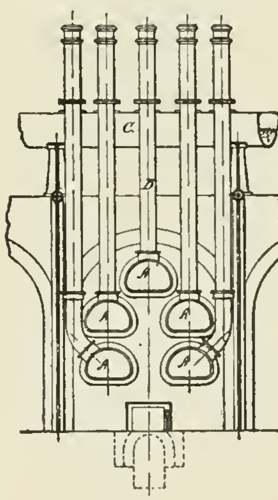


Fig. 1.

There are many forms of retort settings. In the more modern type the retorts are heated from what are known as regenerative furnaces, that is, furnaces which are worked at a comparatively low temperature and whose products of combustion contain a certain proportion of hydrogen and carbonic oxide, due to the introduction of steam below the fuel bed. These products, passing through ports to the chamber containing the retorts, meet there an incoming stream of air, which has been previously heated in flues, brought to a high temperature by the passage of the escaping chimney gases, through similar flues, parallel to and separated by a thin wall from the air flues. The furnace gases and the air combining in the retort chamber produce a very high temperature. The cuts illustrate the simpler form of retort setting and are given as being typical and easily understood, and not as showing modern practice.

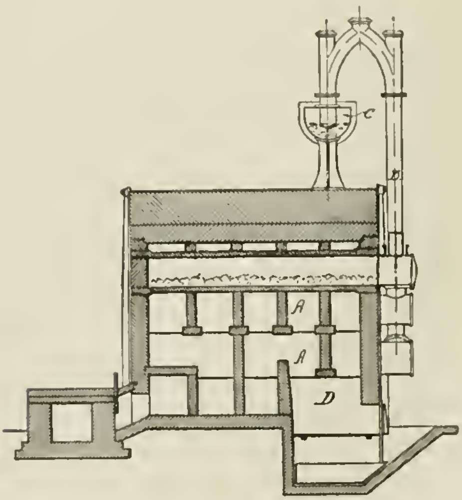


Fig. 2.

From the retort the gas passes to an exhauster, which is a form of gas pump, designed to draw the gas away from the retorts, and force it through the condensers, scrubbers and other apparatus and into the holder, thus reducing the gas pressure that would otherwise exist in the retorts. The operation of one type of exhauster will be readily understood from a reference to Figure 3, which is a cross-section of an exhauster. F is a cast-iron case, consisting of two half cylinders, of equal diameter, separated by a rectangular prism, and with flat ends. The moving parts consist of two impellers, C and D, keyed to the shafts, A and B, and so set in the case that the axes of the corresponding shaft, impeller and half cylinder, coincide. The impellers are so shaped that as they rotate each is always in contact, at some point, with the cylindrical portions of the case, and at the same time in contact with the other impeller, while the ends are practically in contact with the ends of the case. The shafts are supported by bearings on the case, and connected with each other at each end by two gear wheels, one on each shaft, of the same diameter and with an equal number of teeth, so that the relative position of the impellers is always the same at the same point in any revolution. The lower shaft is extended at one end and provided with a belt pulley, or connected direct to an engine on the same bedplate as the exhauster.

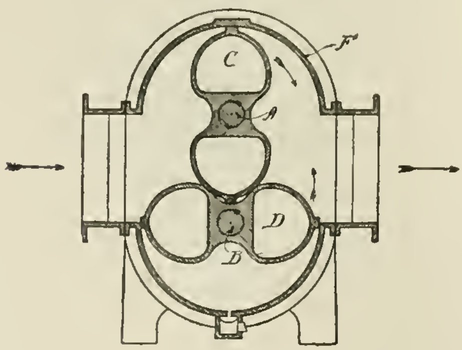


Fig. 3.

The action is as follows: Motion being imparted to shaft B, is transmitted through the gear wheels to shaft A, causing the two impellers to rotate, as shown by the arrows, and by the continual increase in volume of the space on the inlet side and decrease in volume of that on the outlet side, to draw the gas from the inlet and force it through the outlet, the contact between the impellers preventing the gas from passing back between them. From the exhauster the gas goes to the "condenser," a device designed for the cooling of the gas and the removal of the tar.

A simple form of condenser is shown in Figure 4. It consists of a nest of wrought-iron pipes enclosed in a cylinder, and so connected that gas passes around the tubes while water passes through the tubes. The gas passing around the tubes is cooled by contact with them, and partly by reason of this cooling and partly from the physical contact of the gas with the sides of the tubes, the tar vesicles are broken, and

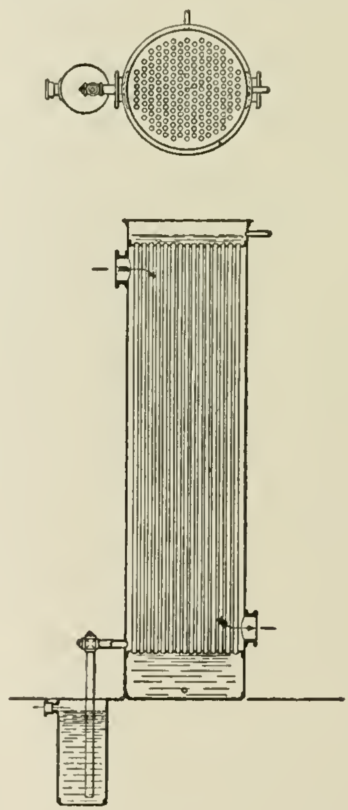


Fig. 4.

combining into drops, run down as drops of tar to the lower part of the cylinder, from which the tar is conducted, through an appropriate pipe, to the well or reservoir, as shown. The gas goes next to the "scrubber," which is designed for the removal of ammonia.

A simple type of scrubber consists of a wrought-iron cylinder, filled with wooden grids, coke or other porous material. Figure 5 shows

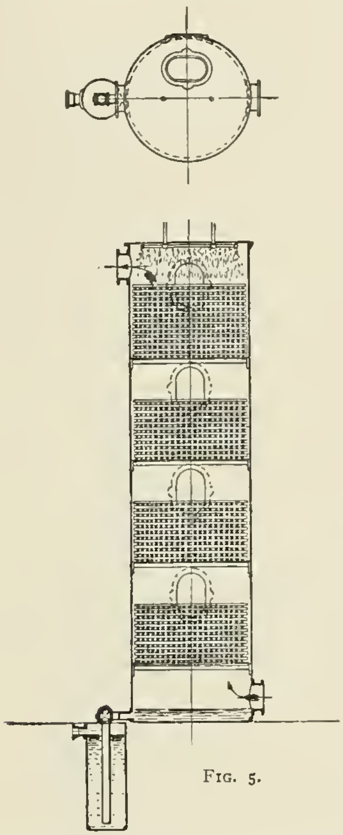


Fig. 5.

a scrubber with grids. The gas entering at the bottom passes up through the filling against a shower of water dripping over the filling. The intimate contact of the gas and water results in the absorption of the ammonia from the gas and also the removal of a certain part of the sulphur compounds and carbonic acid present in the gas, in combination with the ammonia — as sulphide of ammonia and carbonate of ammonia. The scrubber will also remove any traces of the tar that may have escaped from the condensing apparatus.

There are several forms of scrubbers. The above described is the simplest, and except that in some of them the scrubbing material is mechanically moved, so as to come alternately in contact with the water and the gas, the principle of all is substantially the same.

The gas passes from the scrubbers into the purifiers. These are rectangular boxes that are ordinarily built from 3 to 8 feet deep, and of a horizontal section depending upon the amount of gas that it is desired to purify in them. They are ordinarily built in sets of four or six, so connected by pipes and valves that the stream of gas may be made to flow through them in any order desired,— this because it is found economical to pass in sequence through the purifiers and to be able to vary this sequence as the material in the different boxes is more or less charged with sulphur compounds. A section and plan of a box are shown in Figure 6. A is the

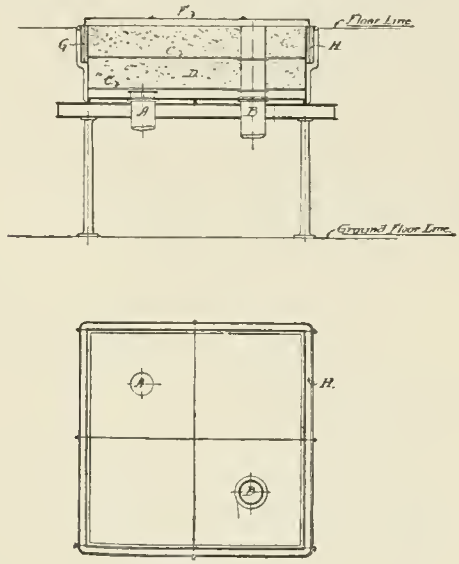


Fig. 6.

gas inlet at the bottom of the box. B is the gas outlet. C are the trays upon which the purifying material D, either lime or iron sponge is placed. F is the lid which is made gas-tight by the insertion of the lip G on its edges into the water-seal H, bolted to and encircling the box. When the lid is on the box the lip G, being in water, will prevent the flow of gas from the box into the atmosphere. When the purifying capacity of the material in the box has become exhausted, which is determined by appropriate tests, the gas is shut off from that box, the lid is raised, and the material is removed — to be carted away, if it is lime, or to be spread upon a brick or concrete floor, for re-oxidizing, if it is iron sponge.

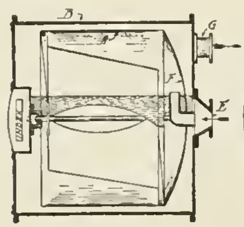


Fig. 7.

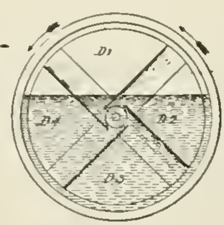
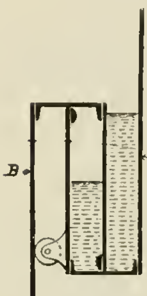


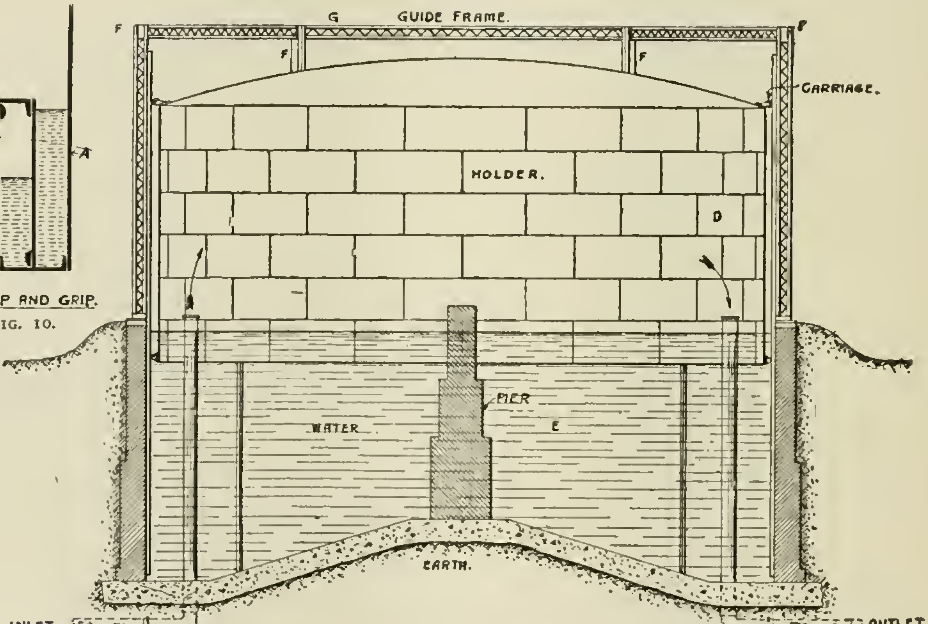
Fig. 8.

The gas having passed through the lime or iron sponge is completely purified and ready for measurement and storage, and for distribution to consumers in the territory supplied. It is measured by passing through what is technically known as a "station meter." The station meter of a gas works (see Figures 7 and 8) is a so-called "wet" meter of large dimensions. In principle it is the same as the small wet meters used for measuring gas as sold to individual consumers in those cities whose winter temperature is above the freezing point of water. Figures 7 and 8 show vertical sections of a station meter. It consists essentially of a drum or cylinder of metal, A, horizontally mounted in a metal case, B, so that it may revolve freely on its axis, and divided by wings or partitions into several compartments, D1 to D4, the shape and position of the wings being so designed that, as the drum revolves, each end of each of the compartments so formed, in turn opens above the surface of the water in which the drum revolves, and which fills the enclosing case to about three fifths of its diameter, no compartment having both its inlet and outlet ends above the surface of the water at the same moment. The gas to be measured is introduced through a pipe, E, entering one end of the meter case and compartments filled and emptied is the amount of gas that passes through the meter. This is registered on a dial connected to the drum through an appropriate series of gear wheels. The meter drum revolves because the gas entering is forced by the exhauster into the space between the outer surface and the inclined side of the compartment opening at the moment above the water.

The point of view of Figure 8 is the inlet end of the meter. The drum revolves in the direction of the arrows. Compartment D4, as shown, has its inlet submerged and its outlet open, and as the meter revolves the water enters this compartment, expelling the gas, which flows out of the drum and through the space between the drum and the case to the meter outlet, G. Compartment D1 is full of gas with both inlet and outlet submerged, the outlet being about to rise above the water. This will happen before D4 is entirely emptied of gas. D2 is filling with gas,



CUP AND GRIP.
Fig. 10.



SECTION.

Fig. 9.

rising to above the water line through a hood, F, covering the inlet end of the drum. Into this hood open the inlet ends of the compartments of the drum. As the drum revolves, the inlet end of each compartment in turn rises above the water and receives gas through the inlet pipe and hood. Because the other end of the compartment receiving gas is below the surface of the water, no gas passes through, but all that enters is retained in the compartment until its inlet end is again sealed by passing into the water. At that moment its outlet end rises above the surface, and the water, entering the inlet end as the revolving drum carries the inlet down, forces the gas through the outlet end of the compartment. As one compartment empties, another is filling, and the flow through the meter is continuous, though intermittent as to any compartment. The sum of the contents of the its inlet being above and its outlet below the surface. It is the force of the gas entering this compartment that is giving motion to the meter drum, and expelling the gas from the compartment D4. Compartment D3 is entirely filled with water. It will begin to receive gas before D2 is quite full and while D1 is emptying.

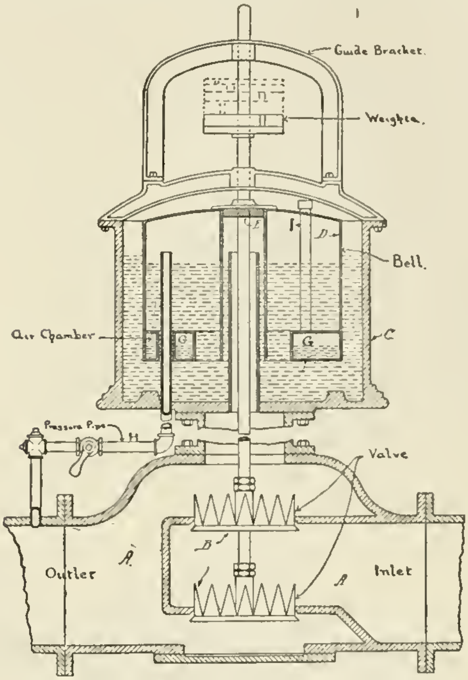
From the station meter the gas passes to the holder or holders, in which it is stored for use at such hours as the demand in the district supplied is in excess of the capacity of the manufacturing apparatus.

The construction and action of a gas holder, sometimes erroneously called a "gasometer," may be readily understood by reference to Figure 9.

A gas holder consists of a sheet iron cylindrical vessel, D, closed at the top, open at the bottom and floating in a tank, generally built of brick, as in the figure, or of iron, open at the top and filled with water. The holder is so guided in the tank and along columns FF, standing on the edge of the tank, and connected at the top by girders, that it will rise and fall freely as gas is forced into it or permitted to pass out. The columns and girders are called the "guide frame." To reduce to a minimum the friction produced by the rising and falling of the holder, rollers are attached to its upper and lower circumference. These rollers move on plates inserted into the tank for the purpose, and against the columns above referred to. Gas is admitted to the holder through what is known as the inlet pipe, A, rising above the water in the tank, and opening under the holder. As gas is forced through this pipe into the space between the water and the holder it forces the latter to rise. Gas passes from the holder to the street mains through the outlet pipe, B. As ordinarily used, gas flows continuously into and out of the holder, or set of holders, the excess of make of gas during the day filling them in preparation for the increased demand during the dark hours.

Large gas holders are often made of a so-called "telescopic" type. This expression means that there are within the tank several concentric cylindrical wrought iron sections, one of which only is closed at the top — this being the inner section. The columns in this case have a height equal to the sum of the heights of all the sections. The inner or covered section has as its lower edge a circular trough or "cup" A (Figure 10) which, as the section rises, engages with a similar but inverted trough B, called a "grip," on the upper circumference of the next section. The trough on the lower edge of the inner section being filled with water, a water seal is formed, which prevents the escape of gas. When the holder is down, the cups and grips are under water. Each section, in turn, as it fills with gas, and its lower edge rises to the surface of the water, engages the next lower section in a similar manner. When all the sections are full of gas the volume contained is approximately the capacity of a single section holder multiplied by the number of sections. The main advantage of the system is the small tank depth and ground area per unit of volume of holder capacity. As the gas flows out from the full holder, and the holder sinks into the tank, each section in turn rests on landing stones in the bottom of the tank. The inner section is not permitted to sink so far as to touch the landing stones, but is kept always afloat, except when necessary to make repairs.

The gas leaving the holder to enter the distributing system passes through a district governor, Figure 11. This is a device for establishing and maintaining, at the will of the operator, any desired pressure of gas at the point where the gas enters the street main system. It consists essentially of a valve box, A, inserted in the pipe leading from the holder to the street mains, and containing a valve, B; a cast iron tank, C, placed over the valve box; a sheet iron bell, D, working in the tank, and so fastened to the valve rod, E, that as it rises and falls the valve moves with it, and a connection, H, called the pressure pipe, from the outlet of the valve box to the interior of this bell. The shape of the valve is not important. It may be conical, parabolical or cylindrical, but it must always be so made and so arranged that the upward and downward pressures exerted upon it by the gas will be equal, and so balance each other. In the cut it will be seen that two surfaces of the valve are exposed to the inlet pres-



Non-Automatic Street Main Governor.

FIG. 11.

sure,— one a lower surface and the other an upper surface. Also that two surfaces of the valves are exposed to the outlet pressure,— one a lower surface and the other an upper surface. The pressure on the lower and upper surfaces, it will be seen, balance each other; therefore, they will have no effect on the position of the valve or the bell. There is an annular air chamber, G, on the bell, D, and located beneath the surface of the water in which the bell floats. It is designed to counterbalance the weight of the bell. The exact balance desired is established by pouring water into the air space through the pipe I, rising above the top of the bell. The interior of the bell is connected with the outlet of the governor, through the pressure pipe, H. When, because of an increased consumption of gas along the lines of mains, the pressure on the mains is reduced, the pressure on the interior of the bell is also reduced. This will cause the bell to drop until the opening in the valve connected to the bell is sufficient to pass enough gas to restore the pressure in the outlet, and, therefore, under the bell, which existed before the increased demand for gas occurred. In like manner, if the demand for gas upon the mains is reduced, the pressure in the mains will rise, which also raises the pressure on the interior of the bell — closing the valve until the opening is only sufficient to allow enough gas to pass to maintain the pressure previously existing in the outlet and under the bell. In order to increase the pressure in the outlet, which is important at hours of increased demand for gas, it is sufficient to place weights on the top of the bell, as shown in the cut. This addition of weight makes a higher pressure necessary at the outlet for any given position of the bell, and, therefore, for any given opening in the valve. To reduce the pressure at the outlet, weights are removed from the bell. It will be seen that it is thus a simple matter to regulate the pressure at the outlet of the governor, and therefore, in the inlet of the street main system, from hour to hour, as the demand for gas varies. It will be impossible with this device to increase the pressure at the outlet of the governor beyond the pressure at the inlet of the governor.

There are governors in use that automatically establish and maintain predetermined pressures in the main system. They are in principle as the governor described, except that by means of an ingenious device they automatically increase or diminish the weight on the bell as the pressure at the governor outlet diminishes or increases.

The sequence of the apparatus above described, and the part each takes in the preparation of coal gas for illuminating purposes, is graphically shown in Figure 12 which represents, in brief, the essential parts of a coal gas apparatus from the retort to the governor, and supposed to be in operation. All auxiliary apparatus, boilers, engines, pumps, conveyors, etc., are omitted from the sketch.

At A is the coal being distilled. At B the gas rising from the coal is bubbling through the water in the hydraulic main. At this point the gas contains all the tar and impurities with which it leaves the coal. It is a dark brown color and so dense as to be opaque. Its temperature is approximately 200° F. It consists of hydro-carbon gases, hydrogen, carbonic oxide, water vapor, ammonia, sulphuretted hydrogen and other sulphur compounds, carbonic acid, tar — as a mist of vesicles and small drops,— free carbon and traces of nitrogen and oxygen. At C is the exhauster pumping the gas from the retorts and forcing it through the subsequent apparatus into the holder. At D the gas entering the condenser is practically as it entered the hydraulic main, except that a proportion of the tar and water vapor and all the free carbon have been deposited, due to the cooling of the gas and friction. At E the gas entering the scrubber has parted with practically all of the tar and most of the water vapor it contained when leaving the retort, and with the water vapor there has been deposited a certain amount of ammonia, which the water vapor absorbed as it condensed to liquid. The ammonia absorbed by the water also carried out of the gas a certain part of the carbonic acid and sulphur compounds. At F, the outlet of the scrubber, the gas has practically lost all of its ammonia, water vapor and tar. It is now transparent, and contains of deleterious constituents only sulphur compounds. At G, the outlet of the purifiers, the sulphur compounds have been removed to an extent that renders the gas fit for consumption in closed rooms. The gas may now be used without fear of injury to person or fabrics. At H the gas is passing through the station meter. At I the gas is entering the holder, where it is stored, to be used as the demand of the town or district supplied may require. At J the gas is entering the governor. At this point the pressure will vary and have no relation whatever to the requirements of the district supplied. At K the gas is leaving the governor. At this point the pressure of the gas may be varied in accordance with the demands of the district supplied. If, owing to the approach of evening, or other causes, the consumption of the gas in the town or district increases, the governor, if automatic, will open, thus providing a passage for a larger supply of gas and increasing the pressure at the outlet of the governor. If the governor is not automatic in its action, the pressure may be varied by the addition or subtraction of weights as heretofore described.

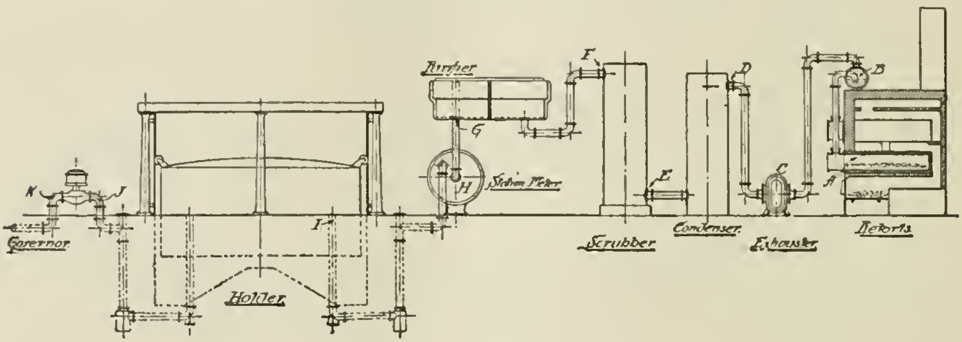


Fig. 12.

The generation and preparation of water gas differs radically from coal gas manufacture, up to the point of entrance to the purifiers; thereafter there is no material difference in the treatment of the two gases.

Figure 13 represents in brief the essential parts of a water gas apparatus, from the generator to the purifier. All auxiliary apparatus, boilers, engines, blowers, etc., are omitted from the sketch.

The Lowe Double Superheater Water Gas Apparatus, which is the modern type of apparatus for the generation of what is known as carburetted water gas, consists essentially of three wrought-iron cylinders connected in sequence, the top of the first cylinder or generator being connected to the top of the second cylinder, or carburetter, which is at its bottom, connected with the bottom of the third cylinder or superheater. The connections in practice are short and like the cylinders lined with fire-brick.

In Figure 13, A is the generator, B the carburetter, and C the superheater. A, B and C are connected with a main blast pipe H and so arranged that air may be introduced in desired quantity and proportion to beneath the grate in A, to the top of B, and to the bottom of C. At the top of C is a stack valve (7) for the exit of the waste furnace gases, and a take-off pipe (8) for the exit of the water gas. When the apparatus is in operation A is filled nearly to its outlet with coke or anthracite coal. B is filled to within a short distance of the connection with A with so-called "checker brick," or fire-brick placed on edge, and with openings between them of from one and one half to three inches. C is similarly filled with fire-brick to within a short distance of its outlet. The fire-brick in B and C are supported on fire tile arches a short distance above the connection from B to C.

The process of making gas in this apparatus may be conveniently divided into two periods, called, respectively, the "blow" and the "run." The blow is the period of introduction of air to gases still contain a small proportion of the unconsumed carbonic oxide and hydrogen, which burn in the air introduced at this point through valve (3) heating the checker work in C to the temperature desired. During the blow the "stack" valve (7) is open and the products pass out of the chimney and so into the open air. When the apparatus has been brought to the desired temperature, which is known from observation through sight cocks conveniently placed, the air is shut off from the three chambers A, B and C, and steam is admitted under the fuel bed A. Oil is then admitted into the top of the chamber, B, spraying down over the checker work in B, and mingling with the carbonic oxide and hydrogen gases formed by the passage of the steam through the fuel in A. The oil is vaporized immediately upon contact with the bricks in the hot chamber, B, and the vapor passing with the gases down through the hot checker brick of B, and up through the hot checker brick of C, is gasified, and the mixture of gases passes out through the outlet valve at the top of C, as carburetted water gas. The

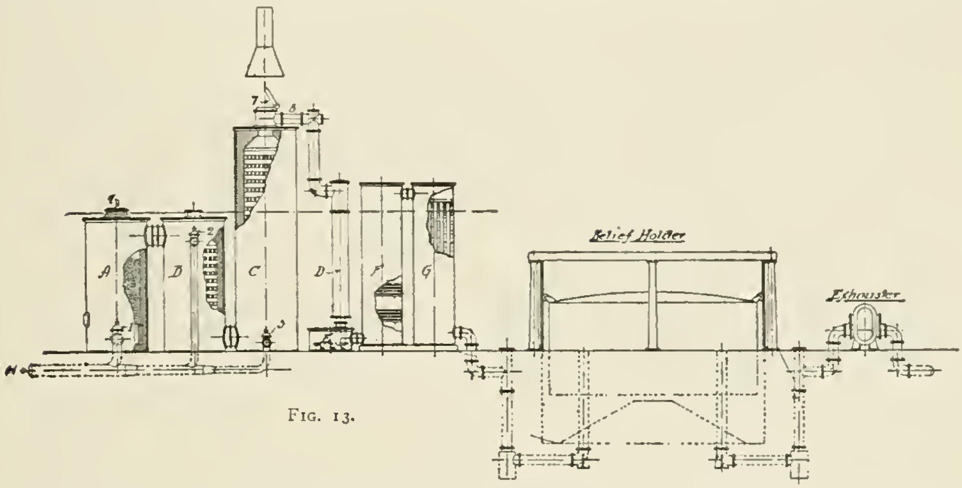


Fig. 13.

the apparatus in the process of heating it to a temperature at which it can economically treat the steam and oil used in the manufacture of the gas. The run is the period of the introduction of steam and oil, and therefore of the generation of gas. Necessarily the blow precedes the run. A power blower maintains a pressure of air on the blast pipe to which are connected the blast valves leading to the apparatus as above described. The valve (1) being opened, air flows into the generator A beneath the grate. Being under pressure this air rises through the fire bed, bringing it to a high state of incandescence. The products of combustion leaving the fuel bed are nitrogen and carbonic acid, with a relatively small proportion of carbonic oxide and hydrogen. Passing into the top of the carburetter B these gases meet an incoming stream of air, admitted through the valve 2, in which the carbonic oxide and hydrogen in part burn to carbonic acid and water vapor. This combustion raises the temperature of the gases and of the checker brick in B down through which the gases pass to the outlet of B and into the bottom of the superheater, C. At this point the stack valve (7) is closed at the moment that the carburetted gas appears, which marks the expulsion of all the blast gases previously contained in the apparatus. Upon the closing of the stack valve the carburetted water gas makes its exit through the outlet pipe D to the wash box E. At this point the gas is brown in color and opaque; it is composed of hydro-carbon gases, hydrogen, carbonic acid, carbonic oxide, sulphur compounds, tar, water vapor, free carbon, nitrogen and oxygen. In E, which has the function of the hydraulic main in coal gas generation, the gas deposits a considerable amount of the tar and free carbon, or lamp black, which it contained and which are due to the gasifying of the oil. From the wash box E the gas passes through the scrubber, F, which in design is similar to the scrubber described above in connection with coal gas manufacture. The scrubber F removes the lamp black and a large proportion of the tar from the gas. These are washed down through the trays in F by a spray of water admitted at the top. The gas passing through the condenser G is cooled to the temperature desired. The last traces of tar may here be removed.

The run is continued until the temperature of the apparatus falls to a point that makes it necessary to re-heat the brick work and the fuel bed. When this temperature has been reached, the oil and steam are shut off. The air valve (1) is opened. The blast rising through the fuel bed in A forces ahead of it the good gas contained in B and C until the judgment of the operator tells him that all the good gas has been forced out of the cylinders, at which moment he opens the stack valve (7).

It will be noted from the above description that the scrubber is before the condenser, which is the reverse of the order in coal gas manufacture. The reason of this is that in water gas manufacture there may be a certain amount of lamp black in the crude gas which must be washed out at the earliest possible moment, and also because there is no necessity of cooling water gas before scrubbing, because there is no ammonia to be removed. The gas leaving the condenser passes to a gas holder, known as a "relief holder," used to equalize the flow of gas to the purifiers, making it uniform from minute to minute, although the process of water gas generation is intermittent, as above described.

From the relief holder the gas is drawn by an exhauster located at the inlet to the purifiers, and from that point on its preparation for use is the same as described above in coal gas manufacture.

After purification, measurement, and storage, the gas, whether coal or water gas, enters the "distribution system," through the governor heretofore described.

The gas leaving the governor enters the street main system. The size of the pipes in this system and their distribution in the streets of the districts supplied depend upon the amount of gas to be delivered in the period of maximum demand, and upon the location, in the district supplied, of the areas of large and small consumption at the time of maximum delivery. The main pipes are ordinarily of 12-foot cast iron lengths, jointed with lead or cement. Wrought iron mains are in use to a considerable extent in some cities.

A "service" is the technical name applied to a pipe laid from the main to supply an individual consumer, the distinction between a main and service pipe being that the main pipe is laid for the general supply of a district or street,—a service pipe being used to connect this main with the premises of a consumer.

A certain amount of water vapor condenses in the mains and services of a gas distribution system, and it is necessary that these should be so laid as to drain to some central point or points, at which this water can be collected in so-called "drips," and the stoppage of mains and services by this accumulated condensation prevented. These drips are cast iron pots, and are connected to the mains at low points in the distribution system. The condensation is pumped from them through a small pipe rising from the bottom of the drip to the surface of the ground, where it is plugged and covered with an iron cap. Observation soon indicates how frequently it is necessary to pump any drip, and at such times a wagon, fitted with a tank, a pump and a hose connection, is sent to the spot and the water is pumped from the drip into the tank on the wagon.

Services are almost universally of wrought iron. It is common practice to provide on a service, at or near the curb line of the street, a cock which may be opened with a wrench inserted through a cast iron box having a lid at

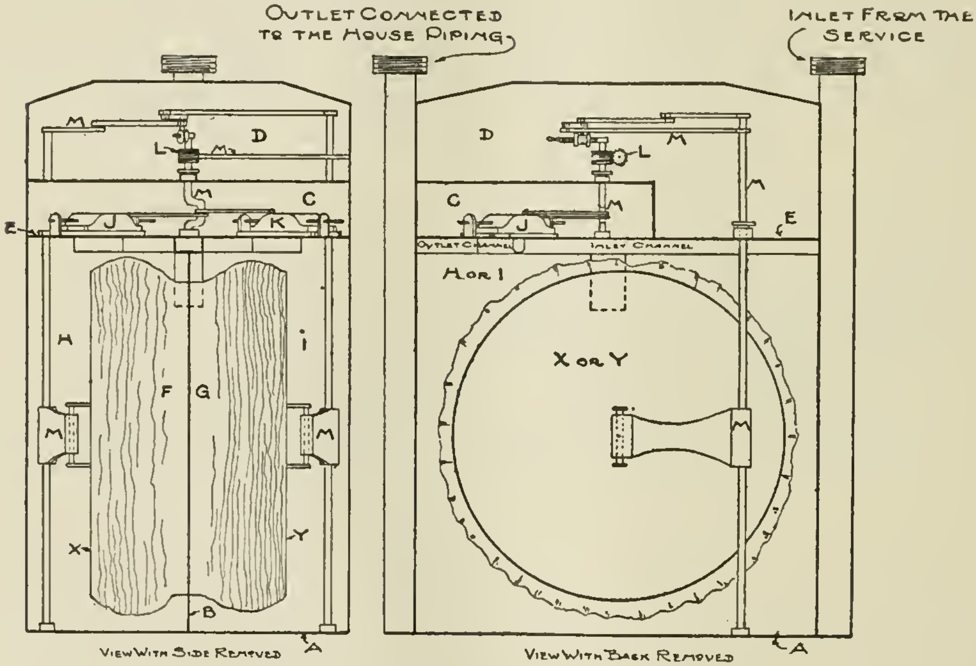


Fig. 14.

the surface of the sidewalk. The purpose of this is to enable the gas company to shut off the supply of gas from any premises in case of fire, or in case of the abandonment of the use of gas on the premises. The arguments for and against the practice of using so-called "service cocks" have persuaded some companies to adopt and some companies to reject them. The service pipe passes ordinarily through the cellar wall to a meter located in the cellar of the premises to be supplied.

The meter used in cold countries to measure the gas supplied to an individual consumer is almost universally of the "dry" type, which, as shown in Figure 14, consists of a tin box A divided into two measuring compartments by a vertical partition, B, these measuring compartments being separated from the superimposed valve and dial compartments, C and D, by a horizontal partition E. The measuring apparatus consists of two leather bellows, F and G, attached to the tin partition, B, and having light tin heads, X and Y, and located one in each of the measuring compartments H and I. The bellows are connected with the valves J and K and the dial gearing L through the rods and cranks M, M.

Gas is measured, as is any liquid commodity, by the alternate filling and emptying of enclosed spaces having a determinable and unvarying capacity. The capacity of the spaces multiplied by the sum of the fillings and emptyings is the volume measured. In the dry meter the gas is measured in the bellows F and G, and in the measuring spaces H and I, surrounding the bellows. Each bellows and each surrounding measuring space is alternately filled with gas, shut off for a moment from any connection with either the inlet or the outlet of the meter, and then opened to the outlet. This filling and emptying is so alternated that there is a continuous flow of gas through the meter, as long as there are any openings for the escape of gas in, or connected with, the house piping connected to the meter outlet. When no openings exist there is no place for the gas to escape and the meter will not move. To understand the action of the meter it is best to follow it through a complete cycle — see Figure 14. Assuming th burners to be all shut off and no leaks to exist in the house piping, the pressure on the outlet of the meter will be the same as on the inlet, no gas will pass, and as it is the passing of gas that moves the meter, it will, under the conditions assumed, be at rest.

In whatever position the bellows and connected valves of the meter may be, and whether the meter be in action or at rest, there is always an opening for the gas into one of the bellows or measuring spaces, and another opening from the other bellows or measuring space into the meter outlet and house piping. If now a burner cock be opened, the gas in the house pipes will begin to flow out through the burner, the pressure in these pipes and in the bellows, or measuring space, at the moment open to the house piping, will fall, and the gas in the service will tend to flow in to restore the pressure. To do this the gas must pass into the meter. Assume that the inlet of bellows F is open. The valves and connections are so arranged that when this condition exists the outlet of F and the inlet of space H will be closed, and the outlet of space H will be open. The gas from the service will then, by reason of the reduced pressure in the house piping and in the space H, force its way into the bellows F, expanding it into the space H, and forcing the gas from the space H through its outlet valve into the meter outlet and the house piping. When the bellows F has expanded to its full working length the rods and cranks connecting it to the valve J will have so far moved the latter that the inlet to the bellows F will close and its outlet open. This change also closes the outlet of space H and opens its inlet. Gas now flows into H, compressing the bellows F, and forcing the gas from it into the house piping. It is clear that at each filling of the bellows F there will be displaced from H and forced into the house piping as much gas as enters F; and that at each emptying of F an equal volume of gas enters H. Thus we have H and F alternately filling and emptying as long as the burner cock is open. It is evident that the gas does not flow through the bellows or through the measuring space. It flows into them alternately, is for a moment shut in, and then as the outlet valve opens flows out. There is, therefore, a definite measuring of each volume of gas that passes the meter. This volume is indicated on the dial by the movement of the rods, cranks and gearing.

In order to insure a continuous flow of gas to the burner, with an intermitting motion to the bellows, each meter is composed of at least two bellows and measuring spaces, so valved that there shall be no moment when there is not at least one inlet and one outlet open. When the burner cock is closed the pressure in the house piping rises in a moment to that in the service and the meter ceases to move. It is evident that when gas is passing the meter it is because the pressure in the service is enough in excess of the pressure in the house piping to overcome the inertia and friction of the moving parts of the meter; and, further, that the meter must cease to move the moment these pressures are equalized. As this difference cannot continue if there is no outlet for the gas, no gas can pass unless an opening exist in the house piping.

Meters are tested for accuracy by passing through them a volume of gas accurately measured in a small gas holder. The law commonly recognizes as accurate a meter that is not more than 1½ per cent "fast" or 2 per cent "slow."

Pure oil gas and acetylene gas are, to some extent, used for illumination.

Oil gas is extensively used for car lighting. It is ordinarily generated in retorts very similar to coal gas retorts — the oil being drippec into the retort from the end of a pipe. The gas, after purification, is compressed in cylinders, from which it is drawn into similar and smaller cylinders, located under the car to be lighted. Pure oil gas after compression has an illuminating power of approximately 50 candles.

Acetylene is one of the most interesting of illuminating gases. It is produced from carbide of calcium and water. Carbide of calcium, chemical formula — CaC_2, is produced by the fusion of carbon and quicklime in the heat of the electric arc. When water is poured upon this substance acetylene gas is liberated. The chemical reactions are as follows:

Calcic Carbide + water = Lime + Acetylene

$CaC_2 + H_2O = CaO + C_2H_2$.

When there is an excess of water present the following reaction also takes place:

$CaO + H_2O = Ca(HO)_2$

Quicklime + water = Slaked lime.

Acetylene has an illuminating power of approximately 240 candles. Coal gas has an illuminating power of 14 to 18 candles, and water gas as ordinarily supplied, has an illuminating power of 20 to 27 candles.

Gas produced by the distillation of coal for the production of coke, for industrial uses, has in recent years been conserved, and in some cases is being distributed by local gas companies. This gas is generated in large ovens, generally heated by the combustion of a part of the gas produced, and is treated in the same manner as coal gas generated in retorts, as heretofore described.

The "candle-power" of gas is the amount of light it yields, expressed in terms of standard sperm candles, made under rigid specifications and burning at the rate of 120 grains of sperm each per hour, the gas being consumed through a specified burner at the rate of 5 cubic feet per hour, and depending for its light on the incandescence of some of its component parts, and not, as in the case of the Welsbach burner, on the incandescence of some extraneous substance, subjected to the heat of the flame. Briefly, when it is said that certain water gas is of 25 candle-power, it means that when burned at the rate of 5 cubic feet per hour, through a suitable burner — it would yield 25 times as much light as would a standard sperm candle, made under specifications prepared by the Board of Trade of London, and burning at the rate of 120 grains of sperm per hour.

There are some gases, as for instance acetylene, which cannot be burned at as high a rate as 5 cubic feet per burner per hour without badly smoking. When it is said that acetylene gas is of 240 candle-power it means that when burned at an efficient rate it yields a candle-power that bears the same proportion to the rate at which it is burned as 240 bears to 5.

The calorific or heating value of a gas is the amount of heat generated by the combustion of one cubic foot of the gas, generally expressed in British thermal units. A British thermal unit is the amount of heat absorbed by one pound of water when raised 1° F. in temperature — the temperature being at or near the maximum density of water, or 39.1°. The heating power of gas varies. Acetylene gas has a calorific value of 1,477 heat units per cubic foot. That is to say, the combustion of one cubic foot of acetylene generates as much heat as it is necessary to add to 1,477 pounds of water to raise the temperature of the water from 39.1° to 40.1° F. Natural gas may have a value of approximately 1,000 heat units per cubic foot. Following are analyses of a water gas and a coal gas, giving the calorific value by calculation; that is, the theoretical heating value, as estimated from the heating value of the components of the gas. The value by calculation will be higher than the value developed in a test with the calorimeter, because of some slight losses in the use of the calorimeter.

Gas develops its highest illuminating effect when flowing from the burner at a low pressure. To accomplish this there is located in the burner, at some point below the tip, a so-called "check," having an opening of less area than the opening in the tip at the point of combustion. Obviously, the gas flowing through the burner at any rate per hour, will pass through the outlet and larger opening at less pressure than is required to force it through the smaller opening in the check.

	Water gas 23.7 C. P.	Coal gas Approx. 16 C. P.
C_6H_6	.5	.5
C_nH_{2n}	11.8	4.3
CO	31.3	8.0
H	36.1	47.0
CH_4	12.6	36.0
C_2H_6	2.3	0.0
O	.4	.4
N	2.3	2.2
	100.0	100.0
Calorific value by calculation	669.5 Brit. Ther. Units.	647 B. T. U.

Burners for illumination, excluding the Welsbach and other forms of incandescent burners, are of three general types, the batwing, the fishtail and the argand. (See GAS ILLUMINATION, HISTORY OF.)

Gas pressures are expressed in terms of height of water column. If we say the gas pressure is "one inch" we mean that it is equal to the pressure of a column of water one inch high. If we connect to a gas pipe one leg of a U-shaped glass tube, half full of water, the other leg being open to the atmosphere, the water will fall in one leg and rise in the other until the difference in the water levels in the two legs equal the pressure of gas in the connected pipe. If this difference is one inch we say the gas has a pressure of one inch.

The conception of a system of illumination comprehending a central source, and radiating lines of conduits; the measurement and recording of the service rendered as rendered, and the absolute and immediate control by the served of the time, period and measure of service, was as bold and startling as has occurred in the mind of man. Its fruit, the science and art of gas lighting, has amply justified the conception and has had a leading position among the activities of the wonderful 19th century. Wax and sperm oil were for 50 years its most potent competitors in the field of artificial illumination. Then came the discovery and the utilization of petroleum. Next, and so far last, came the wonderful and adaptable electric light.

WALTON CLARK,

Gen. Supt. the United Gas Improvement Co., Philadelphia.

Gas Engine. There are two classes of engine other than those driven by steam: (1) external combustion engines or hot air engines driven by the expansive energy of air or a mixture of air and gas heated from an external source through the walls of the containing vessel, as in the production of steam from water in a steam boiler; and (2) internal combustion engines driven by the expansive energy of air heated by the combustion of the fuel *within* the working cylinder itself.

The former, even in their highest form of development, were practical failures and are obsolete, but the latter have been developed within the last few years into an important class of highly efficient prime movers, represented by the various types of engine now commonly known as gas, gasoline, distillate, alcohol, and oil engines.

History.—The prototype of the modern internal combustion or gas engine was first conceived, in 1678, by the Abbé d'Hautefeuille, an eminent mineralogist and chemist of France. He proposed to drive a piston in a cylinder by the energy developed from explosions of gunpowder; but it does not appear that any machine was actually built by him, and besides the fact that, about two or three years later, small engines employing the same motive power were devised by Christian Huygens and Denis Papin, no further development of this class of engines occurred until 1791.

In this year, John Barber, an Englishman, patented an engine which was to be driven by the motive power derived from the explosions of a mixture of hydrocarbon gas and air. This engine was essentially a gas turbine. The gas used was generated from solid or liquid fuel, and after being mixed with a suitable quantity of air and water, was exploded in a vessel called the exploder, the energy thus developed being exerted against the vanes of a turbine.

A few years later, John Street, another Englishman, received a patent for an engine which he proposed to operate by the use of vapor derived from a liquid fuel and air, which was to be ignited and exploded in a suitable cylinder.

About the year 1799, Philip Tebon, a Frenchman, patented an engine designed to use coal gas for the fuel component of the explosive mixture or charge. He was soon followed by several inventors with similar engines of very ingenious construction, but none of them appear to have attained any practical success.

About the year 1860, Lenoir, a Frenchman, produced the first practical gas engine. It was of the double-acting type, and consisted of a cylinder three inches in diameter in which a piston worked with a stroke of five and one-half inches, and developed about one horsepower. The charge, consisting of an explosive mixture of coal gas and air, was drawn into the cylinder during the first half of the outward stroke of the piston and exploded by an electric spark from an induction coil at the beginning of the second half of the stroke. The products of combustion were exhausted during the return stroke at the same time that effective work was being done by the explosion on the other side of the piston. The igniter was placed in the cylinder wall at a point opposite the half length of the stroke, the platinum igniter points extending into the cylinder and exposing the electric spark, which constantly jumped through them, to the gas in each end of the cylinder alternately, according to the outward and inward movement of the piston. The cylinder was provided with a water jacket to prevent the overheating of its walls, and the engine worked so smoothly and regularly, that several manufacturers expected it would prove a successful substitute for the steam engine, and built it for commercial purposes in sizes up to 12 horsepower.

Many defects were soon discovered, however, especially the great fuel expense due to the consumption of over 100 feet of illuminating gas per brake horsepower under the most favorable load, and quickly led to the discontinuance of its manufacture.

It is interesting to note, however, that the Lenoir engine, although unsuccessful owing to a lack of fuel economy, yet possessed all the accessories of the successful modern gas engine, such as the electric igniter, the water jacket, etc. Its lack of success was directly due to the employment of a cycle of operations which did not include as one of its phases the compression of the charge prior to ignition.

Lenoir's effort, however, proved very important. The attention of inventors and scientists, long directed to the development of the steam engine, was re-directed to the gas engine, and led to the valuable experiments and works of Beau de Rochas, N. A. Otto, and Eugen Langen, during the period of 1861 to 1878.

It appears that about 1862, Rochas was granted a patent for the specifications of an engine in which the charge passed through four distinct phases in one cycle of operations as follows: It was drawn into the cylinder during the first outward stroke of the piston; compressed during the return stroke; ignited and exploded at the beginning of the second outward stroke or power stroke; and the products of combustion expelled from the cylinder during the second return stroke. Although this cycle gave only one power impulse for every two revolutions of the engine crankshaft, it included the feature of compression as one of its phases; and although Rochas stood on the very threshold of success, he failed to build an engine under his patent and it remained practically unnoticed for sixteen years.

About the same time, 1862, Otto, then a young German merchant, built an experimental engine on a somewhat similar principle, but abandoned it for lack of success.

Subsequently, in 1867, with the assistance of Eugen Langen, a skillful mechanical engineer, he produced a vertical engine in which a free piston was driven upward by the explosion of a charge of gas in the bottom of the cylinder and gave a power stroke only as it descended under the pressure of the atmosphere. This so-called "atmospheric engine," although very crude in mechanical construction, consumed only about one-half the amount of gas required by the Lenoir engine, and served to demonstrate the advantage of compression.

About the year 1873, Brayton of Philadelphia, produced the first successful gas engine built in the United States. It was of the vertical type and had two cylinders—a working or power cylinder and a charging cylinder, in which the charge was compressed prior to its introduction into the power cylinder. The charge used was an explosive mixture composed of one volume of gas to nine of air and was admitted into the power cylinder under a compression pressure of 74 pounds per square inch, during the earlier part of the downward stroke of the piston, and ignited after the piston had traversed one-fourth of its stroke, so that the force of the explosion pushed the piston to the completion of its stroke without any increase in pressure. Accidental ignition of the highly compressed mixture in the charging cylinder was prevented by placing a grating consisting of several layers of wire gauze in the port connecting the charging cylinder with the working cylinder. This engine showed a thermal efficiency about 33 per cent. higher than that of the Lenoir engine.

In the meantime Otto's labors had not ceased with the production of his atmospheric engine of 1867. At the Paris Exposition of 1878, he exhibited a new engine which worked on the Rochas cycle of operations. Its most ingenious feature was a slide valve which accomplished the double purpose of admitting the charge to the working cylinder, and then igniting it by means of a gas flame which passed from a jet in the valve cover, through the valve itself, into the combustion chamber. Its fuel economy was equal to that of his atmospheric engine. Its thermal efficiency was much higher than that of Brayton's. It worked noiselessly, smoothly, and regularly, and served to clearly establish the fact that the four-cycle principle was the most effective method for overcoming the many difficulties which up to that time had stood in the way of the successful operation of an internal combustion engine.

Since then, although many successful gas engines have been built which work under different or modified cycles, especially those of the two-cycle type, in which a power impulse is realized for every revolution of the crankshaft, the great majority of the standard types of internal combustion engine operate on the four-cycle principle. It is a fact, however, that the relative merits of these two principal types of engine have not as yet been satisfactorily decided by practical results.

Working Principles.—All heat engines operate through the medium of a working substance which absorbs heat, converts a portion of that heat into mechanical energy, and rejects the remainder still in the form of heat. The working substance may be a solid, a liquid, or a gas, and the action of the engine may be due to changes of either the form or the volume of its working substance.

In the case of an internal combustion engine, the actual working substance is atmospheric air, and the action of the engine is due to changes of the volume of this working substance under the influence of the heat evolved by the combustion of the fuel gas with which it is intimately mixed. The fact that the fuel gas or other vapor can be derived from coal burned in a gas producer, and from gasoline, oil, and alcohol transformed by means of carburetters and vaporizers, has created the various trade name such as producer gas engines, gasoline engines, oil engines, etc., but in all of them the actual working substance is atmospheric air, and they are all essentially gas engines, differing from each other only in the manner in which the working substance is heated.

Methods of Heating.—In all cases, the working substance is heated by the burning of the fuel gas or vapor within the working cylinder itself; this is the general gas engine method of heating, but the manner in which the heat is applied varies in the different types of engine, and permits of their being grouped into three well-defined classes:

1. Engines heating at constant temperature; with an increase of volume and a decrease of pressure of the working substance, and *vice versa.*

2. Engines heating at constant pressure; with an increase of temperature and an increase of volume.

3. Engines heating at constant volume; with an increase of temperature and an increase of pressure.

The first is represented by the Diesel engine, the second by the Brayton engine, and the third by the Otto, and by the great majority of internal combustion engines regardless of the peculiarities of their cycles of operation.

The effect of heating at constant volume is as follows: Imagine a cylinder of non-conducting material having an area of 10 square inches. Let 10 cubic inches of an inflammable gas at a temperature of 32° Fahr. (493° absolute) be placed in the bottom of the cylinder and under a piston having no weight except that due to the normal pressure of the atmosphere

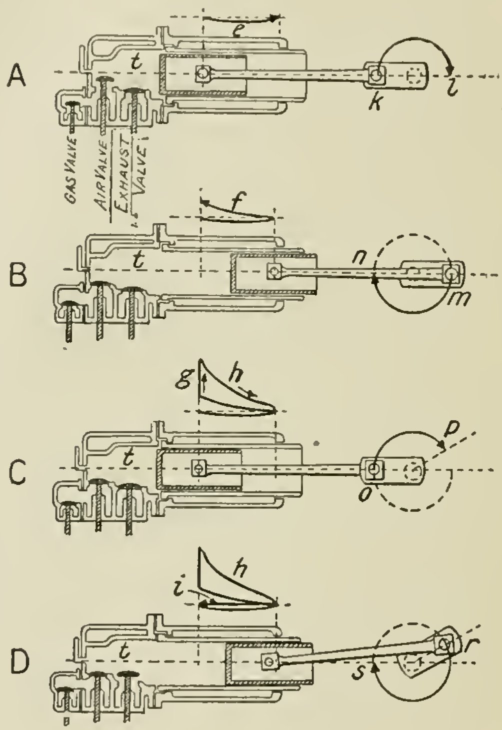


Fig. 1. Four-Cycle Engine.

(14.7 pounds per square inch). Let the gas be ignited, and assume that the resulting combustion raises its temperature to 1200° Fahr. (1661° absolute). According to Gay-Lussac's law, a gas increases in volume by 1-493 of itself for each degree of temperature above 32° Fahr., or, for convenience, the rate of expansion may be taken as equivalent to $\frac{1}{\text{Absolute temperature}}$. Therefore, 10 cubic inches of gas heated to a temperature of 1661° absolute will increase in volume to $1 \div 439 = .002035 \times 10 \times 1661° = 33.8$ cubic inches, or a little over three times its original volume, and raise the piston to a corresponding height. During this operation, the pressure (14.7 pounds per square inch) will remain unchanged.

Now, suppose that while the gas is kept at a constant temperature of 1661° absolute, the piston is forced down and the gas compressed to its original volume. The pressure will then rise from 14.7 pounds per square inch to $14.7 \times 3.38 = 49.6$ pounds per square inch, and represent the amount of energy expended by the gas in raising the piston to a height of 33.8 inches.

Again, suppose that after the gas had been ignited, the piston is held fast, thus preventing the gas from expanding. Then, while the volume is thus kept constant and the temperature raised to 1661° absolute, the pressure would rise to 49.6 pounds absolute, and represent the mechanical energy stored up in the gas and available as power for doing work.

This increasing of the pressure by raising the temperature while the volume is kept constant, exactly represents the action of the working substance of an engine heating at constant volume—the explosive mixture being ignited during the slow movement of the crank over its inner dead center so that the heat evolved by the explosion, often as high as 3000° absolute, increases the pressure behind the piston up to 250 or 300 pounds per square inch, before it can move outward and relieve the pressure by increasing the volume.

Cycles of Operation.—The practical working cycles in use at present are the Beau de Rochas or Otto cycle, already partially defined, and more commonly known as the four-part cycle and the two-part cycle—the former giving a power impulse for every two revolutions of the crank, and the latter one power impulse for every revolution of the crank.

Four-Cycle Engine.—The successive phases of the four-part cycle are shown by the diagrams A, B, C, D, of Fig. 1, in which the lines *e, f, g, h, i,* show the pressure conditions existing within the cylinder during the successive strokes of the piston required to complete the cycle. By referring to these diagrams and also to Fig 2, which shows the normal indicator diagram of an engine heating at constant volume, this cycle may be explained as follows:

Diagram A, represents the charging stroke. When the crank revolves from *k* to *l*, the gas and air valves open, and the suction caused by the outward motion of the piston fills the cylinder with the explosive mixture. During this operation, the pressure of the indrawn charge is slightly diminished by expansion in a partial vacuum, so that the admission line *e* falls below the atmospheric line.

Diagram B, represents the compression stroke. When the crank continues its revolution and passes from *m* to *n*, the gas and air valves close, and the inward movement of the piston on its first return stroke compresses the charge into the compression space *t*, raising both its temperature and pressure, the accession of temperature being exactly sufficient to bring the special mixture used to its point of ignition or inflammation, as shown by the line *f*.

Fig. 2. Indicator Diagram Four-Cycle Engine.

Diagram C, represents the power stroke. At the end of the compression stroke and while the crank is passing over its inner dead center *o*, the charge is ignited by contact with a hot tube, electric spark, or otherwise, and the heat caused by the resulting explosion causes a sudden increase of pressure which carries the explosion line *g*, upwards almost vertically, until the outward motion of the piston allows the heated air to expand with a consequent reduction in temperature and pressure as shown by the expansion line *h*. Usually, the exhaust valve opens when the crank reaches a point *p*, at about ⅛ the length of the piston stroke from its termination, and allows the pressure of the gas to drop to about that of the atmosphere.

Diagram D, represents the scavenging or exhaust stroke. The exhaust takes place during the revolution of the crank from *r* to *s*, the second inward movement of the piston expelling the products of combustion into the open air. The cycle then repeats itself.

Usually, the presence of a slight amount of back pressure causes the exhaust line *i*, to lie a little above the atmospheric line with which it would otherwise coincide. Back pressure is usually due either to a too early opening of the exhaust valve, or to a restricted valve area which results in the "wire-drawing" of the products of combustion during exhaust.

It is apparent that, in a single cylinder engine, the intermittent character of the power impulses requires the use of a heavy flywheel to equalize the motion of the crankshaft, by storing up enough energy from the working stroke to overcome the resistance and carry the piston through the other three strokes of the cycle. Therefore, it is evident that a high rotative speed is advantageous, and a high initial pressure and temperature at the instant of explosion are desirable, with a low terminal value for both at exhaust, so as obtain a high, mean effective pressure. Under these conditions the use of highly explosive gaseous mixtures and reliable methods of ignition become very important.

drives the piston downwards on its power stroke, and as it passes the exhaust port J, Fig. 4, the products of combustion are exhausted into the open air, and the fresh charge drawn into the crank chamber is compressed and permitted to pass through the port D, and the by-pass E, into the combustion space G. The momentum of the flywheel then carries the piston upwards on another compression stroke proper, and the cycle of operations is repeated, giving a power impulse for every revolution of the engine crankshaft.

Lubrication.—In the successful operation of an internal combustion engine, the proper lubrication of the working parts requires the most careful consideration. The provision of a water jacket around the cylinder and other water cooling arrangements in connection with the valve chambers and pistons, serves a two-fold purpose: (1) to keep the cylinder walls from becoming so hot that they will cause premature explosions by igniting the fresh charges while they are being drawn into the cylinder, or before final compression; and (2) to keep the temperature of not only the cylinder walls, but also those of the valve chambers, and in the case of large engines, the walls of the pistons, down to a point low enough to prevent the burning of the lubricating oil.

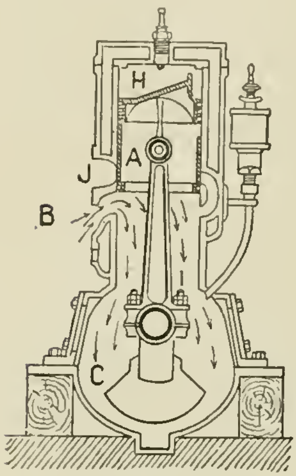


Fig 3.

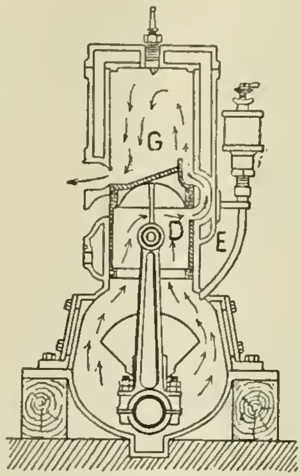


Fig. 4.

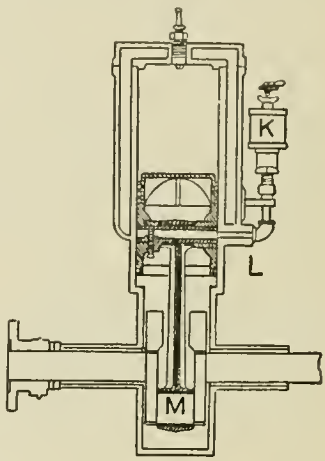


Fig. 5.

Two-Cycle Engine.

Two-Cycle Engine.—The principle of operation of a two-cycle engine heating at constant volume may be briefly explained as follows: Figs. 3 and 4, show vertical cross-sections through the cylinder and crank case of a two-cycle engine; and Fig. 5, a longitudinal section through the crank shaft.

The suction due to the up stroke of the piston A, draws a charge of vaporized gasoline and air through the vaporizer inlet B, into the interior of the crank case or crank chamber C, Fig. 3.

The following down stroke of the piston compresses the charge thus introduced into the crank chamber, and as the piston reaches the lower limit of its stroke, it brings the admission port D, opening into the hollow of the piston, opposite the by-pass E, Fig. 4, communicating with the crank chamber, and permits the compressed charge to pass into the combustion space G, of the cylinder. The next up stroke of the piston compresses the charge into the compression or clearance space at the top of the cylinder, where it is ignited by a spark from the igniter terminals at the lower end of the spark plug H, Fig. 3. The resulting explosion

Fig. 5, illustrates the method of lubricating an engine of the vertical two-cycle type. In the first place, the oil used should invariably be a mineral oil of high fire test, from 450° to 600° Fahr.

For the wrist pin, piston, and cylinder, it is carried directly from the sight feed cylinder lubricator K, through the passage L, in the hollow of the piston pin. In the case of the crank pin M, the revolving crank pin connection takes up the oil fed into the crank chamber through the pipe leading from a separate sight feed lubricator placed on the crank chamber.

In order to permit of the effective lubrication and economical operation of a gas engine, the cooling water circulating through the water jacket should not be allowed to issue at a temperature higher than 150° Fahr. nor lower than 100°.

Double-Piston, Two-Cycle Engine. — The chief motive for the development of the two-cycle types of engine is the desire to attain the ideal condition—an impulse at every revolution of the crankshaft. In the types already developed, the chief cause for whatever lack of success there may be, lies partly in the conditions attending the transference of the gases from one part of the cylinder to the other, and partly in the insufficient scavenging permissible.

In order to obviate these difficulties, many attempts have been made to produce a double-piston engine, but although many patents have been granted for very ingenious machines of this type, all of them appear to be more or less impracticable or uneconomical.

The Atkinson Differential Engine appears to be the pioneer of this type. It was exhibited at the British Inventions Exhibition in 1885, and consisted of a single cylinder with two trunk

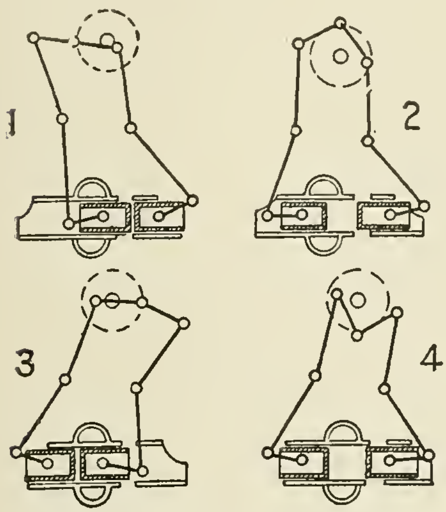


Fig. 6. Double Piston, Two-Cycle Engine.

pistons working in the opposite ends thereof. These pistons were connected to the engine crankshaft by an ingenious system of levers and connecting rods which transmitted the motion of the pistons to the crankshaft.

The four diagrams of Fig. 6, show the positions of the pistons at different points of the cycle. In the first, the pistons are at one extreme of their stroke and are just beginning to separate. The charge is now admitted between them through an automatic lift valve. In the second, the admission of the charge has been completed and the further movement of the pistons is about to close the ports leading to the admission and exhaust valve. In the third, the charge is compressed and ignited, the resulting explosion causing the pistons to rapidly separate. In the fourth, the exhaust port is uncovered, and the products of combustion discharged into the atmosphere. By this method, the several operations of admission, ignition, expansion, and discharge are performed in a single cylinder during one revolution of the crank. This engine was never manufactured for commercial purposes.

Six-Cycle Engine.—The so-called six-cycle or scavenging engine has never proved of much importance, and is here mentioned solely for the purpose of covering the principal points in the general development of the various gas engine cycles. A six-cycle engine is essentially of the four-cycle type, but in addition to the operations taking place in the latter, a third revolution of the crank or two additional piston strokes, serve the purpose of admitting and expelling a charge of pure air into and from the cylinder immediately after the products of combustion have been expelled therefrom by the exhaust stroke proper. By thoroughly scavenging the cylinder in this manner, the designers expected to lessen the dilution of the fresh charges by the inert gases forming the products of combustion, and thus obtain a higher economy of fuel consumption. These expectations were not fully realized, however, and the construction of this type of engines has been entirely abandoned in recent years.

Types of Gas Engine.—As already stated, the various types of internal combustion engine may be grouped into several well-defined classes according to the method of heating their working substances or according to their cycles of operation. They may also be grouped according to their structural characteristics, their action, and the method of governing employed.

When classified according to their structural characteristics, the usual definitions are based on the position and number of cylinders comprising an engine unit, with the addition of the terms four-cycle or two-cycle to indicate their mode of operation. This method of grouping is the one generally employed for trade purposes.

Thus, both the four-cycle and the two-cycle engines may belong, either to the horizontal or to the vertical, single, twin, tandem, or multi-cylinder types, and may be either single-acting or double-acting.

The designations "hit-or-miss" and "throttling" engines, very popular among writers and tradesmen a few years ago, are rarely used at the present time. In the hit-or-miss engines, the governing mechanism operates to reduce the speed by entirely cutting out a charge or a number of charges whenever necessary. In the throttling engines the governing is effected by increasing or reducing the area of the admission valve opening according to the variations of the load on the engine. It is obvious that any gas engine can be governed by either method, regardless of its cycle of action, or of its structural characteristics.

Governing.—The principal if not the only point to be considered in the matter of governing is the efficiency of a particular method to maintain uniform speed under varying loads, and different conditions of service. Some engines are equipped with very sensitive hit-or-miss governing mechanisms, but at their very best, they are not satisfactory for use on engines employed to drive direct connected dynamos for electric lighting and other purposes requiring a steady current. In this connection the throttling method is much more effective, and with reliable igniters and proper ignition control, is giving eminent satisfaction in all standard engines. Its application is also practically essential in the case of a marine engine, where the rocking of the vessel tends to operate against the action of a hit-or-miss governor.

Ignition.—In the matter of ignition, the most important conditions are safety and reliability. The use of the naked flame is obsolete, and that of the hot tube or hot head nearly so, the latter being still satisfactorily used in some types of oil engine.

The method almost universally employed at present is that of the electric spark. The necessary current is derived either from chemical or storage batteries, or from small dynamos or magnetos driven by the engine itself, and passed through an inductive resistance or spark coil. The efficiency and reliability of the igniter devices now on the market leave very little to be further desired in this connection.

Oil Engines.—As already stated, gasoline, oil, and alcohol engines are essentially gas engines having the additional accessories such as carburetters and vaporizers for converting the liquid fuel into vapor prior to its admixture with the air, and its introduction into the working cylinder. All of them are of either the four-cycle or two-cycle type, and ignite their charges either by hot head or by electric spark. There is, however, one important exception to this general rule, and that is the Diesel engine.

The Diesel engine was originally designed to operate on solid, liquid, or gaseous fuel and to ignite its charge by the heat of compression, thus doing away with all ignited arrangements, and establishing a truly ideal system of power generation. It is of the vertical type, works on the four-cycle principle, and has been chiefly developed as an oil engine.

Its cycle of operations is as follows: During the charging stroke, air only is admitted to the cylinder at atmospheric pressure and temperature. On the return stroke, this air is compressed to a pressure of about 500 pounds to the square inch, and its temperature thus raised to about 1000° Fahr. Then, at the instant of the beginning of the power stroke, the fuel oil is sprayed into the heated air in the compression space and instantly ignited. The admission of fuel is continued for about a tenth of the stroke, and the combustion maintained during the whole or a portion of this period according to the action of the governor. After the fuel supply is cut off, the working substance expands adiabatically during the remainder of the stroke to a terminal pressure but slightly above that of the atmosphere. The return stroke of the piston exhausts the products of combustion in the usual manner.

The unusually massive type of construction required to apply the high compression pressures, and to successfully withstand the severe shocks of the resulting powerful explosions, unfits it for service where a minimum of weight is essential, but for heavy work, and especially for driving electrical and pumping machinery, it is equal to any of the standard types of engine on the market.

Alcohol Engines.—Any gas or gasoline engine may be operated with alcohol by the use of a suitable carburetter. This accessory is the principal element which limits the use of alcohol as a fuel, requiring to be kept at a much higher temperature with alcohol than with gasoline. On this account, it is very usual to start the engine and run it with gasoline until the burner is well heated, when the gasoline is shut off and the alcohol turned on. For this purpose, two types of carburetters are employed—the duplex carburetters of the constant level or float feed type, and the atomizing carburetters.

The alcohol engine has been developed to a greater extent in France and Germany than in the United States. This is due to the fact, that while the policy of the French and German governments has always been favorable to the production of alcohol by distillation, a high revenue tax has been the feature of American practice up to April 1906, when Congress passed the bill removing the tax on denatured alcohol, thus placing it upon the list of available fuels for internal combustion engines. Under these conditions, and the effort to produce it cheaply in large quantities, great progress in the development of alcohol engines, especially for marine purposes, may be confidently expected in the immediate future.

American practice appears to favor the use of methyl alcohol, regardless of its disagreeable odor, on account of its cheapness, while in France, ethyl alcohol or spirits of wine is more commonly used on account of the prevalence of the vineyard.

A satisfactory mixture, quite extensively used, consists of

Ethyl 90 per cent.	100	volumes
Methyl 90 per cent.	10	"
Hydrocarbon	0.50	"

This mixture added to an equal volume of benzole forms the denatured or non-potable alcohol commonly known by the trade name of "electrine." It has a calorific value of 13,150 B.T.U.'s, and contains a hydrocarbon having a boiling point about 400° Fahr.

Horsepower of Gas Engines.—Up to within the last few years, a gas engine of 100 brake horsepower was considered to be a very large power generating unit of its class. The recent discovery, however, of the suitability of blast furnace gas, and other lean gases such as the different kinds of natural gas, and producer gas, for use in gas engines, has led to the development of large engine units developing as high as 7000 horsepower.

Up to the present time, the efforts of the English and German manufacturers have been the most active and successful in this direction. The Crossley, Cockerill, Nurnberg, Oechelhauser, and Deutz engines represent some of the standard types. Some of these—the American-Crossley, Nurnberg, and the Cockerill—are also built in this country under United States patents. They range in size from 500 to 7000 horsepower per engine unit, and are especially designed to burn blast furnace, natural, and producer gas.

Large engines of distinctively American construction are, however, being gradually developed to a state of high efficiency by several of the more prominent American concerns. The Westinghouse tandem engines of the single or double crank type, are being built in units ranging from 500 to 6000 horsepower, while those of the Standard Gasoline Engine Co., consisting of six-cylinder units of the marine type, range from 500 to 1000 horsepower.

Use and Economy of Gas Engines.—With a full appreciation of all their shortcomings, it is safe to assert that the gas engine is the most efficient and economical power generator of the day. It is more portable than any other type of prime mover, as exhibited by its application to automobiles, roading machines, farming machinery, etc., and its cleanliness and adaptability are making it the choice in many other kinds of service heretofore performed by steam engines.

Its use for marine purposes, even as a gasoline motor, indicates its ability to compete in economy with the triple expansion steam engines which are well known to be the most economical of their class. In this connection, it is interesting to note that both in this country and in Europe gasoline engines are being extensively used on torpedo boats, destroyers, and other forms of naval craft, and points to the strong probability of producer gas engine installations on the larger naval vessels in the near future.

For stationary service, the producer gas engine has fully demonstrated its economical superiority over steam-engine plants of equal power. The reasons for this superiority are now very clearly understood. The steam engine is an economical motor only when made in large power units. In units of 100 to 500 horsepower, operating under actual working conditions, the coal consumption per brake horsepower hour ranges from 2.4 to 4 pounds. With smaller powers, present practice requires 5 or 6 pounds, and the average for an ordinary working district using a large number of small engines ranges from 10 to 12 pounds of coal per brake horsepower hour.

With producer gas engines, one brake horsepower hour has been attained on one pound of coal, and judging from present developments such performance or better may be confidently expected as that of daily practice in the near future. See GAS PRODUCERS in this Encyclopædia.

The advantages of its use in connection with electric power plants have been also satisfactorily demonstrated. One of the highest authorities (Schoemburg) gives a comparative estimate of the cost of equipping a mill with an electric power plant for supplying direct current to lamps and motors, the power furnished during the day being 900 kilowatts, and that furnished during the night 250 kilowatts.

The power systems compared are as follows: dynamos driven by steam engines; dynamos driven by steam turbines; and dynamos driven by suction producer gas engines. The following figures give the first cost per kilowatt, and the cost of operation per kilowatt, of each system.

	First Cost per Kw.	Cost of Operation per Kw. Hour
Steam engines	$135.00	1.44 cents
Steam turbines	104.50	1.30 "
Gas engines	112.75	1.15 "

It will be understood, of course, that estimates of this nature necessarily depend on local conditions, and on the various assumptions made, and that, as a general rule, the question as to which system is best must be solved for each particular case.

The chief limitations of the gas engine are irregularity of torque and consequent variation of angular velocity, and lesser capability of adapting itself to varying loads, and especially to extreme over-loads, than either the steam engine or the steam turbine. The adoption of multicylinder types of construction and the use of large fly-wheels reduce the magnitude of these defects to a minimum, however, so that in the opinion of the best engineering foresight, the internal combustion engine, in some one or more of its various forms, is more likely to be the prime mover of the future than any of its present competitors.

Bibliography.—For further information consult: Dugald Clerk, 'Gas and Oil Engines' (New York 1905); Hutton, 'The Gas Engine' (New York 1904); Lucke, 'Gas Engine Design' (New York 1905); and the many valuable and practical articles in the various trade journals and technical magazines.

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Gas Holder. See GASOMETER.

Gas Illumination, History of. The development of gas lighting can properly be placed to the credit of the 19th century. "Spirit of Coal," produced by the distillation of coal, was known as far back as 1739, and the attention of Robert Boyle was called to this substance by Dr. Clayton, bishop of Cork. Its properties were studied and its inflammability and many of its general characteristics were known at this time, although an inflammable gas rising from the surfaces of certain stagnant pools had been noted as far back as 1659.

The first practical application of gas for illuminating purposes was made in 1792. William Murdock, an English engineer, produced gas by the destructive distillation of coal in iron retorts and conducted it for a distance of 70 feet through iron pipes and lighted and heated his house in Redruth, Cornwall. Lebon in 1801 illuminated his house and garden in Paris by gas produced from the destructive distillation of wood. This method of illumination proved a failure on account of the poor illuminating power of the gas. In 1802 Mr. Murdock installed a plant for illuminating the foundry of Watts & Bolton, near Birmingham, and a similar installation was introduced in Manchester shortly after this time.

Street lighting was introduced by F. A. Winzer (afterward changed to Winsor) in 1807 in Pall Mall. Mr. Winsor promoted a company for general gas lighting in 1809, and was granted a charter by Parliament in 1810 for the establishment of the London Gas Light and Coke Company, generally known as the Chartered Gas Company.

In America David Mellville, of Newport, R. I., was attracted by the developments made along the lines of gas lighting in England, and installed in his house, and in the streets in front of his house, the first gas lights used in the United States. This installation was made in 1806, his apparatus, with improvements, was patented in 1813; and a general installation made in several cotton mills and lighthouses.

Baltimore was the first city in the United States to install gas lighting, in the year 1817.

and since that time the growth of the gas lighting industry has proceeded uninterruptedly, for its convenience and economy have been impressed upon the public.

The original promoters of gas lighting encountered many difficulties. At the time of the installation of gas pipes in the House of Parliament, it was stipulated by this body that no pipes should be placed nearer than six inches to any wood-work. Numerous explosions and fatal asphyxiations caused by lack of experience in handling the new substance are recorded. The disagreeable and often injurious odor of the products of combustion of the gas greatly retarded its favor with the public. With the increasing experience of gas engineers, the dangers of explosions and accidental asphyxiations were eliminated. Considerable inventive genius was brought to bear to remove from the room the products of combustion, or to purify the gas for the removal of those constituents which gave the disagreeable products on burning. Several means were proposed for accomplishing these purposes. The most original improvement, and one in use at the present time, was the invention of Clegg, who introduced the use of slaked lime for removing the sulphurous constituents of the gas before it entered the holders. A later development was that of Lanning, who used ferrous oxide mixed with sawdust or wood pulp to make it porous for the absorption of the sulphur constituents. These methods are to-day in general use. Many other methods, of more or less value, have been proposed.

The illuminating power of a flame is derived from the heating of solid particles to incandescence, and the practice of gas illumination can therefore be divided into two general principles.

1. Where the solid incandescent material is supplied by the decomposition of the gas in the process of combustion.

2. Where the complete combustion of the gas is produced by the Bunsen burner, and a permanent incandescing material is supplied as a part of the apparatus.

The latter method is what is generally known as the Incandescent Gas Lighting system. The original developments in gas lighting were made on the first of these principles. The batswing or fishtail flame was produced by releasing the gas through a narrow slit, and its illumination was produced by the incandescence of the solid particles of carbon derived from the decomposing gas in the flame. The Argand gas burner is a modification of the old Argand oil burner, and consists of a ring of small openings arranged near enough together so that the gas flame is in the form of a continuous cylinder, admitting air to the inside and outside of the cylinder.

The Siemens-Lungren system, known as the Regenerative system, consisted in applying to the burner, gas and air which has been preheated.

Prof. Bunsen, professor of chemistry in Heidelberg, designed a burner to produce a non-luminous flame with complete combustion, and to give the maximum heating effect of the gas. This was accomplished by so constructing a burner that it will carry in and mix with the gas a limited amount of air before it reaches the point of combustion. The additional air necessary to produce complete combustion is drawn from the atmosphere surrounding the flame. This type is known as the Bunsen burner.

The experiments of Henry Drummond in 1826, in which he placed a solid stick of lime in the oxy-hydrogen flame, was the first systematic attempt at the development of what is now known as the Incandescent Gas Lighting system. The Drummond, or lime-light, was until recently in general use for the production of very high power lights, especially in theatres and for stereopticon practice, etc. This system, however, was not applicable to the ordinary conditions of gas lighting. A modification of the Drummond light was made by Tessie du Motay, in which he substituted coal gas for the hydrogen in the ordinary Drummond oxy-hydrogen flame. A burner exhibited at the Crystal Palace Electric and Gas Exposition in 1883, by Lewis, was constructed with a platinum mantle suspended over the flame, and designed to produce a high incandescence. This mantle, however, was unsuccesful, owing to the fact that it rapidly deteriorated by the reducing action of the gas. This burner was designed to operate with compressed air.

Clamond about the same time introduced a burner similar to the Bunsen type, in which he placed a mantle made of threads of magnesia. He also introduced an inverted pattern of burner in which a basket or mantle was made of magnesia threads held in a platinum basket. This burner, like the Lewis burner, was operated by compressed air, and was claimed to produce 4½ candles per foot of gas consumed, with a life of from 50 to 60 hours. Mantles in modification of the Clamond type were produced by C. B. Harris, in which he moulded a refractory material into sheets, pressed into the proper shape and perforated in any desired pattern. Attempts have also been made to make a mantle of asbestos or similar non-combustible material, and saturate this with a substance giving high incandescence.

The first commercially successful results accomplished in the field of Incandescent Gas Lighting were made by Dr. Carl Auer von Welsbach, of Vienna. Welsbach's work in this field began in 1880, in Bunsen's laboratory in Heidelberg, where he was studying the rare earths from a standpoint of pure chemistry. His attention was centred on the oxide of erbium. To produce a continuous light for spectroscopic study he saturated a cotton fabric with a solution of erbium, and after burning out the cotton suspended the residual ash in the flame. This produced an intense green light. The idea occurred to Welsbach to utilize this particular method for producing an ash fabric of incandescing material in the ordinary Bunsen gas flame. When this plan was communicated to Bunsen, he replied: "It appears most improbable that the oxides could be made to adhere." Welsbach, however, continued his experiments, choosing not erbium oxide, but oxides which would give a high white incandescence when heated. His researches led him through the entire field of the elements having stable oxides, and certain oxides of the so-called rare earths were found to give the most promising results.

The oxide of lanthanum made a perfect mantle in appearance and produced an intense glow in the colorless flame of a Bunsen burner, but the mantle was found to crumble to a powder within a short time.

Dr. Auer then began experiments with a view of mixing something with the lanthanum which would produce a non-slaking body. In 1887 what is known as the lanthanum-zirconium mantle was introduced. This mantle was made by saturating a closely knit cotton fabric with the proper mixture of zirconium and lanthanum nitrates, burning out the cotton and leaving a network of ash composed of the oxides of zirconium and lanthanum. These mantles gave 12 candle-power per cubic foot of gas consumed, and lasted several hundred hours. To quote Dr. Auer: "The sum of all these results appeared encouraging, and I was audacious enough to pronounce the endeavors of the gas engineers to increase the illuminating power of the open flame, as useless and vain; for it was evident that it was much more economical to renounce the lighting power of the open flame and to transform it into a Bunsen flame, and to get those substances to incandesce in the very hot part of that Bunsen flame, by which method two or three times the amount of light of an open flame could be attained."

The invention was now called to the attention of the public, and Welsbach delivered numerous lectures before the press representatives. The invention was named the Incandescent Gas Light by Mr. Sceps, editor of the *Neue Wiener Tageblätter*. The announcement of the Welsbach mantle was received with various comment, and many prominent engineers refused to take the matter seriously. Welsbach's confidence, however, was not shaken, and companies were formed for the development of the industry and the manufacture of the lighting fluid from the rare earths. The services of Dr. Ludwig Haitinger, an able chemical engineer, were added to those of Dr. Auer in the development of this work.

The increased efficiency of this method of lighting, however, was not what had been expected, and the public refused to take it up. The mantle rapidly deteriorated and required to be rejuvenated. At that time it must also be understood that these mantles were very fragile and in the early stages of the work they were delivered in the city of Vienna by a boy carrying one in each hand, as they would not bear the ordinary handling in transportation. The usual skepticism of the public in regard to new inventions prevailed, and the commercial failure of this enterprise seemed imminent. The Vienna factory was closed and the plant and laboratory sold. The American factory, under the direction of Waldron Shapleigh, was still producing with some success the lanthanum-zirconium mantle.

Welsbach, however, was not discouraged by these drawbacks, and devoted his entire attention to the development and improvement of the mantle. In the early 90's he went before the public with an entirely new mantle, which was composed of 99 per cent thorium oxide and 1 per cent cerium oxide. This mantle gave 24 candles per cubic foot of gas consumed. The present system of manufacture of mantles is entirely in accordance with this last invention of Welsbach's, which consists in saturating cotton fabric with the proper mixture of the nitrates of thorium and cerium, burning out the cotton fabric and tempering the mantle. It is then coated with collodion and packed for the market.

The development of the invention of Welsbach can be said to consist of three distinct stages:

1. The idea of saturating a cotton fabric with a lighting fluid, afterward burning out the cotton and tempering the ash.
2. The formation of the lanthanum-zirconium mantle which gave about 12 candles per cubic foot of gas consumed.
3. The thorium-cerium mantle, which gave 24 candles per cubic foot of gas consumed.

Various improvements have been made in the Bunsen burner and a large number of designs are now on the market; but the general Bunsen principle is strictly adhered to and the present Incandescent Gas Light is invariably produced by applying the incandescing material to the colorless Bunsen burner flame.

To show the wonderful development of the Incandescent Gas Lighting System attention might be called to the fact that the American Welsbach Company manufactured in 1903 20,000,000 mantles; the English Welsbach Company 10,000,000, and the combined Continental companies 60,000,000 to 70,000,000.

The wonderful ability of Welsbach as a chemist and inventor should also be noted, from the fact that the chemicals used in the production of the mantles were very rare and almost unknown, and that he was called upon to find the raw material for the production of these chemicals, and to invent processes for their extraction in a sufficiently pure state for use. All of this work was accomplished successfully after years of patient, painstaking endeavor.

Within the past decade the decorative side of gas-lighting has been all-appealing. The primary idea of gas lighting was illumination, but with a desire for greater comforts and more luxuries in the everyday life has come the desire for decorative effects. Globes, shades and domes are now made in many varieties. Color schemes of beauty are evolved, and artist and artisan combine to lend decorative worth to shape, color and treatment of the globe or shade which is destined to add to the bare illumination of the gas jet or the incandescent mantle.

Table showing efficiency of various systems of gas lighting in use at the present time:

System	Candles per Cubit Foot of Gas Consumed
Welsbach incandescent thorium-cerium mantle	22 to 24
Welsbach incandescent lanthanum-zirconium mantle	11 to 12
Siemens-Lungren burner	5 to 6
Argand flame	3 to 4
Bray burner	3 to 4
Fish-tail flame	1½ to 3

SIDNEY MASON,
President Welsbach Company.

Gas, Liquefied. The use of compressed ammonia gas has reached large proportions since 1890, and has proven a valuable aid in the preservation of food, the refrigeration of malt liquors, and the manufacture of ice. The introduction of the use of anhydrous ammonia has given great impetus to the manufacture of special machinery adapted to its employment in the departments named. Taken as a whole, its manufacture may be classed as a distinct industry. Although Prof. A. C. Twining, of New Haven, Conn., had in 1850 received a patent for an ice machine using ethyl ether, or other compressed gas, and had in 1855 a machine of one ton capacity in operation in Cleveland, Ohio, and although in 1867, and probably earlier, the ammonia ice machines of Ferdinand Carré were in active operation, this seems to have been the first allusion in the census reports to compressed gases, and no data are there given for them. At the census of 1900 returns were made not only for compressed or liquefied ammonia (known technically as anhydrous ammonia), but also for sulphur dioxide, carbon dioxide, nitrogen monoxide (known technically as nitrous oxide), oxygen, and liquid air, the manufacture being carried on during the census year in 30 different establishments regularly devoted to this business. In addition there were six establishments reported in which liquefied gases were produced as a subordinate part of the product, the major part of the product being in some instances other than chemicals. Besides, one idle establishment was reported. Taking the returns together, it is found that there were 37 establishments devoted to this manufacture, producing $1,220,297 of products and giving employment to 251 wage-earners and $2,185,535 of capital.

Of these establishments 19, employing 181 wage-earners and $1,650,094 of capital, were engaged in producing liquefied carbon dioxide, and the output for the census year amounted to 12,196,061 pounds, of a value of $708,864. In addition, 1 establishment using carbon dioxide in manufacture reported having produced and consumed 165,000,000 pounds of this gas during the year; but, though it was compressed, it was not liquefied for use. There was employed in the manufacture of the liquefied carbon dioxide reported above, 7,027 tons of magnesite, 2,011 tons of limestone, 774 tons of coke, and 4,771 tons of sulphuric acid, and among other products there were obtained 3,095,000 pounds of Epsom salts, 3,278 tons of calcined magnesite, and 5,000 bushels of lime. About 3,500,000 pounds of the carbon dioxide reported came from fermentation or from effervescent springs.

Ten establishments employing 52 wage-earners and $453,328 in capital were engaged during the census year in producing anhydrous ammonia, and the output for the year amounted to 2,443,729 pounds, having a value of $448,157, and there were consumed in this manufacture 2,148 tons of ammonium sulphate, 4,199,708 pounds of aqua ammonia, and 83,402 bushels of lime.

Carbon Dioxide (carbonic acid gas, CO_2).—Carbon dioxide was liquefied by Faraday in glass tubes as early as 1823, through the pressure resulting from the gas being set free from combustion. In 1834 Thilorier operated this method on a much larger scale by the use of wrought-iron cylinders in place of the glass tubes. He discovered that by allowing the liquid to rapidly evaporate the reduction in temperature was so great that a portion of the CO_2 became solid. By moistening this solid CO_2 with ethyl ether he obtained a temperature of —100° C. In 1837 Dr. John Torrey, of New York, liquefied this compound in tubes and applied the liquid to guns as a propellent. In 1844 Natterer invented a pump by which very high pressures were obtained, and through which the liquefaction of carbon dioxide could be better accomplished than by the self-compression method previously used. In all these case when liquefying carbon dioxide, the gas was not only subjected to pressure, but it was also cooled. In 1869 Prof. W. N. Hill, at the United States naval torpedo station, Newport, R. I., proposed the use of liquefied CO_2 in torpedoes. In June-August, 1873, he made more than 500 pounds of the material, and the manufacture was continued at the station at intervals for some years.

In a private communication, from John B. Stobaeus, of Charles Cooper & Co., Newark, N. J., it appears that he began the liquefaction of carbon dioxide on a commercial scale in the United States in July 1884, and put the product on the market. The gas was generated from magnesite imported from Greece, by reaction with sulphuric acid, and the by-product was Epsom salts. The material was sent to the trade in steel tubes weighing about 27 pounds each, and these tubes were fitted with a valve, having a conical seat, which was invented by Mr. Stobaeus. The books of this firm show that 1,188 cylinders, containing 14,256 pounds of CO_2, were produced in 1885, and 10,704 cylinders, containing 128,448 pounds of CO_2, in 1891. The manufacture has since been taken up by others, and in addition to the method used by Mr. Stobaeus the carbon dioxide is now obtained by burning magnesite, by which magnesia is obtained as the by-product; or dolomite, by which a cement is obtained as the by-product; or marble or limestone, by which quicklime is obtained as the by-product; by treating marl with sulphuric acid; and by burning coke. The carbon dioxide issuing from effervescent mineral springs, and that produced in the fermenting tubs during the brewing of beer, is also collected and liquefied. In all of these processes the gas is washed and otherwise purified before compression.

From the data given by Mr. Stobaeus it appears that the cylinders supplied by his firm held 12 pounds of CO_2 each. The American Carbonate Company, of New York, advertise to supply cylinders in two sizes, containing 10 and 20 pounds of CO_2, respectively, representing 600 and 1,200 gallons of gas, the net weight of the cylinders being 27 and 70 pounds. Several of the companies announce that the cylinders are tested for a pressure of 3,700 pounds per square inch.

Compressed carbon dioxide is used in charging soda water, mineral water, cider, beer, and other effervescent drinks. By attaching a charged cylinder of the gas, governed by a proper regulating valve, to a barrel of beer or other beverage the liquid is not only continuously charged with the gas, but by the gas pressure the liquid is forced to the point where it is desired to serve it. By its use the old art of "krausen," which consisted in adding to stored beer, as it was being casked or bottled, some beer in the first stages of fermentation, has been displaced. Carbon dioxide is used in the manufacture of salicylic acid and of many carbonates. It is proposed for use as a medicinal agent by inhalation and in baths; for raising dough in the manufacture of aerated bread; as a refrigerating medium; as a buoyant material in raising wrecks or preventing disabled ships from sinking; and for extinguishing fires, R. Ogden Doremus having found that but 20 per cent of CO_2 in the air of the locality where fire exists is sufficient to arrest the progress of the flames. It has been used by the government as a motive power for automobile torpedoes.

Anhydrous Ammonia.— This material is the chemical substance ammonia (NH_3) in a pure and dry condition and in a compressed and liquefied state, and it is manufactured by the distillation of the ordinary 26° ammonia of commerce in a suitable apparatus. This apparatus, which should be of sufficient strength to stand a pressure of 65 pounds to the square inch, comprises a still, a condenser, three separators, and a drier or dehydrator. The still is heated by a suitable steam coil to a temperature of about 212° F., when the ammoniacal gas, together with a certain amount of water, passes off into the first separator, which latter is usually situated on the top, and forms an upward extension of, the still. In this first separator the greater portion of the watery particles carried over are eliminated by a series of perforated plates, through the perforations of which the gas had to pass, and are returned to the still through a dip pipe. From this first separator the partly dried gas passes through a water-cooled worm in the condenser, and then successively through the two other separators to the drier or dehydrator, where it is passed through a set of similarly perforated plates to those in the first separator, but having small-sized lumps of freshly burnt lime placed upon them, by which any moisture that may still remain in the gas is removed, and the completely anhydrous product can then be passed into the ammonia pump or compressor. It is found advisable to work the still at a pressure above 30 pounds to the square inch, so as to admit of the liquid being raised to a slightly higher temperature than the boiling point of water at atmospheric pressure, without causing the water to boil, the result of this being that the whole, or practically the whole, of the ammonia will be set free, while at the same time the least possible amount of the water will be vaporized and passed over with the ammonia gas.

Or it may be obtained from ammonium salts by heating them with lime and treating the gas as above described. The salt usually employed is ammonium sulphate. Aqua ammonia, or ammonia water, is of different strengths, according to the amount of NH_3 dissolved in it, but the standard strength has a specific gravity of 26° Baumé, and it contains 38.5 per cent by volume, or 26.6 per cent by weight of anhydrous ammonia. Thus 3.76 pounds of 26° ammonia will be required to make 1 pound of anhydrous ammonia. An excellent table of yields of anhydrous ammonia from 26° ammonia is given by Iltyd I. Redwood. The ammonium sulphate or sulphate of ammonia of commerce is reckoned as containing 25 per cent of anhydrous ammonia.

It is believed that some at least of the owners of ice machines produce the anhydrous ammonia that they employ, either in originally charging their machines, or in making good any loss which may take place, but there are no returns on this point. It appears also that there is some anhydrous ammonia imported, the report on «The Foreign Commerce and Navigation of the United States» from the Treasury Department placing this at 14,210 pounds, having a value of $5,870 for the year 1891, but the data for such importations as may have occurred in other years of the past decade do not appear separately.

Although Fourcroy and Vauquelin and, at about the same time, Guyton de Morveau, announced that they had accomplished the liquefaction of ammonia gas, it is believed that, as they had no suitable means for drying the gas, they failed to obtain the anhydrous ammonia. It was first certainly liquefied by Faraday in 1823, and it was not long before it was being produced in considerable quantities. Larkin and Scheffer began the commercial manufacture in St. Louis, Mo., in 1879.

Anhydrous ammonia appears, as stated above, to have first been used for refrigeration by Ferdinand Carré in his absorption machine, but it was not long before it was employed in compression machines of the type invented by Perkins and Twining, based on the refrigerating principle, which was demonstrated by Doctor Cullen in 1755; and although it has had to compete with ethyl ether, carbon dioxide, sulphur dioxide, and air, it is to-day the material which is most largely used in ice machines, and this is the principal use for this substance, though recent researches indicate that other uses will soon be found for it in chemical manufacture and in other arts.

Sulphur Dioxide (sulphurous acid gas, SO_2).— This substance is produced by burning sulphur in air or oxygen, 1 pound of sulphur giving 2 pounds of sulphur dioxide. It was liquefied by Monge and Clouet about the beginning of the 19th century. The liquefied sulphur dioxide is now a regular article of commerce, and is sent into the trade in glass «siphons» and in iron flasks, as being a convenient means of transportation and storage of the substance for use in chemical laboratories and in manufacture. The liquid has found some use in ice machines. The substance is used as a reducing agent, as a bleaching agent, and as a disinfectant. Hardin states that at present (1899) «about 4,000,000 kilogrammes of this liquid are being prepared annually.»

Nitrogen Monoxide (hyponitrous oxide, nitrous oxide, laughing gas, N_2O).— This body is prepared by heating ammonium nitrate to a temperature not exceeding 258° C., when the gas is evolved. It is carefully purified, well washed, and then compressed in steel cylinders. This gas was first liquefied by Faraday in 1823. The Lennox Chemical Company began the liquefaction of the gas for the trade at Cleveland, Ohio, in 1883. The exhilarating properties of the gas were discovered by Sir Humphry Davy, who was the first to inhale it, in 1809, and it then received the name of laughing gas. It is now used as an anæsthetic agent in minor surgical operations, especially in dentistry, its use for this purpose having been suggested by Dr. Horace Wells, and it was first applied by him in the extraction of a tooth at Hartford, Conn., 11 Dec. 1844.

Oxygen.— This gas, as commercially supplied in the compressed condition, is produced by heating potassium chlorate mixed with black oxide of manganese. It is sold in the market for use in medicine by inhalation, when it is usually mixed with nitrous oxide, essential oils, and other bodies which are believed to possess therapeutic qualities. Liquid oxygen is not known to be produced commercially except as referred to under liquid air, but it was the first of the so-called permanent gases to be liquefied, this having been independently effected by Pictet and Cailletet in 1877.

Liquid Air.— Atmospheric air is a mixture of approximately 21 per cent of oxygen and 78 per cent of nitrogen by volume, with ninety-four one-hundredths of 1 per cent of argon, about four one-hundredths of 1 per cent of carbon dioxide, and variable quantities of water vapor, ammonia, and other bodies, according to locality and conditions. After 1823, when Perkins erroneously believed that he had liquefied air, numerous unsuccessful attempts were made to accomplish this result, but in 1877 Raoul Pictet and Louis Cailletet, working independently in Switzerland and in France, achieved the result on a small laboratory scale, and it was later repeated by Wroblewski, Olszewski, and Dewar, who improved the methods so as to notably increase the yields, and in 1893 Dewar froze air into a clear, transparent solid. The liquefaction of air on an industrial scale began about this time with the invention of the machines of Linde, Hampson, and Tripler, and later those of Ostergren and Burger, Dewar, Kuhn, Chase, Code, O'Doherty, Johnson, and others.

The methods may be classified as the cascade method of Pictet, Cailletet, Wroblewski, and Onnes; the self-intensive motor method of Siemens, Kuhn, and Johnson; the countercurrent free-expansion system of Linde, Hampson, Tripler, Ostergren, and Burger; and the self-intensive work method of the American Liquid Air Company, known as the Ala system. Emmens states that the principal features of the method to effect the liquefaction of air on a commercial scale were clearly described in the specifications of British patent No. 2064, granted to Charles William Siemens in 1857.

Owing to the complex composition of air, several different products are obtained by its liquefaction, notably liquid oxygen and nitrogen and solid carbon dioxide. Pictet has invented a separator by which these bodies may be rapidly separated for use, and there is thus drawn off at —70° F., solid carbon dioxide; at —290° F., commercial oxygen gas of 50 per cent purity; at —296° F., oxygen gas of 99 per cent purity; at —300° F., liquid oxygen and nitrogen gas of 95 per cent purity; at —310° F., nitrogen gas of 99 per cent purity; at —312° F., liquid air; and at —316° F., liquid nitrogen.

While many commercial uses for liquid air have been proposed, it is not known to be so used at present. It may, however, be now looked upon as a source of oxygen which promotes combustion and enables man to obtain high temperatures and high illuminating power, but it is not yet proved that this method of heating and lighting can compete economically with electricity. Liquid air does enable man to readily obtain low temperatures, which can be usefully employed in chemical operations, and a continually extending use may be looked for in this direction. Elihu Thomson has pointed out that it may find a useful application in increasing the efficiency of conductors of electricity.

Chlorine.— This gas, which may be produced by the action of muriatic acid on black oxide of manganese or by the electrolysis of common salt, is produced commercially abroad in the liquid state, but no returns are made of it in this country. It is used in chemical manufactures and for bleaching and disinfection. It is sent out to the trade in iron cylinders.

Gas, Manufactured, in America. To relate the entire history of the industry of gas-lighting it is necessary to go back no further than the beginning of the 19th century. Moreover, this statement is just as true concerning other countries as it is in relation to the United States, for while William Murdock, of England, and Philippe Lebon, of France, began to investigate the possibilities of manufacturing and distributing illuminating gas distilled from bituminous coal late in the 18th century, it was practically the dawn of the 19th century before these experiments has resulted so successfully as to establish the practicability of the project. As the question as to whether the credit for the discovery of gas properly belongs to Murdock or to Lebon is still unsettled in the minds of scientists it is useless to attempt to discuss it in such a brief review of the gas industry as this must be.

So far as we have any record the first use of illuminating gas in the United States was in 1806, when David Melville, of Newport, R. I., lighted his house and the street in front of his residence with gas made by him upon his premises. This was fully one year before the first public gas-lighting experiments were given in England, although Murdock claimed to have lighted his place in Old Cumnock with gas manufactured by himself, a little less than nine years prior to the Newport experiment. In Melville's case, however, the question of prior invention was scarcely considered. Encouraged by his success in a project that was purely original with him, he continued to improve upon his process until, in 1813, when his apparatus was so nearly perfect that he decided to patent it. A year or two later he undertook his first big contract, which was to light the cotton mill at Watertown, Mass. This being successful he applied his gas invention to the lighting of another mill at Providence, R. I., and, in 1817, he introduced his system in the illumination of lighthouses.

It was from these small beginnings that the present great industry of gas manufacture in America has grown. It was a slow growth at first, but, gradually, as the apparatus for its manufacture improved, and man's knowledge of the physical laws involved became more accurate, it began to show a more rapid increase. The first company regularly established to manufacture gas was chartered in Baltimore, Md., in 1816. In 1822, Boston adopted the gas system of lighting. In 1823, a lighting company was organized in New York, and during the next three years gas was introduced in New York city, Brooklyn, and Bristol, R.I. In 1835, the New Orleans Gas-Light Company was chartered to manufacture the new illuminant, and these were the pioneer companies in the United States. From 1835, however, the organization of such corporations continued with great rapidity, until almost every progressive city in the country was provided with a gas-lighting plant. In 1859, according to the statistical tables prepared by the "American Gas-Light Journal," there were 297 companies in the United States, working with a capital of $42,861,174, supplying a population of 4,857,000, through 227,665 private meters, while the extent of the growth of the industry from

1860 to 1900, which, while they fall below those given in the «Directory of American Gas Companies," have been pretty generally accepted by persons looking for a conservative estimate. According to the census statistics, therefore, there were in the United States, in 1900, no less than 877 gas establishments; their capital invested was in excess of $567,000,000; the value of their products aggregated $75,716,693, of which amount $69,432,582 was received directly from the sale of gas. The figures of the 12th census show an increase of nearly 84 per cent. in the amount of gas sold during the last decade of the 19th century, and while it is impossible to give anything like an authoritative statement of the number of premises at present supplied in all parts of the United States, there is little reason to believe that the estimate which places the aggregate at more than 2,000,000 is an excessive one. Several years prior to the census year it was reported that there were 134,447 premises supplied with gas in the State of Massachusetts, and more than 153,500 premises in the city of Philadelphia alone.

As the Philadelphia gas-works is operated by the city it has records which are open to the inspection of the historian. Moreover, as its history is typical of that of other early plants established to supply gas to the consumer, its story is an excellent illustration of the development of the gas corporations of that day. The first attempt to manufacture gas in Philadelphia was made in 1815. At this time it was proposed to use wood, but the experiments failed. From that day, therefore, the matter was dropped until the winter of 1826-7, when several influential citizens appeared as advocates of a project to erect gas-works and light the city with gas made from coal. Although favorably regarded in many quarters the proposition was defeated owing to the strong opposition of other Philadelphians of high standing, all of whom claimed that the introduction of gas would be dangerous to the life, limb, and health of the people. Unable to overcome such a tide of popular disapproval of the scheme, the project was dropped until 1835, when an ordinance providing for the construction and maintenance of gas-works and the distribution of gas was finally passed. According to the provisions of this ordinance, stock was issued to the amount of $100,000, and it was estimated at the time that the lighting of the entire city would require the operation of some 20,000 burners, each capable of consuming an average of four feet per hour. The plant was so fully completed as to be put into operation in 1836, and, in 1837, 17,000,000 cubic feet of gas was distributed, 6,816 private burners, and 301 public lamps being supplied. Compare this record of the first year's operations with that of the census year, when the sales in Philadelphia aggregated 7,055,559,210 cubic feet, at an average of $.0761 per 1,000.

The story of the development of the New Orleans Gas Company shows a similar growth. In 1830, the company had an output of 7,300,000 cubic feet, at $7 per 1,000; in 1840, the product had increased to 20,075,000 cubic feet, but the price was unchanged; in 1850, the output was 53,562,000 cubic feet, at $5 per 1,000; in 1860, 132,418,000, at $4.50 per 1,000; in 1870, 236,468,000, at $4. The effect of the panic of 1873 was to cause such serious depression in every line of business in New Orleans that gas sales were naturally reduced, so that, in 1880, they amounted to only 230,296,000, at $2.70 per 1,000. The period between 1880 and 1890 saw a change in the candle-power, the gas which had previously been about 16.5 being raised to 33. Thus while the record of sales for 1890 shows a consumption of only 181,497,000 cubic feet, the increase in the candle-power made the total illuminating value of the gas sold in 1890 equal to fully 363,000,000 cubic feet of the gas sold in 1880.

It was in 1837 that seven of the prominent citizens of Cincinnati procured a charter for the purpose of making and selling gas in that city. In 1843, the capital of the company was nominally $100,000, although it is scarcely probable that even so much as half that sum had been expended in building the works and the six miles of mains through which they operated. In the beginning, $3.50 per 1,000 was the price charged for gas in Cincinnati; in 1846, it was reduced to $3; in 1854, to $2.50, and since that time it has enjoyed periodical reductions until the present day, when it is sold at the price of 75 cents per 1,000 cubic feet. On 1 Jan. 1847, the company had 546 meters and 192 public lamps in use, these being supplied through 32,487 feet of main pipe, ranging from two to eight inches in diameter. In New York, the story is a similar one, for while the first company was started with small facilities, to furnish a few thousand meters and a comparatively small number of public lamps, the system had been extended to meet new requirements, until, in 1900, the annual sale of gas in New York aggregated 18,180,821,125 cubic feet, or 27.1 per cent. of the total sale of the entire country. The rate in New York during this census year was $0.905.

In the early days in the history of gas manufacture in America, soft or bituminous coal was practically the only material used. In some sections of the South gas was manufactured from rosin and pine-wood, and, during the War times, when the existence of the blockade made it almost impossible to obtain coal, nearly all the towns were glad to employ these materials in the making of gas. Compared to the old-fashioned whale-oil lamps and the tallow dips, even the wood-made gas seemed like a brilliant illuminant, whereas the best gas of that day — that which was manufactured from the soft coal — bore only a remote comparison to that which is sold at the present time, the soft coal gas having an illuminating value which was approximately not more than from 15 to 17 candle-power.

It was about this time that M. Tessie du Motay, a Frenchman, and Professor T. S. C. Lowe, the famous American æronaut, began their independent experiments in the manufacture of gas by the dissociation of steam in contact with incandescent carbon. The result of these two series of experiments, both of which were conducted in the United States, was the discovery of Du Motay's cupola-retort system, and the development of the generator-superheater system of Prof. Lowe, the latter being the most important of all inventions that had yet affected the manufacturer of gas thus, as may be seen, it was to America that the world owes the discovery and development of the water-gas system of lighting.

The introduction of the two new systems of gas manufacture was an event of vital importance to the industry. The Municipal Company of New York was the first to construct a large plant under the Du Motay system. By this process non-luminous water-gas was generated in cupolas, carburetted with oil vapor, and passed through retorts externally heated, the gas thereafter being condensed and purified by processes very similar to those of coal-gas and other water-gas systems. Important as this improvement was, it was the Lowe process — covered by patents dated 1872 and 1875 — that was actually the basis of the modern water-gas system. It covers, broadly, the use, in connection with a generator in which non-luminous gas is made, of a super-heater, or fixing-chamber, fired by internal combustion, the combustible being the gases which are formed during the process of "blowing up;" that is, during and from the passage of air through the fuel in the generator. The fuel used in this generator is hard coal, or coke. The air is blown through it at a high velocity, which raises the fuel to a condition of incandescence, which fits it to dissociate the steam that has been admitted during the gas-making period. Lowe's process also covered the introduction of oil, or other enriching substances, into the non-luminous gas, and the fixing of this oil by passage through the superheater. The first attempt to introduce the Lowe system was made at Phenixville, Pa., in 1873. A few months later, the inventor himself erected his apparatus at Conshohocken, Pa., and at Columbia, Pa.

The method which is now used in the making of water-gas is the double superheater, or improved Lowe apparatus, which was developed by the United Gas Improvement Company, the owners of the now-lapsed Lowe patents for the greater part of the country. Of course, many modifications of the two water-gas systems have been made and patented during the past quarter of a century, but none of them have been of so much importance as to deserve special attention, and while the first years of the fight for the introduction of water-gas was waged against the most bitter antagonism on the part of the coal gas interests, the product of the later inventions was so much superior in every way to the old-time coal-gas, that its growth, after it had once obtained a foothold, was very rapid. In 1880 there were less than 90 water-gas plants in the United States — about 75 of the Lowe type and 12 of the Tessie du Motay type, to be as exact as possible — but in 1890 the number had extended to such an extent that there were no less than 260 of the Lowe plants and fully 30 of the Du Motay plants in operation. By that time every city in the United States that could boast of a population of more than 400,000 had introduced water-gas, wholly or in part, while all but six of the cities with more than 50,000 inhabitants had gas made by one of these processes. Since 1890 the ratio of water-gas as compared to coal-gas has further increased until the former now represents fully 75 per cent of the total product of the country. The largest water-gas plants in the United States are the Tessie du Motay plants in New York and Baltimore, and the Lowe plants in Chicago, Boston, Providence, and the 25th Ward Works, in Philadelphia.

The victory of the water-gas interests was due to perfectly logical causes for each of the many arguments which finally obtained for the system such widespread adoption was based upon a demonstrative point of advantage. Its influence upon the mind of the consumer, however, was largely due to its advantage in the matter of candle-power. Whereas the coal-gas averaged about 15 candle-power, the water-gas that is sold is of candle-power varying from 22, which is probably the minimum, to its 25 candles in Pensacola, 33 in New Orleans, and 30 in New York, and with a probable average throughout the country of from 25 to 27 candles. Compare this, from a luminating point of view, with the conditions existing in England, where here are some companies that are chartered to furnish gas of 14 candle-power, and where not over 5 per cent of all the gas manufactured is in excess of 17 candle-power. In its ratio of purity the American water-gas is equally fortunate. The English law, for example, permits 20 grains of sulphur in forms other than sulphuretted hydrogen, and three grains of ammonia for every hundred cubic feet of gas, whereas the average of sulphur per 100 cubic feet of gas sold in the United States is seldom as great as 12 grains, while of ammonia there is only the merest trace. In one long series of analyses, which extended over a period of fully 10 years, it has been shown that the gas manufactured by this particular city contained less than 10 grains of sulphur per 100 cubic feet, and practically no ammonia.

If it had not been for the development of the water-gas process the industry of gas manufacture in American would not improbably have been doomed. The invention of this new system came at a day when the gas manufacturers were already trying to devise means of competing against cheaper oil and the improved oil lamps. A few years later the electrician appeared, and his coming had a most disastrous effect upon gas-making companies and the value of their shares. The introduction of the water-gas system, however, and the development of the improvements which followed its introduction, have been the factors which have enabled the gasman to hold his own. Although in some respects electricity furnishes a more desirable light, the high candle-power of water-gas makes it a cheaper illuminant, unit for unit, than the cheapest incandescent electric lamp. Thus, while the introduction of electric lighting systems has made some inroads into the use of gas for street lighting, and, to some extent, has reduced the sale of gas to the private consumer, practically all of the losses that may be traced to such sources have been offset by the fact that so many other uses have been found for gas besides that of illumination. The gas stove for heating and cooking purposes, the gas-engine, and the many other mechanical devices for the utilization of gaseous fuel are developments of this idea, and this branch of the business has grown so rapidly that fully 60 per cent of all the gas produced in this country is now used for fuel purposes. Then came the Welsbach lamp, the invention of Auer von Welsbach of Vienna, which made the illuminating power of the best burners from five to seven times greater than before, and this so cheapened gas that it once more placed the gasman in a position where he could compete with the purveyor of electric illumination.

As the American gas business stands to-day it is in every sense of the word a home industry, being one of the domestic industries which is entirely independent of foreign countries for the material which it uses. When the New York Gas Company was incorporated in 1823 it made its first gas from oil; later rosin was used, and, by 1860, it was distilling English coals. During that period most of the companies imported the material from which their gas was made. Most of it came from England. Finally, however, they began to use the product of the American mines and it was soon found that none of the soft coals that could be used for gas-making purposes was superior to the bituminous coals mined in this country. The making of watergas called for no further importations. In view of the substances from which it is made — anthracite and petroleum — there is no country in the world that can produce better materials than the United States, and while, up to a few years ago, cannel-coal was imported from Scotland and Australia for the enrichment of coal gas, beds of such coal, equal to any in the world, have since been found in the United States. So, too, as to the meters and clay retorts, which were once imported from Europe. Years ago they were supplanted by American-made goods and the gas concerns never had any that gave better satisfaction. During the early years of the gas lighting business — in fact, up to 1870 — lime was the purifying agent used by American manufacturers to the almost complete exclusion of other materials. About 1880, however, the use of oxide of iron was introduced. To-day more than three-quarters of the gas made in the United States is purified by this agent.

To tell the story of the birth and development of the gas industry in America without reference to the municipal ownership and management of gas proprieties would he impossible. Because of the dissatisfaction which was certain to exist in view of the monopolistic privileges enjoyed by some of the companies under their old charters, such things as legislative investigations and judicial injunctions were inevitable. In some places relief has been sought in the adoption of municipal ownership. Of course, it may be admitted that the charters granted during the early days were extremely favorable to the companies. It must be remembered, however, that gas-making was then an untried field and that some inducements were necessary to tempt capital to enter such an uncertain industry. As the result important concessions were offered in the form of exclusive franchises, etc., but since it has been shown that the business is a safe and profitable one legislation has been far more exacting.

Gas, Natural. *Early History.*— Natural gas is chiefly a natural combination of carbon and hydrogen, which is only about 60 per cent as heavy as air, and is highly inflammable. Its existence has been known since the earliest records of the human race as a curiosity. Perhaps the earliest historical record of the use of natural gas is that of the Apollo Oracle at Delphi in Greece, about one thousand years before the Christian Era. The Chinese are credited with the practical application of this fuel to the evaporation of salt brine for centuries.

The fire worshippers on the shores and islands of the Caspian Sea, Russia, and those of Punjab, India, have preserved a continuous flame in their temples, caused by a steady flow of natural gas for centuries. In after years it caused the deadly explosions in the deep coal mines in Europe and America, being known to the miner as fire damp. Its existence in the United States has been known since the first white men crossed the divide and explored the Ohio River watershed, as the Indians invariably conducted them to these natural vents, and, setting fire to them, viewed the effect with a semi-religious veneration. The discovery of vast reservoirs, sealed up in the porous rocks of the United States and Canada, is of recent years. The artesian driller, searching for salt brine, knew of its presence since the first wells were drilled on the western flank of the Appalachian uplift; afterward the driller in search of petroleum encountered it, but by both of these early prospectors it was considered a source of danger and annoyance. It frequently caught fire, causing loss of life and destruction of the drilling outfit by a sudden outburst.

The earliest economic use of natural gas known in the United States occurred in 1821, when it was used for the illumination of the village of Fredonia, N. Y. A well one and one half inches in diameter was drilled to a depth of 27 feet near a noted gas spring and for many years supplied the village with 30 street lights.

In 1838 a water well dug at Findlay, Ohio, encountered such quantities of a foul smelling gas that it was abandoned for the original object. It was subsequently covered up and conveyed to a house near by and utilized for domestic fuel and lights for nearly 50 years.

About the year 1841, natural gas was found in a well near Charleston, W. Va., which also supplied salt brine, from which it was separated and for many years used as a fuel for making salt.

More or less natural gas was developed in the rush to find petroleum in the valley of Oil Creek in the winter of 1859 and the year following.

One of the first attempts to employ natural gas for fuel purposes was at a well drilled at Erie, Pa., in 1868, which was soon followed by many others; these wells were only 600 feet in depth and supplied from one to three families each. Titusville, Pa., enjoys the distinction of installing the first modern equipped natural gas plant, as well as the first well drilled for petroleum. This plant was constructed during 1872, 13 years after the first oil well was drilled by Col. Drake.

During 1873 natural gas was introduced into many of the villages of Butler and Venango counties for light and fuel, being supplied from wells drilled not far distant in prospecting for petroleum. In the year 1875 the first long line (17 miles in length) was built; the pipe used was 6¼ inches in diameter, supplying the natural gas produced from the Harvey well at Larden Mills, in Butler County, Pa., to a large manufacturing plant known as the Etna Iron Company on the Allegheny River, a few miles above Pittsburg. In the 10 years that followed slow progress was made in the actual use of the known gas wells; many were utterly ruined by pulling the casing and allowing the inflow of water, which gradually sealed up the rock and prevented the flow; this was after a struggle for years. Others were allowed to escape into the air for years. There seemed to be an uncertainty in the minds of all, as to the lasting properties of this natural product.

In the year 1876 the large Haymaker well was drilled in at Murraysville, Pa., and was not utilized until the year 1883, when its product was piped to Pittsburg. By the close of 1883 a number of pipe lines were supplying Pittsburg and the Beaver Valley with natural gas from a number of good gas wells drilled in Washington, Beaver and Butler counties. During May 1885, the first natural gas well from the deep Speechly sand was drilled, seven miles south of Oil City, Pa. During the same year the remarkable deposit of natural gas in the Grapeville pool, near Greensburg, Pa., was also found.

These numerous natural reservoirs at this period with their initial pressure seemed to convey the impression that it could be found in almost any locality and that the supply was practically inexhaustible.

In 1885 the large natural gas fields near Findlay, Ohio, became prominent and the year following large wells were also found in Indiana. These latter developments seemed to give additional assurance of its unlimited supply.

In Pennsylvania, Ohio, and Indiana immense quantities of gas were consumed in the most wasteful manner and in the extravagant display, which in numerous instances turned night into day. The effect upon witnessing mile after square mile illuminated by the burning of escaping wells and torches produced an impression long to be remembered. This extravagance and waste were not realized until many of the then known fields began to show a serious decline in the rock pressure and, knowing the original pressure, it was a simple calculation to show that a large percentage of the quantity of natural gas originally contained in the natural reservoirs had been withdrawn and that something must be done to stop the waste. Even then the reforms were slow and gradual and many companies became bankrupt. It was not until the general introduction of the gas meter in 1890 and 1891 that economy in its use by the consumer was inaugurated. Formerly the natural gas was sold by the size of the orifice through which it was delivered without regard to the manner of its combustion and use. The metre made it to the interest of the consumer to use this convenient fuel in an economical manner. It is estimated that under the metre system a saving of fully one half the gas required to accomplish the same results was made. Another economical improvement introduced consists of shutting in the wells when their flow is not required; their closing or opening being regulated by telephone from a central office. The wells are also more carefully watched and the salt water removed by pumps, instead of by blowing out as formerly. The pipe lines were thoroughly overhauled for leaks and the new pipe afterward used was heavier and of larger diameter, being supplied with heavier thimbles or improved rubber-packed joints. In the cities and towns larger distributing mains are used and a greater number of regulators secured — thereby maintaining a more even pressure — throughout all the changes in consumption, due to changes in temperature.

Production of Natural Gas in the United States.— No other country enjoys the luxury of natural gas to the extent of the people of the United States. It is used in Canada and in a very limited way in England, Germany, Rumania, Galicia, Russia, Persia, India, China, and Japan, but all these countries combined use only 2 per cent of the known world's production of this efficient and convenient fuel, leaving 98 per cent to be consumed by the people of the United States. The total value of the natural gas produced and sold since its introduction, commercially, in the United States, in 1872, up to the close of 1904, was $395,298,090. The following table is compiled from the reports of the United States Geological Survey and shows the value of the production of natural gas in the United States from 1872 to the close of 1904:

YEAR	Value	YEAR	Value
1872 to 1884.	$ 9,100,000	1895..........	$ 13,006,650
1885..........	4,857,200	1896..........	13,002,512
1886..........	10,012,000	1897..........	13,826,422
1887..........	15,817,500	1898..........	15,296,813
1888..........	22,629,875	1899..........	20,074,873
1889..........	21,107,099	1900..........	23,698,674
1890..........	18,792,725	1901..........	27,066,077
1891..........	15,500,084	1902..........	30,867,863
1892..........	14,800,714	1903..........	35,815,360
1893..........	14,346,250	1904..........	*41,725,000
1894..........	13,954,400		
		Total......	$395,298,090

*Estimated

Assuming that 8 cents per 1,000 cubic feet was the average price for this period, this value should represent 4,941,226,100,000 cubic feet in amount. If it were possible to confine this immense quantity in a tank whose end was one square mile in area it would require to be 336 miles in length. Its heating value would equal 247,561,000 tons of coal. Large as this quantity seems, it is quite probable that it does not represent one half of the actual quantity taken from the earth's rocky reservoirs since the discovery of petroleum. The early (and in some cases the more recent practice) in developing petroleum fields, was to allow large quantities of natural gas to escape unconsumed. It is often found in the strata above that containing the petroleum and at thousands of oil wells it has been permitted to exhaust itself into the air.

Value of Natural Gas and Petroleum and Their Combined Value, by States, in 1903.— The combined value of natural gas and petroleum produced by 20 States and Territories amounted, in 1903, to $130,509,410, which is greater by $28,462,637 than $102,046,773, the combined value in 1902. Of the combined value for 1903, 27.4 per cent is the proportion furnished by sales of natural gas and 72.6 per cent is the proportion furnished by the sales of petroleum. The value of all the coal produced in the United States in 1903 was $503,724,381. In

1902 the proportion of the value of the natural gas to the petroleum produced was as 30.2 per cent to 69.8 per cent, a comparative decrease in 1903 of 2.8 per cent. These two products are so intimately connected in the strata and methods of development, that their separate and combined value by States for 1903 is appropriate and interesting.

shut in and the gas held in the rock when not in use.

The reservoirs in which natural gas is usually found stored when pierced by the drill, are composed of porous sandstone or limestone. In some cases a limited quantity of the gas has been found in shales, but this gas may be regarded as having gradually accumulated from

State	Value of Natural Gas	Value of Crude Petroleum	Value of Natural Gas and Crude Petroleum
Pennsylvania	$16,182,834	$18,170,881	$34,353,715
Ohio	4,479,040	26,234,521	30,713,561
West Virginia	6,882,359	20,516,532	27,398,891
Indiana	6,098,364	10,474,127	16,572,491
Texas	21,351	7,517,479	7,538,830
California	104,521	7,399,349	7,503,870
New York	493,686	1,849,135	2,342,821
Kansas	1,123,849	988,220	2,112,069
Kentucky and Tennessee	390,601	486,083	876,684
Colorado	14,140	431,723	445,863
Louisiana	....	416,228	416,228
Indian and Oklahoma Territories	1,000	142,402	143,402
Arkansas and Wyoming	2,460	62,720	65,180
Missouri and Michigan	7,070	4,650	11,720
South Dakota	10,775	....	10,775
Illinois	3,310	....	3,310
Total	$35,815,360	$94,694,050	$130,509,410

The States that produce large quantities of natural gas, as Pennsylvania and West Virginia, distribute it to the adjoining States by a system of pipe lines, so that in some instances the natural gas consumed in a town or city is produced over 200 miles from where it is consumed. Ohio is conspicuous in the table because it consumed much more than it produced, while West Virginia produced much more than it consumed.

Natural Gas Wells and Structural Conditions of Strata.— There is a great variation in the depth of natural gas wells, owing to the diversity of the strata in which the product exists and the changing position of the underlying rocks with reference to the general surface. Some natural vents have produced natural gas in considerable quantities and have proved the incentive for drilling down to the original reservoirs, from which the gaseous fluid was escaping. Other gas wells have been discovered in drilling wells for oil or salt brine. Some of the most important gas fields have been located by expert geologists, who have traced out the summits of the anticlinals, or rock waves, for many miles from surface exposures of the strata.

The depth of wells varies from 250 to 3,000 feet, while their diameter varies from 2 inches up to 8 inches; their output, or open flow, varies from 500 cubic feet per day to 35,000,000 cubic feet per day; their shut in, or rock pressure, varies from 1 to 1,500 pounds to the square inch in extreme cases, while 300 to 400 pounds to the square inch and a volume of 1,000,000 cubic feet per day is considered a very fair well. In many of the deeper wells, two or more reservoirs of natural gas are often found. The cost varies from a few hundred dollars in the shallow shale districts to $10,000 in the deep wells in West Virginia. All large wells are usually tubed and a packer set just above the gas sand; the top of the tubing is held by clamps attached to bolts that are anchored and a heavy gate valve attached, so that the well can be

the underlying rock formation. Almost invariably the large reservoirs have been developed in the strata on or near the crests of the anticlinal or rock waves, while petroleum has been generally collected on the lower horizon; and frequently salt water is found at a still lower level. Sometimes, however, the gas fields are entirely isolated from the petroleum producing areas. There are three leading requisites necessary for the accumulation of natural gas in merchantable quantity. These are as follows:

1. An open or porous strata capable of storing the gas under pressure, generally sandstone or limestone.

2. A slate or shale covering of this porous strata to seal in the upper surface and the fractures of the strata saturated with natural gas.

3. A sufficient flexure or relief of the strata to enable the separation of the salt water and the petroleum from the natural gas, which is almost invariably found in the higher portion of the strata.

These gas reservoirs have been accumulating for ages the gas they contain, gradually reaching the maximum pressure.

Original Pressure.— The original pressure of natural gas reservoirs has been found in many cases equal to the hydrostatic balance, or, in other words, to the weight of a column of water equal to the vertical distance between the reservoir and the surface of the ground. Allowing 2.3 feet for each pound, or about 43 pounds to the hundred feet, a reservoir at a depth of 1,000 feet should show 430 pounds rock pressure per square inch. This hydrostatic pressure has been equalized to a certain extent by a large number of minute vents that have permitted the escape of the lighter hydrocarbons to the surface. These vents are of common occurrence throughout the Appalachian gas field from northwestern central New York to central Tennessee and along the great Cincinnati uplift from central Kentucky to northern Ontario.

These vents have during past ages allowed the gas to escape in immense quantities, amounting to unnumbered millions of cubic feet, so that the supplies from which we are now drawing are presumably but a small fraction of what has been produced in the earth.

Record of Natural Gas Wells.— There were 15,689 wells producing gas at the beginning of 1904. The total number of wells drilled for natural gas in 1904 was 3,095 and of this number 566 were unproductive, amounting to 18.3 per cent.

In the following table will be found the number of wells producing natural gas at the close of 1903, together with the number of unproductive or dry holes completed in the latter year, by States. The number of feet and miles of pipe lines from 2 inches up to 36 inches diameter in use at the close of 1903 is also given by States, as reported by the United States Geological Survey.

out increasing the size of the main lines, many of the large companies have erected powerful compressing plants in convenient localities. Many of these plants are models of mechanical engineering skill. The compressors are, in many cases, operated by large internal combustion engines of from 500 to 1,500 horse-power each. About 9 cubic feet only of natural gas is required to develop one horse-power and 1,000 cubic feet of natural gas at a pressure of 0 compressed to 270 pounds, by consuming 33⅓ cubic feet, or 3⅓ per cent, where very close to double this quantity is required if the natural gas be consumed under boilers and the steam used in condensing engines. There are very few known fields outside of Kansas, Indian and Oklahoma Territories, that have not been more or less depleted. The deep sand reservoirs in southwestern and central Pennsylvania and those of West Virginia should keep up a fair

State	Wells		Total Pipe Laid to Dec. 31, 1903	
	Producing, Dec. 31, 1903	Non-producing Holes Drilled in 1903	Feet	Miles
Pennsylvania	5,915	126	53,886,301	10,205.74
Ohio	1,523	62	27,876,583	5,279.66
Indiana	5,514	242	34,838,053	6,598.01
West Virginia	1,099	43	18,224,176	3,451.55
New York	707	11	7,413,194	1,404.01
Kansas	666	66	[illegible],598,720	1,060.34
Kentucky	123	3	747,385	141.55
Tennessee	2	....	900	.17
California	38	....	347,668	65.85
Colorado	3	....	75,760	14.35
Texas	18	3	149,336	28.28
South Dakota	5	....	26,950	5.10
Missouri	22	4	38,015	7.20
Illinois	43	5	45,618	8.64
Arkansas	2	....	60,000	11.36
Wyoming	2	....	500	.01
Indian and Oklahoma Territories	7	1	4,700	.89
Total	15,689	566	149,333,859	28,282.71

Exhaustion of Natural Gas Reservoirs.— Many of the original natural gas fields have been practically exhausted and a large number of the producing companies have had to seek new localities, where a fresh supply could be secured. This has been often accomplished by drilling deeper wells in more remote regions. The original gas fields adjacent to Pittsburg have been practically exhausted; most of the supply now comes from the deep natural gas sands of southwestern Pennsylvania and West Virginia, distant from 80 to 100 miles. The gas pressure in the original pool in northwestern Ohio is practically exhausted. That of central Indiana has only about 15 per cent of the original pressure and volume remaining. The newly developed field in eastern central Ohio has recently supplied a large and increasing quantity to the inhabitants of that State. West Virginia has, for the past ten and more, especially in the last four years, supplied a yearly increasing quantity of natural gas to Ohio and Pennsylvania. New York and Ohio have also been supplied by Pennsylvania. In all the natural gas fields it requires a constant drilling of new wells and connecting them to the main lines to keep up the supply, which is constantly being depleted. Owing to the decrease in pressure at the wells and the desire to deliver large quantities of natural gas to distant consumers, with-

supply for many years to come. As there are no virgin fields now known to exist it will be impossible to continue the present enormous supply for a long period of years in the future. What may result from the deeper drilling of wells in localities where structural conditions are favorable, is a problem for future determination.

Occurrence, Geological Horizons, etc.— In the United States the principal sources of natural gas are located on the west slope of the great Appalachian uplift, extending from New York through Pennsylvania and West Virginia to southern central Kentucky, with a considerable portion of southeastern Ohio, also along the northern portion of the great Cincinnati uplift in northwestern Ohio and central Indiana and southeastern Kansas. There has been recently developed an important natural gas field in eastern central Ohio. These areas, briefly described, produced in 1903 99.5 per cent of the value of the entire output of the United States.

In California, Texas, Louisiana, Colorado, South Dakota, and Alaska gas is found in geologically more recent rocks, but no attempt is here made to correlate the rocks of one field with those of another. In the Mississippi valley to the eastward natural gas occurs almost universally in rocks of Palæozoic age, extending from the highest Carboniferous down at least as far as the Trenton limestone, a distance of over 9,000 feet. The rocks vary greatly in thickness from place to place, so that no one section can be regarded as typical of all parts of the region. The 50 gas-bearing horizons known are composed of very different material, ranging from the coarser sandstones of the Upper Carboniferous and Catskill period to the finer sands of the Middle and Lower Devonian, the limy sands of the Silurian period, the crystalline limestones of the Ordovician, and the crystalline sands of the Cambrian period.

Uses.—Natural gas is used principally as a source of heat and light in the domestic service. It is employed extensively in industrial establishments for many purposes, notably in the generation of steam, in the manufacture of glass, puddling of iron, in roasting ores, in heating furnaces, in the manufacture of steel and pottery; it is also utilized as a source of power in the gas engine, used in drilling and operating oil and gas wells, and in pumping oil, and as a general source of power for all purposes. The heat value stored in natural gas is greater than that caused by any artificial combination of carbon and hydrogen, and is a perfect fuel as it issues from its original rock-sealed reservoirs. No preparation is necessary for its combustion and no residue is left. It is not affected by ordinary temperature and it is easily distributed by pipes to points of consumption. It is a most economical source of light and power, and an ideal household fuel. Lampblack is the only commercial article that is made directly from natural gas.

Illuminating Properties.—The illuminating properties of natural gas vary in different localities, because of the difference in the percentage of the heavier hydrocarbon, ethane (C_2H_6). All the natural gas found adjacent to petroleum fields has a larger proportion of ethane than the gas farther removed, and therefore the candlepower is considerably greater. Ordinary natural gas, if consumed with a common tip at the rate of 7 or 8 cubic feet per hour, will yield about 6 or 7 candlepower. In an ordinary Argand burner with chimney, it will give about 12 candlepower in consuming 5 to 6 cubic feet per hour. When natural gas is consumed in contact with a mantle of alkaline earth (thoria, etc.), the result is the cheapest and best illuminant known. When the price of natural gas is 25 cents per 1,000 cubic feet, and 50 candlepower is obtained from a consumption of 2½ cubic feet per hour, the cost per candlepower per hour is only 0.00125 of a cent.

Domestic Consumption.—There were 630,000 domestic consumers of natural gas during 1903; and it is estimated that in the western portions of New York and Pennsylvania, in central and western West Virginia, and in Ohio, Indiana, and Kansas, not less than 4,500,000 persons received the benefit of natural gas used as a fuel and an illuminant. Over 8,000 manufacturing establishments were also supplied.

The introduction of natural gas into the household, for which it is eminently fitted, has been accomplished without personal inconvenience or loss of life, except in very rare cases. The risk from fire is less than when wood and coal are used. There have been some cases of asphyxiation when a stove has been burned in a room without a flue connection, as it has been found by experiment that combustion under these conditions is imperfect, especially so as the air in the room becomes more and more saturated with carbonic acid and the vapors of water, the result being the formation of poisonous carbonic oxide.

Calorific Value.— The calorific or heat value of natural gas varies slightly in different localities, as the amounts of carbon and hydrogen vary. Those natural gases which contain the highest percentage of carbon give the best results in evaporating water. The standard used in measuring the evaporation of water is called the British thermal unit, written B. T. U., and is the amount of heat necessary to raise 1 pound of pure water 1° F. at or near 39° F., which is the temperature of the maximum density of water. The quantity of air necessary for the perfect combustion of natural gas varies from 10.4 to 10.8 parts of air to 1 part of natural gas. A number of tests have fully demonstrated that when ordinary care is taken in burning natural gas under boilers in actual service, 1 cubic foot of natural gas will do the work equivalent to the evaporation of 1 pound of water from and at 212° F. Since 20 cubic feet of ordinary natural gas weigh 1 pound, 1 pound of natural gas will evaporate 20 pounds of water, while, under similar conditions, 1 pound of petroleum will evaporate only 16 pounds of water, and 1 pound of good coal will evaporate but 10 pounds of water; therefore 10 cubic feet of natural gas or one half a pound is equal to one pound of good coal. In fact in a number of tests with a Klein or a Kirkwood burner, .87 cubic foot of natural gas has evaporated 1 pound of water from and at 212° F., which will make 17,400 cubic feet equal to one ton of good coal. The actual heating effect of natural gas as a fuel approaches much nearer the theoretical result than when coal is used. The price paid by the domestic consumer for natural gas varies in localities, ranging from 13 to 27 cents per 1,000 cubic feet. The consumers near the supply pay less than those farther off. Manufacturers pay less, ranging from 6 to 18 cents per 1,000 cubic feet. About 20,000 cubic feet of natural gas will equal one ton of good bituminous or anthracite coal. If we assume the average price to be 22 cents per 1,000, then $4.40 worth of gas will produce the same heating effect of one ton of good coal delivered in the bins — to which must be added the expense of shoveling it into the furnace and the removal of the ashes, as well as the inconvenience of the necessary dust and dirt which invariably accompanies a coal fire.

The Natural Gas Engine.—Natural gas, as applied to the internal combustion engine, has caused a complete revolution in the methods of securing power throughout the gas belt. It has in nearly all instances superseded any other source of power in pumping petroleum wells. In some instances this has been done by substituting a gas cylinder for the steam cylinder, using the same engine bed. The economy in the use of natural gas and the dispensing with the costly and troublesome boiler, with its constant attendant, has brought it into great favor for all sources of power, from a 1 horse-power up to 1,500 horse-power engine.

The following table gives the equivalents of natural gas and coal for both the gas and steam engine per indicated horse-power per hour:

Type of Engine	Equivalent of gas and coal	
	Gas	Coal
	Cubic feet	*Pounds*
Large natural gas engine, highest type....	9	0.9
Ordinary natural-gas engine..............	13	1.3
Triple expansion condensing steam engine.	16	1.6
Double expansion condensing steam engine.	20	2.0
Single cylinder and cut-off steam engine...	40	4.0
Ordinary high pressure, without cut-off, steam engine	80	8.0
Ordinary oil well pumping steam engine...	130	13.0

Products of Combustion.— The products of combustion are water and carbonic acid, slightly over two cubic feet of the former in the form of water vapor and about one foot of carbonic acid gas for each cubic foot of natural gas consumed; both are invisible and nearly odorless. Somewhat more than 2 cubic feet of oxygen are necessary, but, owing to the air being composed of a larger percentage of nitrogen, a little over 10 cubic feet of air is required for thorough combustion.

It has been found that in a stove without a flue connection the combustion is imperfect, especially so if the air in the room becomes more or less saturated with carbonic acid and the vapor of water from lack of fresh air. Under these conditions there is a small percentage of carbonic monoxide (CO) produced, which is a deadly and insidious poison, and if breathed by a man or an animal will soon cause death, even when a comparatively small percentage is present.

When but a small stovepipe connecting with a flue is used, recent tests have demonstrated that no carbon monoxide (CO) is formed in the room thus provided, the greater portion of the products of combustion being carried outside as the fresh air is drawn in to supply their place. On the other hand, where there is no flue or other large opening a number of fatal results and narrow escapes from asphyxiation have occurred.

Carbon monoxide (CO) does not usually exist to such an extent in the natural gas produced in West Virginia or Pennsylvania as is found elsewhere. On the other hand, analysis shows its presence in the natural gas produced in the Lima-Indiana field to the average extent of about one half of 1 per cent, and to the average extent of 1 per cent in the natural gas produced in Kansas. Formaldehyde is in some cases formed upon putting the cold surface of a teapot in contact with the gas jet of a stove, or when the gas flame impinges on the cold sheets of a steam boiler. Its presence in small quantities is made known by its pungent and irritating effect upon the nostrils and throat. The effect is dangerous, yet there are no cases known in which death has resulted from this gas thus generated.

Composition.—Analysis of natural gases and manufactured gases, their weight and heating quality per 1,000 cubic feet; also their specific gravity compared:

Constituents	Average for Penna. and W. Virginia	Average for Ohio and Indiana	Average for Kansas	Average of Coal Gas	Average of Water Gas	Average of Producer Gas from Bit. Coal
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Marsh gas (CH_4).....	80.85	93.60	93.65	40.00	2.00	2.05
Other hydrocarbons...	14.00	.30	.25	4.00	.00	.04
Nitrogen	4.60	3.60	4.80	2.05	2.00	56.26
Carbonic acid, CO_2...	.05	.20	.30	.45	4.00	2.60
Carbonic oxide, CO...	.40	.50	1.00	6.00	45.50	27.00
Hydrogen	.10	1.50	.00	46.00	45.00	12.00
Hydrogen sulphide...	.00	.15	.00	.00	.00	.00
Oxygen	Trace	.15	.00	1.50	1.50	.05
Total	100.00	100.00	100.00	100.00	100.00	100.00
Pounds in (a)1,000 cubic ft............	47.50	48.50	49.10	33.10	45.67	75.00
Specific gravity, air being one............	0.624	0.637	0.645	0.435	0.600	0.985
B. T. U. per 1000 (b) cubic feet..........	1,145,000	1,095,000	1,100,000	755,000	350,000	155,000

(a) 1,000 cubic feet of dry air at an atmospheric pressure of 14.7 pounds and at a temperature of 60° F. weighs 76.12 pounds and is a mechanical mixture of 23 parts of oxygen and 77 parts of nitrogen by weight.

(b) B. T. U.= British Thermal Units, which indicate the heat necessary to raise 1 pound of pure water at 39° F. one degree.

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Gas Poisoning, poisoning by the vapor of some substance taken into the body through the air-passages. Theoretically, a large number of substances used in the arts may cause gas poisoning; practically, there are only a few that need special attention.

In general, gaseous substances reach a certain grade of concentration before they become poisonous. This varies with each gas. Forms of gas poisoning comparatively common are numerous, particularly in Europe, where many dangerous industries are established that are here unknown. A partial list of these includes poisoning from muriatic acid gas (HCl), occurring in factories in which soda, glass, and colored wools are made or handled; from saltpetre gas (NO_3H, NO_2H), which is found in fireworks factories, and from sulphurous acid gas (SO_2), which causes trouble in wool-dyeing factories, in paper manufactories, in making sulphuric acid, in sugar-making, and in disinfection. Ammonia gas (NH_3) also frequently causes poisoning; and chlorine (Cl), bromine (Br), iodine (I), in gaseous form, may all cause fatal poisoning. Formaldehyde gas (CH_2O), which is being widely employed as a disinfectant, is a violent poison. Sulphuretted hydrogen (H_2S) is a severe poison, 6 per cent. in the air constituting a menace to health. Practically all of these gases possess distinctive odors sufficient to give warning of their presence. It is, however, a matter of immense moment to realize that there are gaseous poisons that are destitute of any odor whatever. The most important of these are carbon dioxide (CO_2) and carbon monoxide (CO), both of which are odorless gases in the degree of concentration sufficient to cause serious poisoning. Carbon-dioxide poisoning occurs in crowded halls, in theatres, in closed cars, in tunnels, etc., when the normal proportion of this gas is disturbed by oxygen consumption and carbon-dioxide production, the resulting poisoning being from a combination due to these two factors. (See CARBON DIOXIDE.)

Poisoning from carbon monoxide (CO) is not frequent in this country, except by the medium of illuminating gas, of which it is an important constituent, but where old-fashioned stoves without vents are used, and where there is insufficient air to convert the CO to CO_2, this form of poisoning is not uncommon.

Poisoning by illuminating gas is extremely common, occurring both by intent and accidentally. The character of the poisoning and its mode of treatment will vary with the composition of the particular variety of illuminating gas that may be inhaled. The so-called "water-gas" is particularly rich in CO. The leading symptoms of this form of poisoning are, in the beginning, headache, with sense of pressure in the temples, ringing in the ears, flashes before the eyes, beating of the temporal arteries, dizziness, and perhaps unconsciousness. If the breathing of the gas continues, dangerous symptoms develop. There is marked redness of the skin, with unconsciousness; the blood is bright-red—a marked contrast to the dark blood with blueness of the skin seen in carbon-dioxide poisoning. Occasionally there are cramp-like convulsions. The pulse is at first full and strong; later it is thin and small. The breathing is slowed, and becomes a kind of snoring. Vomiting is common, and occasionally the vomit is drawn into the lungs and causes the additional symptoms of suffocation. The patient may die in deep slumber. The diagnosis is not simple, but the chief signs are the reddish face, the snoring breathing, the absence of alcoholic breath, and perhaps the slight odor of gas in the room. The treatment should be energetic. The patient should be brought into fresh air at once, the clothing loosened, and hot bottles applied to the extremities. Active rubbing of the skin with coarse towels, mustard-water applications to the extremities, and artificial respiration should be instituted. The breathing of camphor vapor, or well-diluted ammonia gas may stimulate the breathing. So long as the heart beats there are hopes of reviving the patient. The injection into the rectum of large quantities (2 quarts) of hot salt solution (110°-118° F.), a teaspoonful of salt to a pint of water, is of great service. Small quantities of whiskey (½ ounce) may be added to this. The transfusion of salt solution into the veins is sometimes necessary, but should be performed only by the medical practitioner.

Gas Producer. The primary requirement in using any form of fuel is its conversion into a gas; but whether the gas thus obtained is combustible, *i.e.*, possesses heating value, or otherwise, depends upon the nature of the fuel from which it is derived, and upon the method of gasification employed.

In most fuels, the chief combustible elements are carbon (C) and hydrogen (H), which are present in a great variety of chemical combinations and physical characteristics. When these fuels are completely burned, the products of combustion contain only carbonic acid (CO_2) and water (H_2O), with nitrogen (N) and some of the oxygen (O) of the air supplied for combustion, all of which are incombustible. But when the fuel is incompletely or partially burned, the products of combustion will also contain varying quantities of carbon monoxide (CO), various forms of hydrocarbons (CHy), hydrogen, and sometimes tar and smoke as the products of distillation, all of which are combustible or have a heating value.

Fuels may be burned by either grate or direct firing, or after conversion into gaseous form. The ultimate object of direct firing is the attainment of complete combustion in close proximity to the fuel bed, by vaporizing, distilling, gasifying, and completely burning the fuel elements within the same chamber. It is well known, however, that the processes of vaporization and distillation absorb heat only, and, therefore, it is advantageous to separate them from the point at which the combustion of the gases takes place, and where high temperatures are developed by the heat evolved, as is accomplished by the use of a gas producer or generator.

Generation of Producer Gas.—In the gas producer, the processes of vaporization, distillation, and gasification, result in the generation of a combustible gas, which is led away to a separate combustion chamber in which it is subsequently burned under conditions more favorable to a full realization of the heat value of the fuel, and the attainment of high temperatures absolutely unattainable by any other method of firing.

It should be clearly understood, however, that the use of a gas producer does not enable the generation of a greater quantity of heat than may be obtained by direct firing. Even when the producer is closely connected to the furnace so as to utilize the sensible heat of the gas, a loss of energy of from 15 to 20 per cent. of the calorific value of the fuel is sustained; but notwithstanding this loss, practical experience has very satisfactorily demonstrated that the gas producer accomplishes, with much less fuel, results equal to those obtained by direct firing, and has made possible metallurgical operations impracticable by the latter method.

The advantages of gas firing over direct firing will be better understood by a general knowledge of the manner in which producer gas is generated.

As already stated, the products of the incomplete combustion of a fuel contain various combustible elements which are susceptible of with carbonized fuel; the H being derived from either the fuel, or the decomposition of the moisture in the air supply when it comes in contact with the glowing carbon, so that the theoretical form $CO_2 + C +$ heat $= 2CO$, becomes $H_2O + C +$ heat $= H_2 + CO$.

When uncarbonized fuels such as soft coals are used, the products of distillation of the raw fuel in the upper zone of combustion, consisting chiefly of hydrogen and the hydrocarbons—marsh gas (CH_4) and olefiant gas (C_2H_4), will become mixed with the products of gasification in the zone below, thus affecting the quality of the gas, so that in order to raise

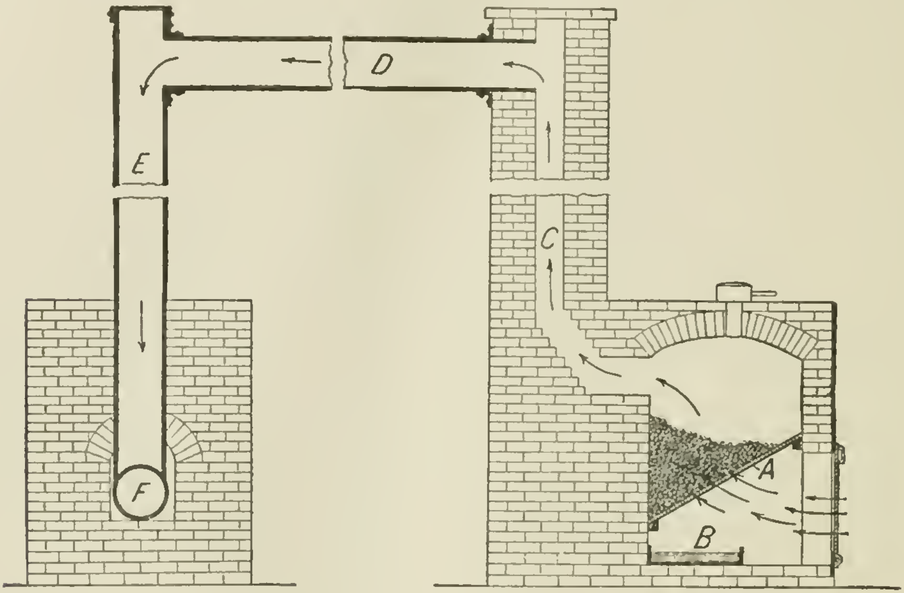

Fig. 1. Sectional Diagram, Siemens Gas Producer.

being burned at a higher temperature than that of the original combustion, and producer gas is simply the product of an incomplete combustion of a fuel in the generator.

The oxygen of the air admitted to the producer comes in contact with the incandescent carbon of the fuel and forms a certain amount of incombustible carbonic acid gas (CO_2). The heat evolved by this reaction is absorbed by the CO_2 thus formed and by the nitrogen of the air supplied. These gases ascend and yield their heat to the fuel above and bring it to the point of incandescence, so that the CO_2 first formed is brought in contact with this glowing carbon, and taking up an additional quantity of carbon is converted into combustible carbon monoxide (CO).

If this gas is generated with dry air in contact with fuel free from impurities, it will contain all the nitrogen of the air, and will be, approximately, composed of carbon monoxide (CO), 34.7 per cent.; nitrogen (NO), 65.3 per cent. by volume, and will possess a heating value of about 118 British Thermal Units per cubic foot.

In actual practice, however, it usually contains a certain amount of CO_2, a little hydrogen (H), and the nitrogen (N) of the air blast used the percentage of the combustible elements in the final product, it is necessary that as much as possible of the CO_2 first formed should be converted into carbon monoxide (CO).

Air when passed over incandescent carbon (C), gives minimum CO_2 at a temperature of about 1900° Fahr.; therefore, the higher the temperature of the producer, and the greater the surfaces of the fuel exposed to the contact of the ascending gases, the greater will be the proportion of CO_2 converted into CO. Furthermore, the formation of CO is greatly affected by the character of the fuel and the depth of the fuel bed, so that, the greater the depth of the fuel bed, and the more porous and finely divided the fuel, provided it does not offer too much resistance to the passage of the air or gases, the greater will be the percentage of CO formed.

Other things being equal, the higher the temperature of the producer, the greater will be the amount of fuel gasified per unit of time, but as this depends largely upon the air supply, an increased air supply signifies more rapid combustion, greater velocity of the gases through the fuel bed, briefer contact of the gases with the fuel, and, therefore, indicates that a greater depth of contact is required if it is desired to maintain a given quality of gas with a low percentage of CO_2.

It is important to note that wet coals retard the development of high temperature in a gas producer, on account of the great heat losses sustained through the high latent and specific heats of the vaporization of water, and also, that for like reasons, carbonized fuels work at a higher temperature than uncarbonized fuels.

Another condition which affects the percentage of combustibles in the gas is the presence of steam in the air supply. Blowing with air alone introduces a large amount of inert nitrogen which tends to dilute the gas and reduce its calorific value. On the other hand, the use of steam increases the percentage of combustibles by adding hydrogen and decreasing the amount of nitrogen, thus increasing the calorific value of the gas, reducing its exit temperature, and preventing clinkering.

The use of steam does not, however, result in the production of a greater amount of heat. The heat is simply transferred from the generator to the furnace by the more potential heat value of H, instead of the less efficient, though greater sensible, heat in the gas itself. Yet, an excessive amount has its disadvantages, as it tends to reduce the amount of CO and increase that of CO and H, thus reducing the percentage of combustibles in the gas and lowering its calorific value as shown in the accompanying table, which gives the analysis of different gases produced with excess of steam in moderate and large quantities.

Volume of Gas	Excess of Steam Moderate	Large
CO_2	5.30	8.90
CO	23.50	16.40
CH_4	3.30	2.55
H	13.14	18.60

Types of Gas Producer.—The various gas-producer arrangements are represented by two general types: (1) The Siemens gas producer, which operates without artificial blast, and is typical of the older producers; and (2) the Taylor producer, equipped with a rotative ash table and operating with a forced steam blast, and representing the later developments in this line.

Fig. 1 shows a vertical section through a Siemens gas producer and regenerator furnace. It consists of two essential parts—the gas producer proper in which the raw fuel is converted into a combustible gas, and the furnace with its regenerators or chambers for storing the waste heat of the flame, given up to the incoming air and gas. As the air is drawn into the producer through the firebars *A*, a certain quantity of the water contained in the trough *B* is vaporized by the heat of the fire above, and mixing with the air, is drawn with it into the fire. The necessary indraught of air, and the pressure required to cause the gas generated in the producer to flow into the furnace, is obtained by means of the vertical uptake *C*, usually built of brick; the horizontal iron tube *D*, of relatively large diameter; and the vertical tube *E*, leading to the gas flue *F* of the furnace. By this arrangement, as the hot gas rises from the producer and passes through the tubes, it is considerably reduced in temperature, thus rendering its density much greater at the furnace end than at the producer, and thereby causing a suction and an indraught of air at the latter.

Fig. 2 shows a vertical cross-section of a Taylor producer charged with anthracite coal. The incandescent fuel is supported by the bed of ash put upon the rotative ash table *A*, before firing, and kept there constantly as an essential feature in the successful operation of the producer. The rotative ash table has a greater diameter than the bosh *B*, and is placed at such a distance below the latter that upon being revolved, the descending ash forms its own slope at an angle of about 55°, and is discharged uniformly by gravity over the periphery of the ash table into the sealed ash pit *C*.

When operated regularly, the line between the ash and the fuel is kept always about six inches above the cap *D* of the central air pipe *E*,

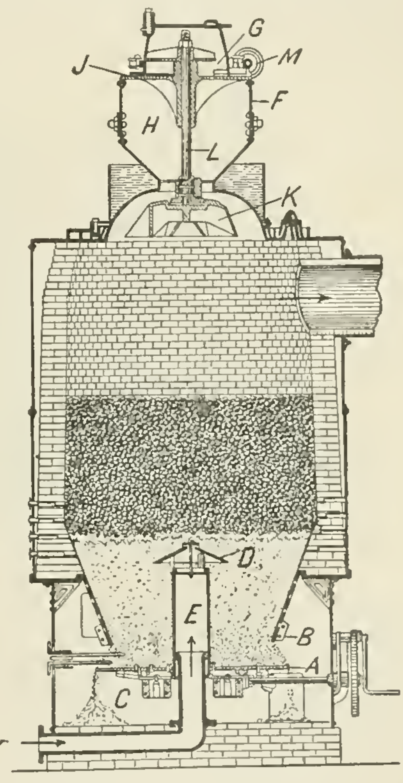

Fig. 2. Vertical Cross-Section, Taylor Gas Producer.

thus allowing the fire to come in contact only with the brick lining, so that all the iron work is protected from the heat. The height of the fire line is maintained by grinding or revolving the ash table once every six or twenty-four hours, according to the rate at which the producer is worked.

The air blast is furnished, usually, by a steam jet blower, but a fan blower may be used if more convenient, and a pipe from some auxiliary source of steam run into the vertical air pipe to supply the steam required for softening the clinkers and maintaining the proper temperature of the producer.

The producer as shown is equipped with a Bildt continuous automatic feed device *F*, consisting of a receiving hopper *G*, which surmounts the main storage magazine *H*, the communication between the two being regulated by a horizontal rotary register *J*, operated by a lever. The distributor plate *K* is suspended below the main magazine, and supported by a steel shaft *L*, which passes upward through the storage cylinder. Both the hood of the distributor plate and the inverted conical base of the magazine are water-cooled, the tendency of the cooling water and the location of the plate above the gaseous current, tending to facilitate the discharge when using strongly caking coals. The receiving hopper is rotated by means of a worm wheel and worm attached to the upper end of the shaft, and the distributo plate is rotated by means of the radial arms and hub of the receiving hopper, which are also keyed to the steel shaft. A hand-wheel nut upon the threaded end of the axis affords means for adjusting the distance between the distributor plate and the coal reservoir, and this adjustment together with the variable speed secured by means of the stepped cone pulley *M*, permits of a ready control of the rate of coal discharge. Experience shows that the use of feeders equipped with distributing plates not only tends to reduce the amount of furnace wear, labor, and repairs, but also results in a great reduction in the coal consumption.

The following table gives the average analyses by volume of the gas produced by the two types of producers:

Constituent	European Siemens Gas	American Anthracite Gas	American Bituminous Gas
Carbon monoxide (CO)..	23.7	27.0	27.0
Hydrogen (H)............	8.0	12.0	12.0
Marsh gas (CH_4..........	2.2	1.2	2.5
Carbonic acid (CO_2)......	4.1	2.5	2.0
Nitrogen..................	62.0	57.3	56.5
	100.0	100.0	100.0

Types of Gas Producer System.—The Taylor gas producer embodies in its structure and method of operation the principal features of the successful producers of the modern type, which are applicable to the production of gas from different fuels for various purposes, and when considered in connection with gas-engine work, form the principal parts of two general but well-defined systems of gas production—the pressure system and the suction system.

In the pressure system, the air required for combustion and for the generation of the gas is supplied to the gas producer under pressure, and the gas generated is delivered under pressure to the engine using it.

In the suction system, both the passage of the air through the producer, and the introduction of the producer gas into the cylinder of the engine, are effected by the suction or aspiration caused by the forward stroke of the piston.

Although the pressure system is composed, usually, of more cumbrous apparatus, and requires more space, it possesses greater elasticity than the suction system for meeting variations in the quality of fuel, and greater capability for utilizing different kinds and cheaper grades of fuel. It is also the better for use with large power-producing units, or where several gas engines receive gas from the same producer plant.

On the other hand, for isolated plants of small capacity, or where only a single gas engine is used intermittently, the application of the suction system not only simplifies the bulk and reduces the cost of the plant, but what is more important, it makes the demand of the engine for gas the controlling factor of its generation from solid fuel.

Pressure Gas Producer System.—Fig. 3 shows the general arrangement of a pressure gas producer system. Usually it consists of a small steam boiler *A*, for making steam, or producing the necessity air pressure; a gas producer *B*, with a continuous-feed arrangement; an economizer *C*, with superheater and wash-box; a scrubber *D*; a purifier *E*; a gas holder *F*, consisting of a steel tank; and suitable drips and connections.

The details of the several organs may be modified to adapt them to varying conditions. For example, the boiler may be omitted where steam can be obtained from some other convenient source of supply, and in some cases a

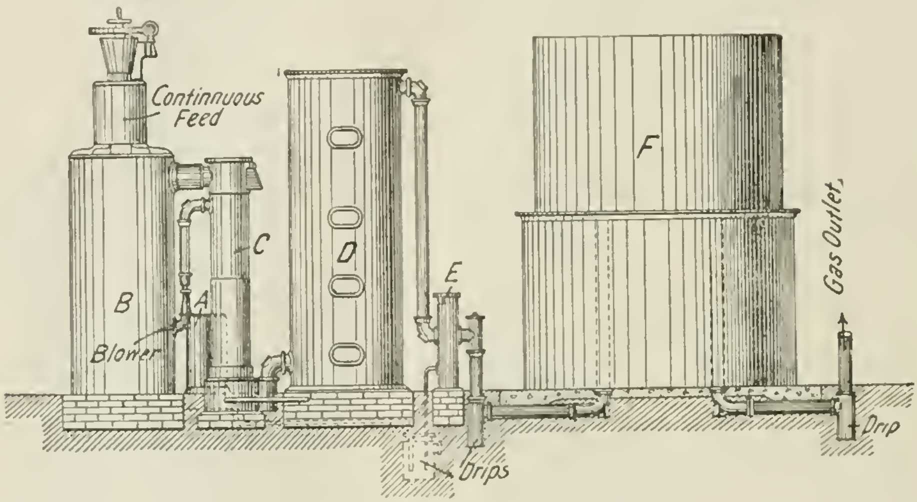

Fig. 3. Pressure Gas Producer System.

separate steam generator is not absolutely necessary.

For smaller equipments, or those employed for operating engines up to 500 horsepower, single producers are generally considered sufficient, but the larger equipments require two or more producers, which may be varied in design and arrangement.

In the operation of a plant of this type, the gases generated in the producer enter the superheater and economizer. In the latter, the air blast of the producer travels in a direction opposite to that of the blower, and the gas passing through the wash-box deposits a large portion of its extraneous matter. The economizer also contains the seal arrangement against the gases stored in the holder and present in the other organs of the plant. From the wash-box, the gas passes into the scrubber, the compartments of which are filled with coke. Here the gas is showered by water sprays, and still further purified by the removal of any tar, sulphur, or ammonia that may be present prior to its introduction into the purifier where the final purifying operations are performed. From the purifier the gas passes into the holder, which stores a supply sufficient to start and run the plant for several minutes, but the main function of the holder is to regulate the pressure, and care for variations in the consumption and mixture of the gases.

The drip pots and drainage pipes are very essential parts of the plant and are suitably placed as shown, while the hot water issuing from the top of the producer is carried by suitable pipes to the holder.

In the pressure systems all of the following named or similar materials may be used for fuel: Anthracite and bituminous coals, lignites, coke, charcoal, wood, peat, and tanbark. Good anthracite coal is the best when convenience of operation is the primary consideration. When bituminous coals are used, preference should be given to those of the semi-bituminous class. According to general experience, soft-coal plants appear to be more expensive than those operated with hard coal, and when the price of anthracite does not exceed that of soft coal more than $1.00 per ton, it is advisable to employ a hard-coal plant. When coke is used, it should be in small pieces of about one cubic inch; as the tendency of large-size coke is to give a weak gas. When coke is used instead of anthracite, one-third more, by weight, of the former should be taken as the fuel consumption.

Suction Gas Producer System.—Fig. 4 shows the general arrangement of the several organs of a suction plant: *A*, represents the producer; *B*, the evaporator; *C*, the scrubber; and *D*, the receiver. The plant operates as follows:

The gases generated in the producer pass through the evaporator, which is simply a small multitubular boiler, and serves to utilize the sensible heat of the gases for evaporating the water. The vapor thus obtained is conducted through the pipe *E*, to the ash-pit of the producer, by the suction caused therein by the action of the engine piston, while at the same time, the gases pass from the evaporator to the scrubber filled with coke. As these gases rise through the interstices of the coke, they come in contact with the descending washing water, which not only takes up and thus removes the dust brought over from the producer, but also purifies the gases of ammonia and any other impurities which the water will absorb. From the scrubber, the purified gas passes into the receiver. The diameter of the receiver is relatively large as compared with that of the suction pipe of the engine, and thus prevents the pulsations which would otherwise be caused by the strokes of the engine piston, between the receiver and the producer.

Usually, in the smaller plants, the producer is provided with a charging hopper of sufficient capacity for holding enough fuel for several hours' operation, and permits the admission of coal to the combustion chamber without allowing air to enter it, during the charging operation.

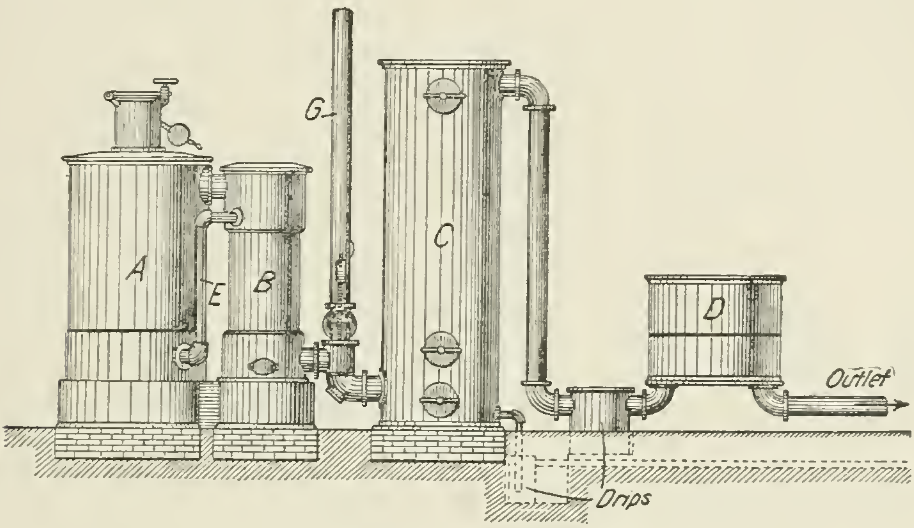

Fig. 4. Suction Gas Producer System.

To operate the plant, a fire is first kindled upon the grate of the producer; the fuel bed then built thereon, and the air necessary for starting combustion is supplied by means of a hand- or belt-driven fan. At first, the poor or lean gases produced at starting are allowed to escape into the open air through the vent-pipe *G*, until the test-cock shows that good gas of the desired quality is being generated. Then, the vent-pipe is closed and the scrubber and receiver brought into the gas circuit. The engine is now brought into operation, and as the suction caused by the strokes of its piston thereafter performs the function of the fan, the latter is stopped.

In the suction systems, only anthracite coal, and the so-called carbonized fuels such as gas-house coke and charcoal, have been used up to the present time. When anthracite is used it should not be less than "pea" size, clean, and of good quality. It is evident that the finer the size of the fuel and the greater its tendency to clinkering, the greater will be the amount of work required of the engine to draw the air current through the fuel bed. Therefore, if continuous action and easy operation are desired, the use of anthracite of the ordinary "nut" size will give the most satisfactory results.

The following table shows average analyses of the gases produced by the two systems.

Element	Per cent. Pressure Plant	Per cent. Suction Plant
Carbonic acid (CO_2)	8.2	8.0
Oxygen (O)	.7	
Carbon monoxide (CO)	19.5	26.3
Hydrogen (H)	16.5	18.2
Marsh gas (CH_4)	2.[illegible]	0.5
Nitrogen (N)	52.2	47.0
	100.0	100.0

In either case, the gas produced is of good quality, when good fuel is used, the pressure-producer gas averaging about 125 B.T.U.'s per cubic foot, and the suction-producer gas about 145 B.T.U.'s per cubic foot, with variations according to the method of operation, and the proportion of hydrogen and carbon monoxide present.

In power-plant operation, the fuel consumption will average $1\frac{1}{2}$ pounds of coal per brake horsepower hour for small powers, and decrease in amount with the increase in the size of the engine until a rate of 1 pound per brake horsepower hour is attained, thus giving a higher efficiency than that of the best marine steam engine or the largest steam pumping engine in the world.

Quality of Gas for Power Plants.—In considering the quality of a gas suitable for the production of power or for use in gas engines, it is necessary to inquire into the amount and quality of gas obtainable from various kinds of fuels.

The following table gives an approximate index to the difference of yield of gas for the different materials available for this purpose.

Material	Yield per pound in cubic feet
Coke or Charcoal	1[illegible]4
Bituminous Coals	75
Brown Coals	55
Turf	45
Wood	35

The actual yield of gas varies, however, within wide limits, according to the composition of the fuel, its general character, and the method of gasification, and in the case of coal, as already stated, according to the proportion of steam used in the producing operations. It may be assumed, however, that on the average, 1 ton of anthracite buckwheat coal will yield about 170,000 cubic feet of gas, having a calorific value of 138,000 B.T.U.'s per 1,000 cubic feet; with an average composition as follows:

Element	Per cent.
Carbon monoxide (CO)	22.0 to 3[illegible]
Hydrogen (H)	15.0 " [illegible]7.[illegible]
Marsh gas (CH_4)	3.0 " 1.5
Carbonic acid (CO_2)	6.0 " 1.5
Nitrogen (N)	54.0 " 60.0

The analysis of gas derived from bituminous coal gives very nearly the same results, with the exception that the values of CH and H are somewhat higher.

Advantage of Using Producer Gas.—The advantage to be derived from the use of producer gas may be briefly stated as follows:

The combined efficiency attainable in the best steam engines and boilers, operating under the most favorable conditions, is about 12 per cent. of the intrinsic heat energy of the fuel used. On the other hand, the modern gas engine, even in small powers, will give an efficiency much higher, but if it be supplied with illuminating gas for fuel, a large amount of the economy due to the higher efficiency is lost in the cost of the gas. Heat energy in the form of coal gas at a dollar per thousand feet, costs thirteen times as much as an equivalent amount of energy in the form of coal at three dollars per ton; therefore, in order to utilize a gas engine to its full advantage, the gas used must be produced as economically as possible. This is exactly the function of the gas producer, and by its use a good gas engine with a theoretical thermal efficiency of 75 or 80 per cent., or a practical thermal efficiency of 25 or 30 per cent., will readily convert into actual work, or available power, 25 per cent. of the heat energy of the gas delivered to it. The gas producer of such a plant will transfer to the gas about 80 per cent. of the intrinsic energy of the coal, so that a gas-producer engine operating on an inferior grade of coal will show an efficiency of 20 per cent., as against the 12 per cent. of a steam engine and boiler plant using the best steaming coal.

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Gas Tar. See Coal Tar.

Gases, General Properties of. The word "gas" was coined by the Belgian chemist Van Helmont, in the first half of the 17th century. It was possibly suggested to him by the Dutch word "geest," signifying a ghost or spirit, the allusion being to the apparently imponderable nature of gaseous bodies. It is known, however, that all gases possess both weight and inertia, and that they differ from other kinds of matter, in these respects, solely by reason of their lesser densities. Any object that is submersed in a gas is buoyed up by an amount equal to the weight of the gas that it displaces, in accordance with the same principle that holds true of solids that are submersed in liquids; and in making refined determinations of the weight of an object proper allowance must be made for the difference in the buoyant effect of the air upon the object weighed, and upon the weights against which it is balanced. It will be seen that it follows, by reason of the principle of buoyancy, that no gas has any apparent weight, when it is weighed in an atmosphere identical with itself in density. If a sphere or other vessel of convenient form is weighed, both when filled with a given gas and when completely exhausted by means of an efficient air-pump, the difference in the two observations gives the weight of the gas, because the buoyant effect of the air upon the containing vessel is the same, whether it is full or empty. In this way the weights of many of the better known gases have been determined with considerable precision. Following are the densities of some of the more familiar gases, as expressed in grams per cubic centimetre at the freezing point of water, and under a barometric pressure of 76 centimetres of mercury at Paris:

Gas	Density
Dry air	0.001293
Oxygen	0.001430
Nitrogen	0.001256
Hydrogen	0.0000896
Carbon dioxid	0.001978
Carbon monoxid	0.001234
Chlorine	0.003133
Ammonia gas (NH_3)	0.000770

The fact that gases have weight and inertia, and that they are also compressible, renders the mathematical study of their internal motions especially difficult. Aerostatics and aerodynamics, which treat, respectively, of the conditions of mechanical stability of gaseous masses, and of the motions of which such masses are capable, are therefore more intricate and difficult than hydrostatics and hydrodynamics, which treat, respectively, of the equilibrium and of the motions of incompressible fluids.

A gas which is mechanically at rest exerts, against the vessel that contains it, a pressure that is everywhere perpendicular to the surface upon which it acts, and which has everywhere the same intensity, save for the slight variation due to the action of gravity,— a variation which is so slight that it can be neglected in all but the most refined physical investigations. When the gas is in motion, the case is different, and the pressure phenomena are complicated, hard to compute, and quite difficult to measure with any considerable approach to precision. In general, the internal pressure of a gas is least in those regions in which the gas is moving fastest. In a mixture of gases, each constituent contributes to the total pressure by an amount equal to the pressure that it would exert if it occupied the given space alone. Like the other gaseous laws, this one (which is known as "Dalton's law") is a close approximation to the actual fact when the density of the gas to which it is applied is not too great. At high pressures, or exceedingly low temperatures, it gives results that are measurably different from the actual facts of observation.

When a gas is subjected to a continuously increasing pressure, its behavior depends upon its temperature. If the temperature is greater than a certain critical value peculiar to each gas, it will never liquefy, no matter how great the pressure to which it is subjected; but if the temperature is lower than this critical value, the gas will ultimately condense into a liquid. (See CRITICAL POINT; GASES, LIQUEFACTION OF.) There is no essential distinction between a gas and a vapor, a "vapor" being merely a gas that is in such a condition that it may be condensed into the liquid form by a comparatively small change of temperature or pressure. The so-called "permanent gases," such as hydrogen and nitrogen, were formerly thought to be incapable of liquefaction; but it is now known that all gases can be liquefied, provided their temperatures are sufficiently reduced, and the phrase "permanent gas" is rarely used at the present day.

When the pressure of a given mass of gas is varied while the temperature remains constant, it is found that the volume is very nearly inversely proportional to the pressure. Thus if a mass of air is enclosed in a cylinder that is provided with a tightly-fitting piston, and the pressure upon it is increased so as to be five times as great as at first, the volume of the air becomes reduced to one fifth of the initial value, provided the compression is performed so slowly that the heat that is set free by it can escape by conduction and radiation. This principle, which was first discovered by the English physicist Robert Boyle, is known as "Boyle's law" in England and the United States. In continental Europe, however, it is known by the name of Mariotte, a French physicist, who discovered it independently of Boyle, but subsequently to him.

When a gas is heated under a constant pressure, its volume increases in a marked manner. All substances exhibit a change of volume under these circumstances, but in gases the change is far greater than for any other bodies, with the exception of certain liquids that are very near to their critical points. The increase in volume of a gas per degree of rise of temperature, when expressed as a fraction of the volume that the gas occupies when it is exposed (at the same constant pressure) to a temperature of 32° F., is called its "coefficient of expansion." The coefficients of expansion of the more familiar gases, such as oxygen, hydrogen, nitrogen, and carbon dioxid, are all very nearly equal; and they have, moreover, substantially the same value, whatever the constant pressure may be at which the experiment is performed. These two facts were discovered independently by Dalton, and by Gay-Lussac, and the first of the two was also discovered, previously, by the French physicist Charles, by whose name it is commonly known. Neither of these is exact, for delicate measurements have shown that the coefficient of expansion of a gas at constant pressure depends to a slight extent both upon the nature of the gas, and upon the intensity of the constant pressure at which the experiment is made. The coefficient of expansion (at constant pressure) of air, oxygen, hydrogen, nitrogen, and carbon monoxid may be taken as 0.00204 on the Fahrenheit scale, or 0.00367 on the Centigrade scale, for ordinary purposes, when the constant pressure at which the expansion takes place is not far from the ordinary atmospheric pressure. The corresponding coefficient for carbon dioxid is slightly larger than this, and may be taken as 0.00206 for the Fahrenheit scale, and 0.00371 for the Centigrade.

The increase in the pressure of a gas, when the gas is heated while its volume is kept rigorously constant, and the increase expressed as a fraction of the pressure that the same gas has when it is exposed (at the same constant volume) to a temperature of 32° F., is known as the gas's "coefficient of expansion at constant volume," although, as a matter of fact, there is really no "expansion" at all in such a case. The coefficients of expansion of gases are very nearly identical, whether the expansion takes place at constant pressure, or at constant volume. For more precise data with respect to the expansion-coefficients of gases, see THERMOMETER; THERMOMETRY.

When a gas is allowed to expand so as to do work (by pushing a piston before it, or in any other way), the temperature of the gas falls, unless it is maintained by the addition of heat from without; the fall of temperature being due to the fact that a portion of the energy that the gas contains is used up in performing the external work. See ENERGY.

When there is absolutely no addition of energy from without, and the gas performs all the work that it is capable of performing in expanding from one of the two given pressures down to the other one, the expansion is said to be "adiabatic." If, on the other hand, a mass of gas that is confined at a definite pressure and temperature is allowed to expand into a vacuum, it does no external work, since the vacuum opposes no resistance to it. In this case the gas is said to undergo "free expansion." The earlier experiments of Joule upon the free expansion of air indicated that it is not attended by any change of temperature whatever. Subsequent more refined experiments executed by Joule and Kelvin, and by Natanson, upon various gases, show that in all cases free expansion is attended by a slight change of temperature. Our experimental knowledge of these slight changes is still exceedingly imperfect, which is greatly to be regretted, since a thorough understanding of the phenomena of free expansion is essential to the numerical evaluation of the absolute thermodynamical scale of temperature. See TEMPERATURE; THERMODYNAMICS.

If P_0 represents the ordinary atmospheric pressure, and V is the volume, at T° and under a pressure of P atmospheres, of a definite mass of gas whose volume is known to be V_0 at the pressure P_0 and at the freezing point of water (T being the temperature as reckoned from this freezing point), then by combining the laws of Boyle, and of Charles and Gay-Lussac, we may easily show that the pressure, temperature and volume of a gas must fulfil the simple relation $PV = P_0V_0(1 + kT)$, where k is the coefficient of expansion of the gas. Since the laws which are thus combined into one expression are only approximately true, the mathematical expression just given is also only approximate. It is very convenient for purposes of calculation, however, when it is not essential that the results which are sought should be known with the utmost accuracy. A mathematical relation of this sort, expressing the relation that must subsist between the pressure, volume and temperature of a gas, is called the "elastic equation," or the "characteristic equation," of the gas.

A rigorously exact equation of this sort undoubtedly exists for every gas; but its precise form is not known in any case. The equation here given is a good first approximation to it, when the gas is sufficiently removed from its critical state; but in the immediate vicinity of the critical state the foregoing equation fails utterly. A better form of characteristic equation was proposed by the Dutch physicist, Van der Waals, as follows: $P = \frac{R(1+kT)}{V-a} - \frac{b}{V^2}$ where P, V, T and k have the same significance as before, and the remaining letters represent constants peculiar to the gas considered. Van der Waals' form of the characteristic equation includes the preceding simpler one as a special case, and it represents the general nature of the phenomena in the vicinity of the critical point quite faithfully.

It has already been said that no actual gas conforms rigorously to the laws of Boyle and Charles and Gay-Lussac, and also that the change of temperature is never rigorously zero, when a gas undergoes free expansion. It is often convenient, however, especially in illustrating the principles that underlie the action of heat engines, to conceive of an ideal gas which would fulfil all these conditions absolutely. An imaginary gas of this kind is commonly called a "perfect gas." This name is unfortunate in some respects, however. A departure from the approximate laws mentioned does not imply any actual imperfection in the gas, and it would be better to follow the lead of those writers who call the imaginary gas an "ideal gas."

Although the coefficient of expansion of a gas is very nearly the same, whether the pressure is kept constant, or the volume, the case is very different with respect to the specific heat; for the specific heat of any gas (that is, the quantity of heat required to raise the temperature of a unit mass of the gas by one degree), is always greater when the pressure of the gas is constant, than when its volume is constant. The heat absorbed by a gas when its temperature rises is expended partly in increasing the internal energy of the gas, and partly in performing the external work that the gas does when it expands. When the volume of the gas is kept constant, no external work is done by the gas; and hence the heat absorbed is less in this case than it is when the gas is allowed to expand while being heated, so as to keep its pressure constant. The quantity of heat required to raise the temperature of a pound of water by one degree being taken as the unit, the quantity required to raise the temperature of a pound of gas by the same amount, while its pressure is kept constant, is given, for several of the more familiar gases, in the accompanying table:

GAS	Specific Heat (Constant Pressure)
Air	0.238
Oxygen	0.217
Nitrogen	0.244
Hydrogen	3.409
Chlorine	0.121
Carbon monoxid	0.244
Carbon dioxid	0.20

The specific heat of carbon dioxid has been given to only two places of decimals, because it varies considerably with the temperature.

The specific heat of a gas at constant volume is hard to measure, and hence it is usually inferred from the observed specific heat at constant pressure, together with the ratio of the two specific heats, as obtained by experiments of a different kind. In the mathematical theory of sound, for example, it is shown that the velocity with which sound will travel through a gas depends upon the ratio of the two specific heats of the gas. It is therefore possible to determine, by calculation, the ratio in question, when the actual speed of sound through a given gas has been found by experiment. The values obtained for the several gases in this way, by different observers, are not as accordant as might be desired. The ratio of the specific heat at constant pressure to that at constant volume appears to have approximately the following values: Oxygen, 1.40; hydrogen, 1.41; nitrogen, 1.41; carbon monoxid, 1.42; carbon dioxid, 1.26.

One of the best-known phenomena of gases is diffusion. Thus when two bottles containing different gases are brought together, mouth to mouth, with the lighter gas in the upper bottle, it is found that the two become perfectly mixed after a time, the lighter gas traveling downward, and the heavier one upward. This phenomenon is believed to be due to the fact that gases consist of a multitude of little particles, or molecules, which are flying about among one another with considerable speed. Many of the molecules in each bottle will in time wander into the other one, so that a sensibly homogeneous mixture eventually results.

Liquids absorb gases, or dissolve them, and sometimes in considerable amounts. Carbon dioxid, for example, is quite soluble in cold water, especially under pressure; and it is upon this fact that the possibility of preparing effervescent mineral waters and wines depends. Porous solids, like freshly prepared charcoal, will also absorb gases in considerable quantity, the gases being retained, apparently, in the form of very thin films, covering the walls of pores of the absorbent substance. (See ABSORPTION.)

When two gases combine with each other chemically, simple volumetric laws are observed, which indicate («Avogadro's law») that the number of molecules per unit of volume is the same in any two gases that have the same temperature and pressure. Two volumes of hydrogen, for example, combine with one volume of oxygen, to produce water; one volume of hydrogen combines with one volume of chlorine, to produce hydrochloric acid gas; one volume of nitrogen combines with three volumes of hydrogen, to produce ammonia gas; and so on.

(See GASES, KINETIC THEORY OF; HEAT; THERMODYNAMICS.) Consult, also: Kimball, 'Physical Properties of Gases'; 'The Laws of Gases' (miscellaneous memoirs, edited by Carl Barus); 'The Expansion of Gases by Heat' (miscellaneous memoirs, edited by W. W. Randall); Preston, 'The Theory of Heat.'

Gases, Kinetic Theory of, the theory which regards gases as aggregates of discrete particles (or «molecules») of matter that are incessantly flying about and colliding with one another, the space in which they are moving being presumably absolutely vacuous, save for the omnipresent luminiferous ether. (See ETHER.) According to this theory, the molecules which are in the outer parts of a given mass of gas must beat incessantly upon the walls of the containing vessel, flying back again from these walls in the same way that they fly away from one another after collisions among themselves. This being the case, it is plain that the walls of the containing vessel are in the same condition as a target against which a furious storm of bullets is striking perpetually. Such a storm of bullets would tend to force the target in the direction in which the bullets were moving before collision; and if the impacts were frequent enough, they would have an effect upon the target which could not be distinguished from a continuous pressure. And if we pass, in thought, from target to retaining vessel, and from bullets to molecules, we shall have a good conception of the kinetic theory of gaseous pressure. Before the behavior of molecular aggregates can be studied by mathematical methods, it is necessary to make certain assumptions with regard to the nature of the molecules. Some of the received assumptions have been made on account of their apparent necessity, and others have been made for no reason whatever, except that they simplify the mathematical treatment of the problems that arise. Thus molecules are assumed to be perfectly elastic, because it has been held to be evident that if they were not so, their incessant collisions must result in a gradual loss of velocity, which would not cease until they were all at rest. The assumption of perfect elasticity is therefore commonly regarded as a logical necessity, since we do not observe any tendency toward rest among the molecules of gases; that is, we do not perceive any tendency toward a fall of pressure, in a gas that is isolated, thermally and otherwise, from its environment. In the earlier mathematical investigations of the properties of gases, from the standpoint of the kinetic theory, the molecules were assumed, furthermore, to be exceedingly small (practically mere physical points), and they were considered to be hard, smooth, and spherical, and to exert no influence upon one another when not in actual contact; these assumptions being made, not because it was considered to be in the least degree likely that molecules have such properties, but merely in order to lessen the mathematical difficulties involved in the subsequent analysis,— difficulties that are serious enough, even when the problem is made as simple as possible. For example, they were assumed to be hard, in order that collisions might be considered as having no sensible duration. They were assumed to be exceedingly small, in proportion to the space in which they move, in order that the probability of a collision in which three or more molecules should come together at once might become vanishingly small in comparison with the probability of a collision in which the molecules come together in pairs, the discussion of the more complex collisions being thereby avoided. They were assumed to be spherical, because spheres can collide with each other in only one way; whereas other bodies (cubes, for example) can come together in the greatest variety of ways, according to their relative orientation at the moment of collision. They were assumed to be smooth, in order to avoid the necessity of taking account of the rotations that are produced when rough spheres glance against one another obliquely. The assumptions stated above were adopted in what may be called the Maxwellian period of the development of the kinetic theory, and Maxwell and other mathematicians made elaborate investigations of the behavior of a practically infinite number of molecules having these properties, when once set in motion in a finite space.

Following are a few of the results obtained by the mathematical study of such molecules as are defined above. It is evident, in the first place, that the velocities of the various molecules are not all equal; for even if such equality existed at any given instant, it would be quickly destroyed by the inter-molecular collisions. Maxwell investigated the distribution of velocities that must subsist in a gas composed of such molecules, and gave a formula by which it is possible to calculate, at any given instant, the number of molecules that have velocities equal to, or less than, any assigned velocity. Thus if the total number of molecules present be taken as unity, the number having a velocity less than the average velocity is 0.533; the number having a velocity less than one half the average velocity is 0.112; the number having a velocity less than twice the average velocity is 0.9820; and the number having a velocity greater than four times the average velocity is 0.0000000074. It appears, therefore, that although any velocity whatever is theoretically possible (so far as Maxwell's formula is concerned), the incessant collisions bring about a sort of averaging which is effective enough to ensure that an almost vanishingly small proportion of the whole number will be actually moving with a speed as great as four times the average. The number having higher velocities falls off with still more remarkable rapidity: for example, the formula shows that less than one molecule in 10^{53} will be moving with a speed as great as 10 times the average. When two or more different kinds of molecules are simultaneously present, the molecules in each set being exactly alike and very numerous, and every molecule being hard, smooth, small, spherical, and perfectly elastic. Maxwell found that the different sets will mix with one another uniformly, and that the velocities in each set will be distributed precisely as though the other sets were not present. The average velocity in each set will be different, however, from the average velocity in every other set, the set in which the molecules are heaviest having the smallest average velocity. In fact, the velocities, in such a case, will be such that the average kinetic energy of a molecule of one set will be precisely equal to the average kinetic energy of a molecule of any other set.

Some of the mathematical difficulties that appeared almost insuperable to Maxwell have been partially overcome by other mathematicians, and, largely owing to the labors of Boltzmann, we now have a far more general form of the kinetic theory of gases. Before stating the nature of the generalizations that Boltzmann effected, it is necessary to offer a short explanation of the expression "degrees of freedom." A mathematical point is completely defined when its three co-ordinates are given; it can move by the variation of any one of these three co-ordinates, while the other two remain constant. Such a point is therefore said to possess three "degrees of freedom." A rigid body in space similarly has six degrees of freedom. Three co-ordinates must be given in order to fix the position of some one of its points,— say its centre of gravity; and it may also have three independent rotations about three independent axes passing through the point so fixed. If the rigid body is not free to rotate, or if (as in the case of the smooth spherical molecules imagined by Maxwell) there is no force acting which tends to produce rotation, the number of degrees of freedom may be considered as reduced to three, the three co-ordinates of the centre of gravity being then sufficient to define the state of the body completely. In particular, a molecule shaped like a dumb-bell may be considered to have but five degrees of freedom, if it is so smooth that collisions cannot set it in rotation about its axis of symmetry. The number of degrees of freedom of a rigid body is six, in the most general case; but if two or more rigid bodies be joined together by hinges, or any other analogous mode of connection that will allow of relative motion between the components, the number of degrees of freedom of the system so formed becomes greater than six. Thus a sytem composed of N straight rods, connected together by flexible joints at their ends, has $(2N+3)$ degrees of freedom.

Boltzmann's form of the kinetic theory may now be stated as follows: Let there be a gas composed of any number of sets of molecules, such that the molecules belonging to each set are exactly like one another, though a molecule belonging to one set may be totally unlike a molecule belonging to another set. Let these molecules have any number of degrees of freedom (which number of degrees may be different in the different sets), and let them be acted upon by parallel forces (such as gravity), or by forces tending toward fixed centres, or by internal forces (that is, forces acting within the individual molecules, between their parts). Let all the bodies be very small in comparison with the total space they occupy, so that the chance of their colliding three or more at a time is practically nothing. Moreover, let them be very numerous, and let them be perfectly elastic, and let them be smooth, so that when they collide the only force tending to make them rotate is that due to normal impact. Let them be set in motion among one another with any distribution of velocities; and let them be hard, but not infinitely so, the force called into play during collision being very great, but not necessarily infinite (as it would be if the hardness were infinite); and let the duration of a collision be exceedingly short, yet not necessarily zero. Then Boltzmann reaches the following conclusions: (1) After a short time, the law of distribution of positions and velocities in each set of the molecules will be precisely the same as it would be if all the other sets were absent; so that each set behaves as a vacuum to all the rest, so far as the distribution of velocities, and the density of aggregation of the molecules in any given region, are concerned. (2) The law of distribution of the velocities in each set is the same as that deduced by Maxwell for spherical molecules. (3) The average kinetic energy *of translation* of the molecules of any one set is equal to the average kinetic energy *of translation* of any other set. (4) The *total* kinetic energy of each set of molecules (including that due to translation, rotation, etc.,) is divided up equally among the different degrees of freedom of that set. This last proposition is undoubtedly one of the most remarkable ever enunciated with regard to molecules, and it appears not to have met with unqualified acceptance among mathematicians, though there are many experimental facts which tend to show that it is at all events a good approximation to the truth.

Although Maxwell and Boltzmann agree that the percentage of molecules that have velocities much larger than the average velocity is very small, it must be remembered that according to either form of the kinetic theory there is always a certain number of molecules that have velocities of any assigned magnitude whatever; and Stoney has pointed out that if this conclusion is really sound, one consequence of it is, that the earth must be continually losing molecules of its atmosphere by their flight from the upper layers of the atmosphere, into space. A molecule of air escaping into space with a vertical velocity greater than about seven miles per second would possess sufficient momentum to carry it beyond the range of the earth's attraction forever. The loss of air that takes place in this manner is probably very gradual, but it is doubtless real, and in the course of ages it may result in the entire dissipation of the earth's atmosphere into the depths of space. It has been suggested that the absence of an atmosphere about the moon, and the apparent rarity of the atmosphere of Mars, may be due to this cause; the action having been more rapid in the cases of these two bodies, because their attractive power is smaller, and hence a larger proportion of atmospheric molecules would have the critical speed necessary to enable them to pass off into space.

It has been stated, above, that Boltzmann found that in a gaseous mixture each set of molecules would assume the same distribution that it would have if it existed in the given space alone. This corresponds to the known experimental fact that gases of different kinds will diffuse into one another, so as to eventually form a homogeneous mixture. When a bottle of some strong-smelling gas, like ammonia, is opened in a room containing still air, we cannot perceive the odor at any considerable distance until quite a time has elapsed. The molecules of the ammonia vapor are indeed moving with high velocities, but they continually strike against air molecules, rebounding from them in such a manner that in any given region there are almost as many of them returning toward the bottle as there are going away from it. They are forced to describe zigzag lines which are so very crooked that by the time an ammonia molecule has reached a point actually 10 feet distant from the bottle, it has in all probability traveled many miles. But eventually the ammonia molecules and the air molecules become thoroughly mixed, just as the kinetic theory predicts. Boltzmann's theory also teaches that in a gaseous mixture the distribution of velocities is the same in each set of molecules as it would be if that set existed in the same space alone. If the explanation of gaseous pressure suggested at the beginning of this article is correct, it follows that each constituent of the gaseous mixture will contribute to the total pressure that the gas exerts against the vessel containing it, by an amount equal to the pressure that this constituent would exert if it existed in the same space by itself. This corresponds to the known law of Dalton with regard to gaseous mixtures,—the law which states that in a gaseous mixture the total pressure is equal to the sum of the partial pressures due to the several constituents separately.

It may be shown that the average kinetic energy of translation of the molecules of a given mass of gas is sensibly proportional to the absolute temperature of the gas. This being admitted, it is easy to understand the reason for Boyle's law. (See GASES, GENERAL PROPERTIES OF.) For so long as the temperature of the gas remains constant, the average velocity of translation of the molecules also remains constant, and therefore the average effect of the blow that a molecule strikes against the walls of the containing vessel is also constant. But the pressure, in this case, will vary in direct proportion to the number of blows that the molecules strike against a unit area of the walls in a given time, and this will also vary in direct proportion to the number of molecules that a cubic inch of the gas contains. We see, therefore, that if the temperature of a gas remains constant, the pressure that the gas exerts will vary directly with the density of the gas; or, to state the same fact in another way, the pressure will be inversely proportional to the volume of the gas, which is Boyle's law.

Avogadro's law may be derived in a somewhat similar manner. Thus let P be the pressure that a gas exerts against a unit area of the containing vessel, let N be the number of molecules that it contains, per unit of volume, and let K be the average kinetic energy of translation of its molecules. Then the kinetic theory shows that the pressure of the gas can be expressed in the following manner: $P = \frac{2}{3}NK$. If two different kinds of gas are to be compared, we may conveniently distinguish the values of P, N and K that relate to the separate gases by using the subscripts 1 and 2. Then for one gas we shall have $P_1 = \frac{2}{3}N_1K_1$, and for the other $P_2 = \frac{2}{3}N_2K_2$. If the pressure is the same in both gases, we have $P_1 = P_2$, and it is easily seen that this involves the equation $N_1K_1 = N_2K_2$. Now, if the temperatures of the two gases are also equal, the average kinetic energy of translation is likewise the same in both gases; that is, $K_1 = K_2$. Taking this into account, we see that it follows that $N_1 = N_2$: or, in other words, when two gases have the same temperature and the same pressure, they also contain the same number of molecules per unit of volume; and this is Avogadro's law.

Knowing the mass of a given volume of a gas, and the pressure that the gas exerts against the boundaries that confine it, we may calculate the average speed that the constituent molecules of the gas must have, in order to produce the observed pressure. The formula by which the calculation is effected need not be given here, but some of the results are of interest. Thus it is found that at 32° F. the molecules of the more familiar gases have the following average velocities, in feet per second: Hydrogen, 5,571; oxygen, 1,394; nitrogen, 1,488; carbon dioxid.

1,491; carbon monoxid, 1,189. At higher temperatures, the velocities are greater, being proportional, for any one gas, to the square root of the absolute temperature.

A very important application of the kinetic theory of gases, which has recently been especially emphasized in connection with the determination of the atomic weight of argon (q.v.), relates to the ratio of the specific heats of a gas. Boltzmann's theory shows that if the specific heat of a gas at constant pressure be divided by its specific heat at constant volume, then the quotient can be expressed in the form $1+\frac{2}{n}$, provided the effects of such forces as may exist between the different molecules of the gas are negligible, n being the number of degrees of freedom of the molecules of gas under consideration. This equation, it will be seen, affords a means of ascertaining the number of degrees of freedom of the molecule of a gas, by setting the foregoing expression equal to the observed value of the ratio of the specific heats, and then solving the equation for n. By this method, it has been inferred that the molecules of hydrogen, nitrogen, oxygen, and carbon monoxid have each five degree of freedom; for the ratio of the specific heats of these gases approximates closely to 1.4, which is the value of the foregoing expression for $n=5$. If the molecules of a gas were really smooth spheres,— so smooth that they could not be set in rotation by their collisions,— then we should have $n=3$, and hence the ratio of the specific heats would be 1.667, a value which is actually observed in the cases of argon, helium, mercury vapor, cadmium vapor, and perhaps a few other substances. Hence it is inferred that argon and helium really are elementary bodies; because it is difficult to conceive of a compound body behaving, so far as collisions are concerned, as though its molecules were smooth spheres; and if they had any other shape, it would be necessary to admit that they have at least five degrees of freedom (since it is impossible for any body in free space to have four degrees of freedom), and this would reduce the calculated value of the ratio of the specific heats to 1.400, a value which it is apparently impossible to reconcile with the results of direct observation.

Most of the results of the kinetic theory, as given above, involve the assumption that the effects of the mutual attractions that may exist between the individual molecules of a gas are small, on the whole. The forces, when they exist, may be great; but we assume that under ordinary circumstances the radius of sensible action of these forces is small in comparison with the length of the average distance that the molecules travel, between successive collisions. When, by reason of the gas being greatly compressed, this assumption becomes of doubtful validity, the foregoing conclusions become correspondingly weakened. The average distance that a molecule travels, between successive collisions, is known as its "free path"; and numerical estimates of the length of the free path have been obtained, by methods which cannot be given in the present article. Thus the free paths of some of the more familiar gases are as follows (expressed in ten millionths of an inch), the gases being supposed to be at 32° F., and under ordinary atmospheric pressure: Oxygen, 38; nitrogen, 36; hydrogen, 67; carbon monoxid, 36; carbon dioxid, 25. When the density of a gas is diminished, the average free path of the molecules increases in direct proportion to the decrease in density. Thus in the high vacua that prevail in Crooke's tubes, the mean free path may be measured in inches; the free path for hydrogen, for example, being about 6.7 inches, when the density of the gas has been reduced to the millionth of the normal density at 32° F. and atmospheric pressure.

The whole kinetic theory of gases is likely to be profoundly modified in the near future, when physicists have learned more about the "electron" (q.v.), which is now commonly regarded as the foundation unit in molecular architecture. For further details concerning the subjects touched in this article, consult Meyer, 'Kinetic Theory of Gases'; Risteen, 'Molecules and the Molecular Theory of Matter.' See also CRITICAL POINT; GASES, GENERAL PROPERTIES OF; MATTER, PROPERTIES OF; MOLECULAR THEORY; THERMODYNAMICS.

A. D. RISTEEN.

Gases, Laws of. Since 1877, when Cailletet and Pictet liquefied hydrogen and other gases, the laws of permanent gases are assumed to apply to a gas which can be liquefied only with difficulty, either by the use of a very low temperature, an extremely high pressure, or by the combined effect of both.

These laws may be stated as follows:

Boyle's or Mariotte's Law.—About the year 1626, Robert Boyle, an Englishman, discovered that, at constant temperature, the volume of a given weight or mass of gas varied inversely as the pressure.

The same law was announced about 14 years later (1640) by Edme Mariotte of France, and is, therefore, often called Mariotte's law.

According to this law, if V_1 represents the initial volume of a given weight of gas expressed in any unit of cubical measure such as cubic feet or cubic inches, and P_1 the initial pressure, expressed in any unit of pressure on a unit of area such as pounds per square inch, then, for any variations of pressure and volume, at a constant temperature, the volume multiplied by the pressure gives a constant result regardless of variations in them, or

$$P_1V_1 = \text{Constant},$$

and for any other volume V_2 and pressure P_2,

$$V_1 : V_2 :: P_1 : P_2,$$

$$\text{and } \frac{V_1P_1}{V_2}=P_2, \quad \text{also } \frac{V_1P_1}{P_2}=V_2.$$

Furthermore, the density of a given weight of gas will vary inversely as the volume, and, therefore, the pressure will vary directly as the densities, and will be directly proportional to them at the same temperature, or—

$$P_1 : P_2 :: D_1 : D_2;$$

or

$$\frac{P_2}{D_2}=\frac{P_1}{D_1}=\text{Constant}.$$

For example: If the initial volume of a given weight of gas is 20 cubic inches, and its initial pressure is 14.7 pounds per square inch, at a temperature of 32° Fahr., and if it be compressed to 10 cubic inches, while its temperature is kept constant, its final pressure will be—

$$\frac{20 \times 14.7}{10} = 29.4 \text{ pounds per square inch,}$$

or two times the initial pressure.

Under the same law, if the initial volume of the gas be expanded to a final volume of 40 cubic inches, while its temperature is kept constant, the final pressure will be

$$\frac{20 \times 14.7}{40} = 7.35 \text{ pounds per square inch.}$$

or one-half the initial pressure.

Isothermal Expansion and Compression.—According to Boyle's law, if a given weight of gas be placed in a cylinder having a tight-fitting piston working therein, and the volume and pressure of the gas made to vary by moving the piston back and forth so as to alternately compress and expand the gas, the action of the gas will be isothermal: *i.e.*, during expansion it will take in an amount of heat equal to the energy expended by it in increasing its volume, and during compression it will reject an amount of heat equal to the energy spent upon it.

In order to perform actual work, however, the pressure exerted against the piston ought to be due to the expansion of the gas under the influence of heat, and under such a condition, its action will conform to the law enunciated by Gas-Lussac, which establishes the mutual relations of the temperature, volume, and pressure of a gas acting under an increase or decrease of temperature.

Gay-Lussac's Law.—This law was recognized by M. Charles, professor of natural philosophy at Paris, some time previous to its announcement by Gay-Lussac, and is, therefore, sometimes called Charles' law, but the credit of establishing it as one of the fundamental bases of modern chemistry belongs to the latter, who announced, in 1802, that different gases expanded in the same proportion when heated from 0° to 80° Réaumur, or that at constant pressure, equal volumes of different gases increase equally for the same increment of temperature; also, that equal increments of volume correspond very nearly to equal intervals of temperature on the scale of a mercurial thermometer.

Absolute Temperature.—According to Gay-Lussac's law, equal volumes of hydrogen, oxygen, air, etc., at a temperature of 32° Fahr., kept at a constant pressure (not necessarily the same for all) and increased in temperature 1° Fahr., will expand, in each case, 1-493 of itself. Therefore, if the original volume of any gas at 32° Fahr. is 493 cubic inches, it will be 494 cubic inches at 33° Fahr., 495 cubic inches at 34° Fahr., etc. Under the same law, if the temperature be reduced, the original volume of the gas will contract by 1-493 of itself for each degree below 32° Fahr. Therefore, at 0° Fahr., the volume will be 493 — 32 = 461 cubic inches; and at 461° below 0° Fahr., the volume will be 0: or in other words, if a perfect gas be cooled to a temperature of — 461° Fahr., it will be in a condition of perfect stability, having neither volume nor pressure, and will afford an ideal point from which all temperature can be counted as zero.

This point is, therefore, called the absolute zero of temperature, and the absolute temperature of a gas according to the scale of a Fahrenheit thermometer is, for example, 32° Fahr. + 461° = 493° absolute; or 64° Fahr. + 461° = 525° absolute.

In the Centigrade thermometer, the zero point of which corresponds to 32° Fahr., the melting point of ice, and each degree of which is equal to 1.8 Fahr., degrees, the absolute zero of temperature is 493 ÷ 1.8 = 273° absolute, or — 273° C., and absolute Centigrade temperatures will be, for example, 0° C. + 273° = 273° absolute; or 100° C. + 273° = 373° absolute, etc.

The temperature of interstellar space corresponds to the absolute zero of temperature defined by this law.

Use of Absolute Temperatures.—By using absolute temperature values in computations and formulæ, all temperature readings are made positive throughout the range of experience and practice, thus eliminating negative readings which result from the arbitrary location of the zero points in the scales of ordinary thermometers relatively to the freezing point of water. Furthermore, as the volume of a gas at absolute zero is 0, the use of absolute temperature value results in expressions which include both the increment of temperature and the increment of volume in the same expression.

Absolute Pressure.—Although the pressure and volume of a gas become 0 at the absolute zero of temperature, that condition is not in any manner connected, as it might be inferred, with the matter of absolute pressures involved in steam or gas engine practice.

Gay-Lussac's Law Applied.—Referring to Boyle's law and the formulæ deduced therefrom, in which V_1 represents the initial volume; V_2 the final volume; P_1 the initial pressure, and P_2 the final pressure; it is clear that $V_1 \; P_1 = V_2 \; P_2$; but according to Gay-Lussac's law, the volume of a gas varies with its temperature; therefore, at constant pressure, the volume of a gas will vary directly as its absolute temperature; and at constant volume, the pressure will vary as the absolute temperature, or the pressure or volume of a gas is directly proportional to its absolute temperature, and if V_1 be the volume of a gas at absolute temperature T_1, and V_2 the volume at absolute temperature T_2, then

$$V_1 : V_2 :: T_1 : T_2;$$

and

$$\frac{V_1 T_2}{T_1} = V_2;$$

or if P_1 be the pressure for absolute temperature T_1, and P_2 the pressure for absolute temperature T_2, then

$$P_1 : P_2 :: T_1 : T_2;$$

and

$$\frac{P_1 T_2}{T_1} = P_2.$$

These ratios indicate the mutual relations of the initial and final volumes, pressures, and temperatures of a gas acting within the cylinder of a heat engine.

For example: If 20 cubic inches of gas at a temperature of 525° absolute be placed in a cylinder and raised to a temperature of 2811° absolute, its volume will increase to

$$\frac{20 \times 2811}{525} = 107 \text{ cubic inches};$$

while its pressure will remain unchanged.

On the other hand, if the initial pressure of the gas is 14.7 pounds per square inch, and it is not allowed to expand when its temperature is raised, its pressure will increase to

$$\frac{14.7 \times 2811}{525} = 78.7 \text{ pounds per square inch},$$

and represent the amount of static energy in the gas available for doing work.

Specific Heat of Gases.—The foregoing laws define the capacity of a gas for doing work as depending on, first, its mass or the amount of matter present; and second, upon the amount of heat it contains as represented by its absolute temperature.

Another important factor, however, is its capacity for absorbing heat or the amount of heat required to raise the temperature of a unit weight of the gas by one degree as measured by a thermometric scale.

This heat-absorbing capacity of the gas stated in units of weight, is called the specific heat of the gas, and if the weight of the gas be multiplied by its specific heat and by its absolute temperature, the product will express the intrinsic energy of the gas under those particular conditions and without an artificial increase of that energy. So that, if W represents the weight of a given quantity of gas, C the specific heat of the gas, and T its temperature, then

$$W \times C \times T = \text{the intrinsic energy of the gas.}$$

It has been shown, however, that the temperature of a gas may be increased either at constant pressure or at constant volume. Therefore, gases must have two specific heats.

The Specific Heat at Constant Pressure is the amount of heat absorbed by the gas when its temperature is increased by one degree on a thermometric scale, with the pressure remaining constant, but the volume increasing.

The Specific Heat at Constant Volume is the amount of heat absorbed by the gas when its temperature is increased by one degree on a thermometric scale, with its volume remaining constant, but its pressure increasing.

Regnault's Law.—According to this law, the specific heat of constant pressure is constant for any gas.

Therefore, if Cp represents the specific heat of a gas at constant pressure, and Cv the specific heat at constant volume, and the temperature of a unit weight of the gas at a constant pressure P be raised from absolute temperature T_1 to absolute temperature T_2, then

$$Cp\,(T_2 - T_1) = \text{Heat absorbed by the gas.}$$

Now, if V_1 be the volume of the gas at T_1, and V_2 the volume at T_2, then

$$P\,(V_2 - V_1) = d\,(T_2 - T_1) = \text{Work done by the gas};$$

in which, d is a constant depending on the specific density of the gas and on the units in which P and V are stated, and the difference between the quantities represented by these two expressions, or $(Cp - d)\ (T_2 - T_1)$ is the increase in the amount of the internal energy of the gas when its temperature is raised from T_1 to T_2.

It can be shown, however, that this increase of internal energy would be the same if the gas be heated in any other manner from T_1 to T_2, and since a gas when heated at constant pressure expands and does work on the external air, the specific heat at constant pressure must necessarily be greater than the specific heat at constant volume by the amount of heat expended in doing that work.

Joule's Law.—But according to Joule, when a gas expands without doing external work, its temperature does not change. In other words, changes of pressure and volume not connected with changes of temperature, do not affect the internal energy of a gas. Therefore, in any change of temperature, the change of internal energy is independent of the relation of pressure to volume, and when two states of a gas are compared, the internal energy is represented by their difference of temperature and not by the difference of pressure or volume.

It has been shown that $(Cp - d)\ (T_2 - T_1)$ represents the increase of internal energy when the temperature of the gas is raised from T_1 to T_2 at constant pressure, and that it also represents the increase of internal energy when the temperature of the gas is changed from T_1 to T_2 in any manner whatsoever.

Now, take the case of a unit weight of gas, the temperature of which is raised from T_1 to T_2 at constant volume.

$$Cv\,(T_2 - T_1) = \text{Heat absorbed by the gas.}$$

But the gas does not expand, therefore no external work is done, and all the heat absorbed represents increase of internal energy, so that

$$Cv\,(T_2 - T_1) = (Cp - d)\,(T_2 - T_1),$$

and

$$W \times Cv\,(T_2 - T_1).$$

represents the available internal energy of a given weight of gas when its temperature is raised from T_1 to T_2, and for any gas

$$Cp - d = Cv;$$

or as already stated, the specific heat at constant pressure is greater than that at constant volume by the amount of the external work done.

When the weight per cubic foot, and the coefficient of expansion by heat, are known, the value of d for any gas may be computed as follows:

Imagine a cylinder one square foot in area having a piston working within it against the normal pressure of the atmosphere.

The total pressure on the piston will be $14.7 \times 144 = 2{,}116.5$ pounds. Let one cubic foot of air at a temperature of 32° Fahr., be placed under the piston and expanded by heat until its volume is equal to two cubic feet. The work done by the cubic foot of air will be 2,116.5 foot pounds, and as a cubic foot of air under the assumed conditions of pressure and temperature weighs .080728 of a pound, the work done by one pound of air will be equal to $2{,}116.5 \div .080728 = 26{,}217.6$ foot-pounds.

According to Gay-Lussac's law, an addition of heat equal to 493° Fahr., or 273° Centigrade, is required to double the volume of a gas, therefore, the external work which will be done by the gas when its temperature is raised one degree will be 1-493 of that done when its temperature is raised 493°, and the external work required to be performed by air when its temperature is raised by one degree Fahrenheit will be $26{,}217.6 \div 493 = 53.3$ foot-pounds = d.

The accompanying table of properties of gases will be found useful in connection with calculations relating to the action of gases in heat engine practice.

PROPERTIES OF GASES.

	Specific Gravity	Pounds per Cubic Foot	Cubic Feet per Pound	Cp	Cv	Ratio $\frac{Cp}{Cv}$	d
Air..	1.0000	0.080728	12.387	0.2375	0.1689	1.406	53.3
Oxygen .	1.1051	0.08921	11.209	0.2175	0.155	1.403	48.2
Hydrogen..	0.0695	0.00561	178.23	3.409	2.406	1.417	768.
Nitrogen....	0.9714	0.07842	12.752	0.244	0.173	1.409	54.8
Carbon monoxide	0.9674	0.07810	12.804	0.245	0.173	1.416	55.7
Carbon dioxide	1.5290	0.12343	8.102	0.216	0.171	1.165	34.8
Marsh gas..	0.5560	0.04488	22.301	0.593	0.467	1.27	94.7
Ethylene....	0.9847	0.07949	12.580	0.404	0.332	1.144	54.2
Steam......	......	0.03794	26.42	0.480	0.369	1.302	85.6

Excepting steam, all the values given in the table are for gas at atmospheric pressure (14.7 pounds per square inch) at 32° Fahr. In the case of steam the temperature is that of boiling water (212° Fahr.).

Mutual Relations of Temperature, Volume, and Pressure.—In conformity with the foregoing laws, the mutual relations of the temperature, volume, and pressure of a gas vary with the conditions obtaining at heating: (1) At constant temperature, an increase of volume is accompanied by a decrease of pressure. (2) At constant volume, an increase of temperature results in an increase of pressure. (3) At constant pressure, an increase of temperature results in an increase of volume.

In doing work under these conditions, a gas acts by four well-defined modes of expansion or compression—isothermally, adiabatically, isometrically, and isopiestically.

Isothermal Expansion or Compression.—In this connection, it might be stated that the most natural conditions for the expansion or compression of a gas doing work, as in the case of one acting in the cylinder of a heat engine, are: (1) For expansion—that in which the pressure decreases as the volume increases, with a corresponding decrease in its temperature due to the external work done by the gas in moving the piston. (2) For compression—that in which the pressure increases as the volume decreases, with an increase in its temperature due to the work spent upon the gas by the piston in the act of compression.

If, however, during expansion the gas absorbs an amount of heat equal to that expended by it in moving the piston, and during compression it rejects an amount of heat equal to that which is spent upon it, thus maintaining a constant temperature, its action will be isothermal, or the heat will be equal at all points of the piston stroke, and the product of the volume and pressure at any point will be constant.

It is obvious, that in the case of a gas acting isothermally, the piston must be perfectly free from leakage, and its movement must be regulated to correspond exactly to the heat-absorbing capacity of the gas.

On the other hand, it is clear, that if the piston were moved in and out rapidly, thus unduly increasing or decreasing the temperature of the gas, the fundamental condition of constant temperature will not be satisfied, and the action of the gas will not be isothermal.

Adiabatic Expansion or Compression.—In order to utilize a gas acting isothermally, to do work, suitable means have to be provided for adding to the gas a sufficient amount of heat to replace the loss due to the external work done during expansion, and to withdraw the heat added to it during compression.

But, suppose that no such means are provided for maintaining a constant temperature, and that the gas acts within a cylinder which is a perfect non-conductor of heat. Then, during expansion the temperature of the gas will be diminished by an amount equal to the heat units expended by it in doing external work, and during compression its temperature will be increased by an amount equal to the number of heat units of work spent upon it.

In this case, the action of the gas will be adiabatic—the external work during expansion being done entirely at the expense of the intrinsic energy of the gas, and the work spent upon it during compression being an increase of that intrinsic energy by mechanical means.

It is obvious, that adiabatic action must be accompanied by change in the ratio of pressure to volume; therefore, at the end of the piston stroke the pressure will be less than it would be in the case of isothermal expansion by an amount corresponding to the amount of heat expended in doing external work.

Thermal Lines.—Since the work performed by the action of a gas in the cylinder of a piston engine is represented by the product of two factors—the pressure of the gas multiplied by its volume,—it is clear that if the pressure

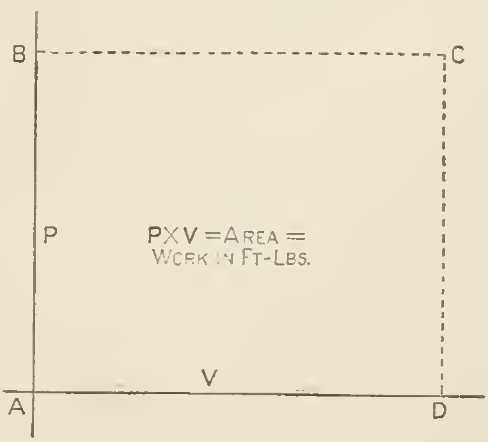

Diagram 1.

be stated in pounds, and the volume in feet corresponding to the length of the piston stroke, a diagram can be drawn which will represent in foot-pounds the work performed by the engine.

In diagram 1, let the line AB represent a pressure P of 300 pounds expended by a gas in increasing its volume and driving a piston from A to D, a distance V of two linear feet. Then, P × V represents the area of the rectangle ABCD, and $300 \times 2 = 600$ foot-pounds, represents the work performed.

In this case, the pressure is assumed as constant, and illustrates the simplest form of a pressure-volume diagram. Usually, however, the pressure is not constant, but diminishes as the volume increases, and *vice versa*, according to variations of temperature which cause corresponding variations of pressure and volume, so that the areas of the pressure-volume diagrams or indicator diagrams of heat engines will be bounded by either straight lines or curves representing the thermal lines of the action of gases under different modes of expansion or compression, as shown in diagram 2.

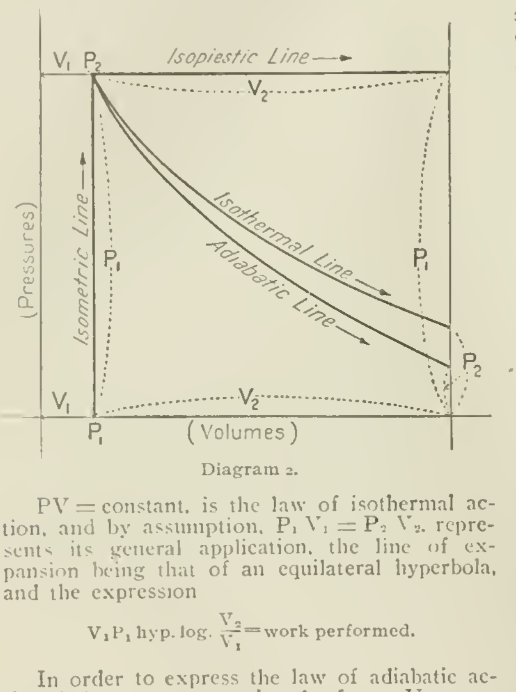

Diagram 2.

PV = constant, is the law of isothermal action, and by assumption, $P_1 V_1 = P_2 V_2$, represents its general application, the line of expansion being that of an equilateral hyperbola, and the expression

$$V_1 P_1 \text{ hyp. log. } \frac{V_2}{V_1} = \text{work performed.}$$

In order to express the law of adiabatic action, it is necessary to give the factor V an exponent n equal to the ratio—specific heat at constant pressure divided by the specific heat at constant volume, so that $PV^n =$ constant, and by assumption $P_1 V_1^n = P_2 V_2^n$, and

$$\frac{P_1 V_1 (1 - r^{1-n})}{n - 1} = \text{work performed.}$$

where r is the ratio $\frac{V_2}{V_1}$, or the ratio of expansion.

Isometric action is shown by thermal lines parallel to the line of pressures, the heating being at constant volume.

Isopiestic action is shown by thermal lines parallel to the line of volumes, the heating being at constant pressure.

Relative to the horizontal and vertical lines on a pressure-volume diagram, it will be observed, however, that in the case of isothermal expansion or compression, if the temperature and pressure remain constant, the line traced on the diagram will be a horizontal line, and if the temperature and volume remain constant, the line traced will be a vertical line, thus resembling isopiestic and isometric lines respectively, although actually representing an entirely different mode of action. It may be stated as a general rule, however, that horizontal and vertical lines indicate isothermal action in the case of a steam engine, and isopiestic or isometric action respectively, in the gas of an internal combustion engine.

See articles Gas Engine and Gas Producer, in this Encyclopædia.

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Gases, Joule's Law of; Boyle's or Mariotte's Law of; Gay-Lussac's Law of; Regnault's Law of; Absolute Pressure; Absolute Temperatures; Adiabatic Expansion or Compression; Density of; Isothermal Expansion and Compression; Specific Heat of. See Gases, General Properties of; Gases, Laws of.

Gases, Liquefaction of. It has also been long known that most solids can be transformed into liquids by the application of heat, and that many liquids can also be transformed into vapor by a further addition of heat. Conversely, it was known that certain aëriform substances, such as steam, can be converted into liquids by the mere abstraction of heat. It was believed, however, that an essential difference exists between gases and vapors, vapors being condensible to the liquid form, while gases were believed to be permanently aëriform, and not condensible by any experimental means at our disposal. In the early part of the 19th century the validity of this distinction came to be doubted, and Faraday, at the suggestion of Davy, undertook the systematic study of the question. He succeeded in reducing to the liquid form quite a number of gases that had previously resisted liquefaction. His general method consisted in generating the gas in large quantities in a limited space, so as to produce a very high pressure, under the influence of which (when the experiment was successful) the gas passed into the liquid state. The most convenient way of carrying out this experiment is to make use of an inverted U-shaped glass tube, one of whose legs contains a chemical preparation suitable for the generation of the gas in question, while the other end dips into a freezing mixture; the tube being hermetically sealed. If cyanide of mercury be heated in one of the legs of a tube of this kind, for example, cyanogen gas is generated in such quantities that the pressure causes a large part of it to condense in the chilled end of the tube. Chlorine was liquefied by Faraday in this manner in 1823. Shortly afterward Thilorier succeeded in solidifying carbon dioxid by the combined application of intense cold and great pressure, and Cagniard de la Tour, Regnault, Natterer, and many other experimenters, improved the methods in use with the result that many of the gases that had been previously regarded as non-condensible were reduced to the liquid form. Oxygen, hydrogen, nitrogen, and some few other gases still resisted all attempts at liquefaction, however, and these were still called "permanent gases," although the conviction had forced itself upon physicists that all gases could be conquered, if the necessary conditions of success could be discovered. The subject was in this state when Andrews undertook his classical study of the phenomena of liquefaction of carbon dioxid. In 1863 he made the following announcement: "On partially liquefying carbonic acid by pressure alone, and gradually raising at the same time the temperature to 88° F (31° C.), the surface of demarcation between the liquid and gas became fainter, lost its curvature, and at last disappeared. The space was then occupied by a homogeneous fluid, which exhibited, when the pressure was suddenly diminished or the temperature slightly lowered, a peculiar appearance of moving or flickering striæ throughout its entire mass. At temperatures above 88° F. no apparent liquefaction of carbonic acid, or separation into two distinct forms of matter, could be effected, even when a pressure of 300 or 400 atmospheres was applied." It appeared, therefore, that a certain temperature exists, above which carbon dioxid cannot be liquefied by any pressure whatever; and this discovery was soon verified in the case of other gases. The temperature in question is known as the "critical temperature" of the gas under experiment. (For its numerical values in the cases of the more important gases, see CRITICAL POINT.) The reason that oxygen, nitrogen and hydrogen resisted previous attempts at liquefaction, even when the pressure was pushed to 3,000 atmospheres, was that the critical points of these gases are very low indeed,— far below any temperature at which the attempt at liquefaction had been made. The problem of liquefying the so-called "permanent gases" was, therefore, resolved into the production of exceedingly low temperatures. One means for the production of such temperatures was given by Thilorier, who showed that by mixing solid carbon dioxid with ordinary ether, a temperature as low as 165° F. below zero may be attained. The cold produced by the expansion of the gases themselves has also been utilized for the production of the necessary degree of cold, and in the best modern forms of apparatus the gas, after being cooled by its own expansion, is furthermore caused to circulate about the pipes that are conducting fresh supplies of gas to the point at which the expansion takes place. In all cases, every care is taken to make use of any process or device which will lower the temperature of the gas; and by the strictest attention to this general principle, it has been found possible to liquefy every known gas except helium and possibly one or two of the other rare gaseous elements recently discovered in the atmosphere. It is highly probable that these will also succumb, when they can be obtained in sufficient quantity to be treated by the same methods that have yielded success in the case of so obdurate a gas as hydrogen. Hydrogen was first liquefied, in quantity, by Dewar, in 1898. Consult: Hardin, 'Rise and Development of the Liquefaction of Gases.'

Gas'kell, Elizabeth Cleghorn Stevenson, English novelist: b. Chelsea 29 Sept. 1810; d. Alton, Hampshire, 12 Nov. 1865. She was brought up by an aunt at Knutsford in Cheshire, where she spent the greater part of her early life. This town is said to be the original of the village in her story of 'Cranford,' described as inhabited exclusively by maiden ladies and widows of limited means. She married in 1832 the Rev. William Gaskell (q.v.), a Unitarian clergyman then recently appointed minister of Cross Street Chapel, Manchester. Her first work, 'Mary Barton,' appeared in 1848. The 'Athenæum' says it raised the Lancashire dialect almost to the level of the broad Doric used by Scott in his northern novels. In this, as in most of her works, Mrs. Gaskell appears as a social reformer. Her moral and economical theories may be questioned, but as a writer of fiction she wields artistic and dramatic powers of a high order. 'Mary Barton' represents the struggles formerly so rife in Lancashire, and which have since passed in new phases and into other quarters, between workmen and employers. 'The Moorland Cottage' appeared in 1850; and in 1853, her next novel, 'Ruth,' which aims a distinct blow at the common moral judgments of society. The tale is powerfully told, but will hardly satisfy a dispassionate reader of the soundness of Mrs. Gaskell's moral theories. Her later works include: 'Cranford' (1853), an English classic, the popularity of which is constantly increasing; 'North and South' (1855); 'Sylvia's Lovers' (1860); 'Cousin Phillis' (1865); 'Wives and Daughters' (1866). In 1857 appeared a 'Life of Charlotte Bronte,' of which the 'Athenæum' observed "As a work of art we do not recollect a life of a woman by a woman so well executed."

Gaskell, William, English Unitarian clergyman: b. Latchford, near Warrington, Lancaster, 24 July 1805; d. Manchester 11 June 1884. He was graduated from the University of Glasgow in 1824; studied theology at Manchester College, York, in 1825–8; was junior minister of Cross Street Chapel, Manchester, from 1828, and senior minister from 1854. In 1840–6 he was secretary to Manchester New College, and in 1846–53 professor there of English history and literature. He also taught logic and English literature in Owens College. He was an editor of the 'Unitarian Herald' 1861–75; made a favorite rendering of Luther's 'Ein feste Burg'; wrote many original hymns, of which some appear in James Martineau's 'Hymns of Praise and Prayer' (1874); and published numerous tracts and sermons, besides 'Two Lectures on the Lancashire Dialect' (1844), appended to the 5th edition (1854) of the 'Mary Barton' of his wife, Elizabeth Cleghorn Gaskell (q.v.).

Gasoline. A colorless, inflammable fluid, the first and highest distillant of crude petroleum; an arbitrary name first given to certain gravities of naphtha used for making illuminating gas in house-plants. Specifically all gasoline is naphtha in the manufacturing laboratory. The specific gravity ranges from .58 to .90, compared with the unit 1 assumed for water, at 60° F. For every 20° F. the specific varies .01. Measured on the Baumé scale, higher specific gravities are denoted by lower numbers, and lower specific gravities by higher numbers without definite graduations. For example, a change of 6° on the Baumé scale, from 74° to 68°, means a difference in specific gravity of .017, the increase being from .690 to .707; in the other direction a change from 74° to 80° Baumé shows a difference of .022, or a change in specific gravity from .690 to .668. Gravities from .50 to .65 are used in varnishes, paints, oilcloth manufacture, etc., as driers; gravities .65 to .68 are generally known as "stove" gasoline; .68 to .76 are used in burners for steam automobiles and in carburetters of gasoline (hydrocarbon) automobiles; higher gravities are used in cleansing establishments, and to raise the specific gravities of lower grades which contain more or less grease from lower distillation. Crude petroleum yields about 15 per cent gasoline (naphtha) for all gravities and about 4 per cent only for gravities above .76. Gasoline, like all other products of crude petroleum, was for a long time disposed of as waste in the effort to make kerosene; it was there and had to come out. In the latter sixties it was exported to Europe in small quantities. Representing the lightest portion of crude oil, gasoline is extracted by distillation, just as whiskey is produced, and in much the same sort of apparatus. The stills or retorts may be of any shape and size; both are immaterial, and practice has differed. They may be cylinders placed horizontally and in banks, or cylindrical or conical, standing perpendicular and having curved domes. Rectification is effected by a copper coil, many feet in length inside the retort and passing through the crude petroleum, carrying steam at a high pressure, assisted by a gentle direct fire varying from 122° to 257° F. Each retort has an inlet pipe for the crude petroleum and an outlet pipe for the distillant. The outlet pipe passes over the side and down to a cooling coil or worm immersed in cold running water. This worm acts as a condenser that changes back to liquid form the vapors driven off the petroleum by the heat. A smaller pipe leads from the condenser to a receiver having glass sides through which the "still-man" can watch the flow of distilled oil. From the bottom of the receiver a number of pipes lead to different storage tanks, each pipe having a cut-off valve to regulate the flow of the varying gravities to their proper tanks, each cut-off being known as a "sweeping." The first product from the retort is a gas formed by the mingling of the fumes of the petroleum with the small volume of air left in the reservoir; this is sometimes conveyed to the fire-box and used as fuel. When the first flow of the distillant reaches the receiver, the still-man tests it with a Baumé hydrometer for its specific gravity. Usually this first flow is found to be about .90 specific gravity. It is of a highly volatile nature, so nearly a gas that when exposed to air it rises in an invisible vapor and will quickly evaporate. It cannot be confined for any length of time in barrels, even if they have been successively coated inside with wax and repeatedly painted outside to make them air-tight. Even in the coldest weather it will pass through the wood. For these reasons this gravity is not put out commercially, but is used to bring up the gravity of a mass made up of lower gravities; that is to say, if .88 is being tanked the still-man lets all the .90, .89, .88 and enough of the .87 gravity oil flow into the receiver to make an average mixture of the density wanted. The oil is repeatedly tested with the hydrometer until the right gravity has been produced in the receiver, when it is let off to the proper storage tank. If .82 is the next grade wanted, all the gravities from .86 down to perhaps .78 are commingled in the receiver until a uniform fluid of the required gravity is obtained to let off into its tank. This process is called "fractioning," and is continued through gasoline into kerosene, the next distillant, down about .42 specific gravity. Gasoline is known in England as "petrol," in France as "essence." The English term is a copyrighted name first given some years ago by a refining firm called upon for high gravity naphtha by an experimenter in hydrocarbon mixtures. See PETROLEUM.

ERNEST L. FERGUSON,
Writer on Gasoline Engines and Components.

Gasom'eter, or **Gas Holder**, an inverted cylindrical vessel of sheet iron, placed in a tank of cast iron, stone, or brick containing water. A pipe ascends from the bottom of the tank through the water, to admit the gas to the space between the surface of the water and the crown of the gas holder. Sometimes a second pipe descends through the water and the bottom of the tank, for the issue of the gas to the main pipe. Frequently only one pipe is used for the inlet and outlet alternately. The water is for the purpose of retaining the gas within the vessel. The pressure of the gas raises the gas holder; and the weight of the gas holder, or such part of it as is not taken off by balance weights, impels the gas through the pipes. When balance weights are necessary, they are attached to the edge of the crown of the gas holder by long chains, which pass over pulleys on the top of columns which serve also to guide the motion of the vessel in rising and falling. Gas holders are constructed of various sizes, some exceeding 200 feet in diameter and having nearly 6,000,000 cubic feet capacity.

Gasometric Analysis. In chemistry, the art of separating, and of estimating, quantitatively, the several constituents of a gaseous mixture. The methods employed may be divided into three general classes: (1) Those based on diffusion; (2) those based upon the absorption of certain constituents by substances over or through which the mixed gases are passed; and (3) those in which the given mixture is oxidized, and its original composition inferred from an examination of the products of the oxidation. In the application of diffusion methods, the mixture is caused to pass through a porous septum of graphite, gypsum, or baked clay. The lighter constituents pass through faster than the heavier ones, so that a partial separation is effected. By causing the mixture to pass through a succession of such porous partitions, the concentration effects may be correspondingly increased. This method has been employed in many chemical researches, especially for effecting the concentration of gaseous substances that are present in a mixture in very small quantity. Its value as an experimental method was well demonstrated in connection with the study of the rare gases of the atmosphere, in effecting the separation of helium from argon. In general, the rates of diffusion of two gases are proportional to the square roots of their densities; and the density of argon being 10 times that of helium, it follows that helium will diffuse through a porous septum about 3.2 times as fast as argon.

In the analysis of gases by the absorption of certain of their constituents by means of chemical substances, use is made of the following facts (among others): Water absorbs HCl, HBr, and HI, very readily; solid caustic potash, when moist, absorbs all acid gases, such as CO_2, SO_2, H_2S, HCl, etc.; dilute sulphuric acid absorbs all alkaline gases, such as ammonia; concentrated sulphuric acid also absorbs water, alcohol, ether, methyl oxid, and (more slowly) propylene and its homologues; alkaline solutions of pyrogallic acid absorb oxygen very readily; cuprous chlorid in solution in hydrochloric acid absorbs oxygen and carbon monoxid; and solutions of CrO_3 and of $KMnO_4$ absorb H_2S and SO_2. In the study of special problems, certain unusual absorbents also suggest themselves. Thus in the isolation of the rare gases of the atmosphere, great use was made of the fact that red-hot metallic magnesium absorbs nitrogen gas, while it is without effect upon argon, helium, and the other gases of that group.

The combustion methods are particularly applicable to those cases in which the mixture to be analyzed is capable of being burned so that the final products are water, carbon dioxid, and free nitrogen, together with excess of such gas as may have been added in order to effect the combustion. The combustion is effected in an instrument called a «eudiometer,» which commonly consists of a graduated glass tube that is closed at the upper end, and which is provided with a pair of platinum electrodes fused through the glass near the closed end. A sample of the gas to be analyzed is introduced into the tube (the lower end of which dips into a mercury bath), and its volume is determined by reference to the graduation marks; readings being simultaneously taken of the thermometer and barometer, so that the observed volume of the gas can be reduced, in the subsequent calculations, to standard conditions of temperature and pressure. A known quantity of such gas as may be required to effect the combustion is next added; pure oxygen being used if the gas under examination is rich in carbon and hydrogen, and pure hydrogen being used if it is highly oxygenated or chlorinated. It is usual, also, to add a known quantity of «fulminating gas,» which is prepared by the electrolysis of water, and consists of pure oxygen and hydrogen, in the proportion in which they combine to form water. The mixture is then exploded by passing an electric spark between the electrodes that are sealed into the eudiometer near its closed end, and after the heat developed by the explosive combustion has been lost by radiation, the volume of the mixture is again determined. The several constituents that remain in the eudiometer tube are then removed, one by one, by the temporary introduction, into the tube, of suitable absorbent substances. The volume of the gaseous contents of the eudiometer tube are observed after each partial absorption, and from the data so obtained the quantities of carbon, oxygen, hydrogen and nitrogen that were present in the original sample may be calculated. Consult: Hempel, 'Methods of Gas Analysis'; Sutton, 'A Systematic Handbook of Volumetric Analysis.' See also, in this encyclopedia, Chemical Analysis; Spectroscope.

Gasparin, Agénor Etienne, ä-zhä-nôr ā-tē-ĕn gäs-pä-răn, Comte de, French author: b. Orange, France, 12 July 1810; d. near Geneva, Switzerland, 4 May 1871. Elected to the Chamber in 1846, he attracted attention by his advocacy of religious liberty, prison reform, abolition of slavery, and social purity. At the outbreak of the American Civil War he published two books maintaining the justice of the Federal cause entitled, 'The Uprising of a Great People' (1861), and 'America Before Europe' (1862). Other important works were: 'Slavery' (1838); 'Christianity and Paganism' (1850); 'Liberal Christianity' (1869); 'Innocent III.,' published posthumously.

Gasparin, Valérie Boissier, vä-lā-rē bwä-sē-ā, Comtesse de, French author: wife of A. E. de Gasparin (q.v.): b. Geneva, Switzerland, 13 Sept. 1813; d. near Geneva 1894. Two of her works obtained the Montyon prize at the Academie Française: 'Marriage from the Christian Point of View,' and 'There are Poor in Paris and Elsewhere.' Among her other publications are: 'Journey in the South by an Ignoramus'; 'Let's Go Make a Fortune in Paris'; 'A Book for Wives'; 'Read and Judge' (strictures on the Salvation Army), and 'The Near and the Heavenly Horizons.' Several of her books were translated into English, the last named being read very widely in America in its English form.

Gaspé, gäs-pā, **Philip Aubert de**, Canadian author: b. Quebec 30 Oct. 1786; d. there 29 Jan. 1871. A lawyer, afterward sheriff, he became involved in debt for which he was imprisoned four years; and when released, secluded himself on his estate of St. Jean Port-Joli. His 'Old-Time Canadians' (1862), and his 'Memoirs' (1866), treat of Canadian traditions and folklore, and were written in French. The former was perhaps the most popular book ever published in Canada. An English translation was made by Mrs. Pennie.

Gaspé, Canada, a district in the province of Quebec, forming the northern part of the peninsula that lies between the Bay of Chaleur and the Gulf of St. Lawrence. Area, 7,500 square miles. Pop. (1901) 52,200. The name is sometimes extended to the whole peninsula. Cape Gaspé is a bold headland of the Schikshock or Notre Dame mountains, terminating the peninsula and forming the north shore of Gaspé Bay. The inhabitants are chiefly engaged in important fisheries, which with the export of lumber, form the staple industries. Gaspé, a village and port of entry in Gaspé Bay where Cartier landed in 1534, is the capital and commercial centre of the district. Pop. (1901) 454.

Gaspee, The, British revenue vessel, burned 1772. She was an armed schooner of eight guns, stationed at the entrance of Narragansett Bay to prevent that evasion of the British navigation laws which had largely built up the prosperity of the Atlantic coast and was almost the entire subsistence of Rhode Island. Its authorities connived at the traffic, and at a regular price furnished false flags, which for years passed muster, but Lieut. Dudingston of the Gaspee adopted the method of searching thoroughly every trading vessel which entered or left the bay, without regard to her flag or papers, and sending the contraband goods to

Boston for adjudication. This meant ruin to Rhode Island; the executive wrote demanding Dudingston's authority, and the chief justice sent a sheriff on board; both held that his proceedings were illegal, as he should have a commission from the governor and be sworn in. They were referred to the admiral, and then to the British secretary of state. On 9 June 1772, the regular packet left Newport for Providence without notifying Dudingston, who gave chase but ran the Gaspee aground at Namquit Point, seven miles below Providence, at low tide. That night the leading men of that city, with a company of assistants, set out in eight large boats, boarded and captured the vessel, badly wounding the commander, set the crew on shore, and burnt the schooner. The Rhode Island authorities opened an investigation with great zeal, and offered rewards for the apprehension of the guilty parties, but could discover none. The home government was greatly incensed, and appointed colonial commissioners, who sat at Newport 4-22 Jan. 1773, to make inquiry, and ordered Gov. Wanton to arrest the offenders and send them to England for trial. The governor and the chief justice applied to the assembly for instructions, which body referred it to the discretion of the chief justice, who refused to allow any arrests for transportation to be made.

Gasquet, gās'kĕt, **Francis Aidan**, English Roman Catholic ecclesiastic: b. London 5 Oct. 1846. He was educated at Downside College, Bath, and was superior of the Benedictine Monastery, and college of Saint Gregory, Downside 1878-84. He is the presiding abbot of the English Benedictines and has published: 'Henry VIII. and the English Monasteries' (1888-9); 'Edward VI. and the Book of Common Prayer' (1890); 'The Great Pestilence' (1893); 'The Last Abbot of Glastonbury' (1895); 'A Sketch of Monastic Constitutional History' (1896); 'The Old English Bible, and Other Essays' (1897); 'The Eve of the Reformation' (1900).

Gassendi (properly **Gassend**), **Pierre**, pē-ār gä-säṅ-dē, French philosopher and mathematician: b. Champtercier, near Digne, Provence, 22 Jan. 1592; d. Paris 24 Oct. 1655. At 19 he was appointed to fill the chair of philosophy at Aix, and although the authority of Aristotle was still warmly maintained, he ventured publicly to expose the defects of his system. His lectures on this subject, 'Exercitationes Paradoxicæ adversus Aristotelem' (1624), gave great offense to the votaries of the Aristotelian philosophy, but obtained him no small reputation with others, through whose interest, after taking orders, he was made doctor of divinity. A second book of 'Exercitationes' excited so much enmity that he ceased all direct attacks on Aristotle, although he still maintained his preference for the doctrines of Epicurus, which he defended with great learning and ability. He strenuously maintained the atomic theory, in opposition to the views of the Cartesians, and, in particular, asserted the doctrine of a vacuum. On the subject of morals he explained the doctrines of Epicurus in a sense the most favorable to morality. He was appointed lecturer on mathematics in the Collége-Royal at Paris in 1645. He is ranked by Barrow among the most eminent mathematicians of the age, and mentioned with Galileo, Gilbert, and Descartes. Gassendi was the first person who observed the transit of Mercury over the sun. His chief works are: 'De Vita Moribus et Doctrina Epicuri' (1647); 'Institutio Astronomica,' 'Syntagma Philosophiæ Epicuri' (1649); 'Tychonis Brahæi Copernici, Peurbachii et Regiomontani Vitæ' (1654).

Gasterop'oda, the largest and most typical and familiar of the four classes of mollusks (phylum *Mollusca*). The name refers to the most prominent tribal characteristics, namely, that the inferior surface of the body forms a flattened sole or disk, by the contractions of which the animal advances. In all these animals the primitive symmetry of the body is obscured by the unequal development of parts, whence results the spiral disposition of the majority. The simplest gasteropods, however, such as the chiton, are symmetrical, not lop-sided like the higher forms. They have the mouth at one end of the long axis of the body, the anus at the other; the gills, kidneys, genital ducts, and circulatory organs are paired; there are two pairs (pedal and visceral) of nerve cords running parallel to one another along the body, and the ganglia are slightly developed. Of all mollusks these simplest gasteropods are probably nearest the hypothetical worm-like ancestor. When a shell is present it consists of only one piece, whence the name "univalve," formerly applied to the class; or if of more than one piece the separate portions are placed one behind the other in the axis of the body (*Amphineura*, chitons). The gasteropods agree with the cephalopods in possessing a distinct head, containing a feeding instrument or "tongue" in the form of a lingual ribbon, but are separated from that class by the mode of formation of the shell, and by the absence of arms around the head. The lingual strap or odontophore consists of a central portion (*rachis*) and lateral pieces (*pleuræ*). On all three of these, on the central, or only on the lateral regions, are placed silicious denticles, whose number, form, and arrangement have been made the basis of classification of genera.

Mode of Life.— Though the number of terrestrial gasteropods, breathing the air directly by means of a pulmonary chamber, is very large — over 6,000 living species — those living in water are greatly in the majority, including over 10,000 forms, mostly marine. Of these, some 9,000 or so belong to the prosobranchs or *Streptoneura*, a relatively small minority being opisthobranchs and nudibranchs. The heteropods and some opisthobranchs enjoy a free-swimming pelagic life, but most marine forms frequent the coasts either on the shores or along the bottom. Deep-sea gasteropods are comparatively few. The locomotion effected by the contractions of the muscular "foot" is in almost all cases very leisurely, and the average tendency is toward sluggishness. As to diet, the greatest variety obtains; most prosobranchs with a respiratory siphon and a corresponding notch in the shell are carnivorous, and so are the active heteropods; most of the rest are vegetarian in diet. Numerous genera, both marine and terrestrial, are very indiscriminate in their feeding; others, are as markedly specialists, keeping almost exclusively to some one vegetable or animal diet. Some marine snails partial to echinoderms have got over the digestive difficulty presented by the calcareous character of the skins of their victims by a secretion of free sulphuric acid from the mouth. This acid changes the carbonate of lime into sulphate, which is brittle and readily pulverized by the rasping tongue. A few are parasitic — for example, eulima, stylifer, and the very degenerate *Entoconcha mirabilis,* all occurring in or on holothurians.

Life-history.— The eggs of gasteropods are usually small, and are surrounded with albumen, the surface of which becomes firm, while in the common snail (*Helix*) and some others there is an egg-shell of lime. The eggs not unfrequently develop into embryos within the parent, but in most cases they are laid, either singly or in masses, and often with cocoons. Few objects are more familiar on the seashore than the clustered egg-cases of the whelk, which together form a ball often about the size of an orange. Inside each of the numerous egg-cases are many embryos, but only a few reach maturity, the others serving as food material, an infantile cannibalism or struggle for existence not uncommon in the class. As to development it may be noted that the ovum divides more or less unequally, according to the amount of yolk, that a gastrula-stage occurs as usual, and that this is succeeded in typical cases, first by a «trochophore» and afterward by a «veliger» larva (see MOLLUSCA).

General Interest.— As voracious animals, furnished with powerful rasping organs, many gasteropods play an important part in the struggle for existence among marine organisms, while other terrestrial forms are most destructive devastators of vegetable and flowering plants. The manner in which numerous plants are saved from the ravages of snails, by their chemical and physical characters, is an interesting subject of investigation recently worked out by Prof. E. Stahl. From very early times, various gasteropods, such as whelks, have been utilized for human consumption and also as bait, while yet more frequently the shells, often so beautiful in form and color, have been used for the decoration of the person and the dwelling, for the basis of cameos, as domestic utensils, or even as weapons, and in many other ways. From the mucous glands of the roof of the gill-cavity in the genera *Purpura* and *Murex*, there exudes the famous secretion, at first colorless, but afterward becoming purple or violet, which furnished the ancient Tyrian dye.

Geological History.— A few gasteropods occur in strata as far back as the Cambrian, from which remote period they have continued with a steady increase. Almost all the Palæozoic genera are now extinct, and during these ages the siphon-possessing forms seem to have been almost, if not altogether, unrepresented. A host of new gasteropods appeared in the Jurassic period, and many of the modern families have their origin in Cretaceous times. Numerous as the fossil forms are, the number of types wholly extinct is comparatively small; both as regards persistence of types and increase of numbers, the gasteropods are a peculiarly successful class.

Classification.— The grouping of forms within the class is as follows, according to the latest conclusions of naturalists, as summarized by Cooke in the third volume of the Cambridge Natural History' (1894):

Class GASTEROPODA; order *Amphineura;* sub-orders, *Polyplacophora, Aplacophora;* order, *Prosobranchiata;* sub-orders, *Diotocardia, Monotocardia;* order, *Opisthobranchiata;* sub-orders, *Tectibranchiata, Ascoglossa, Nudibranchiata, Pteropoda;* order, *Pulmonata;* sub-orders, *Basommatophora, Stylommatophora.*

(For the characters of the orders see *Classification* in the article ANATOMY.) The sub-divisions are based upon different anatomical categories in each order. Thus the first sub-order of *Amphineura* embraces all the ordinary chitons having a foot and plated shell, both of which are absent in the degraded *Aplacophora.* Among the *Prozobranchiata* (which embrace the ordinary marine shells) two auricles in the heart characterize the *Diotocardia,* a single auricle the *Monotocardia,* of which the strange pelagic *Heteropoda* are now regarded as only a subordinate group. The *Opisthobranchs* are classified according to gill-features; and the *Pulmonata,* according to relative position of the eyes.

See MOLLUSCA, and consult the works cited thereunder, especially Cooke, 'Shells' (New York 1896), in which will be found many instructive references to other authorities.

Gaston, William, American jurist: b. Newbern, N. C., 19 Sept. 1778; d. Raleigh, N. C., 23 Jan. 1844. He was graduated at Princeton 1796; was admitted to the bar 1798; elected to the State Senate 1799; and congressman 1813–17, voting with the Federalists and opposing the «Loan Bill.» Returning to the practice of the law he obtained great reputation as an orator, and was frequently a member of the State legislature. He drew up the act creating the supreme court of North Carolina and served as judge of that court 1834-44. During his later years he was a Whig, opposing nullification.

Gastor'nis, a genus of fossil birds of the epyornis family, whose remains, indicating several species, have been found in the Eocene rocks of both England and France. They were birds of the size of an ostrich, with long legs, weak wings, and little if any power of flight.

Gastræa, găs-trē'a, a hypothetical primitive animal consisting simply of a sac or stomach, with an ectodermal and endodermal layer of cells. This simple organism, to which the embryonic gastrula-stage (see EMBRYOLOGY) is the nearest modern approach, and was regarded by Hæckel as recapitulative of the primitive gastræa, Hæckel assumes to have been the first animal generated on the earth, and the germ from which the whole animal kingdom with its infinite diversities was gradually evolved. His hypothesis, called the Gastræa theory, asserted that there must have been many species, families, etc., of these primitive organisms, whence all the *Metazoa* have been evolved. These generalizations were announced by Hæckel in 'Die Gastræa-theorie, die Phylogenetische Classification des Thierreichs und die Homologie der Keimblätter,' published at Jena in 1874, and have since been extensively considered in all works on embryology.

Gastrec'tomy, the removal of a part or the whole of the stomach-wall. It is performed for the cure or relief of deep ulcerations, cancerous growths, or contractions of the wall that cause serious obstruction.

Gastric Juice, the secretion of the stomach, is in man a clear almost colorless fluid of acid reaction, containing one half of 1 per cent solids. The amount secreted varies with the demand, but approximates 1,000 cubic centimetres in 24 hours. In health secretion takes place only under the stimulus of food. Hydrochloric acid, the chief constituent, is present in one or two parts per thousand. During the first stage of digestion it is all combined with the food, but later it is found free. The other important ingredients of this secretion are pepsin, a ferment that has the power of converting albuminous foods into forms that can be absorbed and assimilated; and rennin, a ferment that causes coagulation of milk by converting the casein, one of the milk proteids. Inorganic salts, the alkaline chlorides and phosphates, and phosphates of calcium, magnesium, and iron constitute most of the solids.

Gastritis, găs-trī'tĭs, a general term that includes all strictly inflammatory diseases of the stomach. Phlegmonous gastritis is a very acute, fatal, but rare disease that starts in the deeper layers of the stomach-wall and results in an abscess. Acute gastritis or acute gastric catarrh is an acute inflammation of the lining mucous membrane. The membrane becomes swollen, is covered by a coating of tenacious mucus, and tends to bleed at minute points. Errors in diet, either by over-indulgence or the ingestion of improper food, is the most frequent cause of the malady. Certain chemicals and drugs, very hot food or liquid, foreign bodies, and unripe fruits may cause the irritation. The symptoms depend on the severity of the inflammation, the milder forms being spoken of as sub-acute. Frequently premonitory symptoms, such as a feeling of fulness or tenderness, or the eructation of gases, may be noticed, and may be soon followed, in the more severe cases, by nausea, vomiting, and a rise of temperature, accompanied by painful thirst. If the retching or vomiting of mucus continues, there is apt to be great weakness and prostration. The duration of the disease under proper treatment is seldom over three or four days. The stomach should be given absolute rest for 24 hours, or even longer if nausea or retching continue. The intense thirst may be relieved by small pieces of ice, but not even the drinking of water is permitted. Rest in bed may be indicated in the more severe cases and, if so, hot poultices applied to the stomach region relieve some of the distressing symptoms. Drugs are of little value except to quiet excessive vomiting. Toxic gastritis is that form caused by the ingestion of corrosive and irritating drugs and chemicals. It is a severe form of acute catarrh, with the added effect of the particular poison taken. Strong acids and corrosives cause death of the deeper tissues, with ulceration and even perforation of the wall. The treatment depends upon the poison taken, but dilution by the imbibing of demulcent drinks is usually of value if sufficiently early. Chronic gastritis or chronic gastric catarrh is a chronic inflammatory change in the mucous membrane of the stomach. It is the most wide-spread of maladies, affecting all classes and ages. Not uncommonly successive attacks of acute gastritis, even in early life, start those progressive changes that sooner or later make themselves known as chronic catarrh. The most common cause is the repetition of insult to the stomach in food, both as to quantity and quality, and in drink irritating from high temperature or presence of alcohol. Other causes may operate, such as venous congestion from disease of the heart, liver, and spleen, changes in the blood-elements, and the constant poisoning of infectious diseases.

For an understanding of the symptoms of this affection it must be appreciated that three mechanisms make up gastric digestion — the nervous, the muscular, and the secretory. Deviation from the normal in any one of these is almost certain to act on the others, and when, in addition to these mechanisms, the close relation of the stomach and other digestive organs is considered, a marvelous complex is apparent. The symptoms of a chronic catarrh may be unnoticed, may be merely evidenced by changes due to poor gastric digestion, or interwoven with resulting derangement of all the digestive apparatus. In the early stages the mucous membrane is swelled, the gastric juice still has its normal ingredients and, in addition, the membrane secretes a mucus owing to degeneration of the cells. From this stage to a complete absence of acid, and then of ferments, the change is gradual, the final stage being known as atrophic gastritis. No symptom or group of symptoms is characteristic of the disease, the diagnosis being made with accuracy only by examination of the gastric contents. At one time or another one or more of the following symptoms are noticed. Absence of appetite, bad taste in the mouth, coated tongue, nausea and, occasionally, vomiting, eructation of gases and some liquid, heartburn, and a feeling of fulness or bloating after meals. The presence of inflammation, and the stage, are determined by chemical and microscopical analysis of the contents of the stomach after a test-meal has been eaten. In all except the atrophic stage there is always more or less mucus found mixed with the food. This is the distinguishing feature.

Of itself the disease is not fatal, but severe disorders of nutrition may result that render the sufferer more liable to other diseases.

The treatment consists in correction of the causes as much as possible, particularly in a dietetic regimen free of irritation and of ready digestibility. Lavage or washing of the stomach is of supreme importance where it can be borne. Drugs are of little use except for the relief of distressing symptoms. Where great diminution or absence of acid is found, it may be supplied, but the large amount necessary usually makes the procedure impracticable. Electricity, massage, and hydrotherapy may be beneficial.

Gastros'tomy, the operation of making a more or less permanent opening between the interior of the stomach and the overlying surface, the lining membrane of the stomach being joined to the skin entirely around the margin of the opening. This procedure is undertaken when for any reason the entrance of food into the stomach by natural passage is prevented.

Gastrot'omy, a simple incision of the wall of the stomach, usually undertaken for the exploration of the interior or for the removal of foreign bodies.

Gas'trula. See EMBRYOLOGY; GASTRÆA.

Gatacre, SIR **William Forbes**, English soldier: b. 1843; d. 6 March 1906. He joined the English army in 1862; was instructor of surveying in the Royal Military College in 1875–9;

deputy-adjutant and quartermaster-general in the Hazara Expedition in 1888, and in the Burma, Tonhon Expedition in 1889. He led the British forces in the Sudan in 1898, during the first advance against Atbara, and later commanded a British division in that region during the movement against Khartum and Omdurman. When the war in South Africa broke out he was ordered there and given an important command. He was repulsed at Stormberg with heavy loss. In April 1900 he was recalled to England.

Gatchina, gä'chē-nä. See GATSCHINA.

Gate City, The, a name given to Keokuk, Iowa (q.v.), and to Atlanta, Ga. (q.v.).

Gate of Tears, or **Gate of Mourning**, the Straits of Bab-el-Mandeb, Arabia; the term is an exact translation of the words Bab-el-Mandeb, which have reference to the many shipwrecks which anciently occurred thereabouts.

Gates, Elmer, American psychologist and inventor: b. Dayton, Ohio, 1859. He has done much original work in electric meteorology and has made several electrical mining inventions. He is the author of a system of mind-building and experimental psychology, having four laboratories for experimental research in these fields. Among his works are: 'Psychurgy or the Art of Using the Mind'; 'Art of Mind-Building.'

Gates, Horatio, American military officer: b. Maldon, Essex, England, 1728; d. New York 10 April 1806. He joined the British army early in life; in 1755 was assigned to duty at Halifax, N. S., and later served with Braddock's expedition. In July 1775 Congress appointed him adjutant-general; in 1776 he was given a command in the Northern army, and 2 Aug. 1777 assumed command of the Northern department. He defeated Burgoyne at Saratoga, 7 Oct. 1777, the British general surrounding his army on the 17th. (See SARATOGA, BATTLE OF.) In November of the same year he was appointed president of the new board of war and ordnance; and in 1778, while holding that post, sought with the aid of his friends in Congress to supersede Washington as commander-in-chief. This action soon brought him into discredit, and he resigned from active service. In June 1780 he again entered the army, becoming commander of the troops in North Carolina. On 16 August of that year, his army was defeated near Camden, S. C. He was soon afterward suspended from duty, but reinstated in his command in 1782 after the capture of Cornwallis.

Gates, Lewis Edwards, American educator and critic: b. Warsaw, N. Y., 23 March 1860. He is a brother of M. E. Gates (q.v.). He was graduated at Harvard 1884, instructor in forensics there 1884–7, instructor in English 1890–6, then becoming assistant professor of English. He is a frequent contributor of critical articles to the magazines. He has published: 'Selections from Jeffrey' (1894); 'Selections from Newman' (1895); 'Selections from Matthew Arnold' (1898); 'Three Studies in Literature' (1899); 'Studies and Appreciations' (1900).

Gates, Merrill Edward, American educator: b. Warsaw, N. Y., 6 April 1848. He was graduated at the University of Rochester 1870, was principal of the Albany Academy 1870–82, president of Rutgers College 1882–90, and president of Amherst College 1890–9. He has been very active in promoting Civil Service measures, and ballot reform. He was made chairman of the United States Board of Indian Commissioners 1884, and was president of the American Missionary Association 1893–8. He has published: 'Athens and the Greeks of To-day'; 'Sidney Lanier, Poet and Artist'; 'The Debt the School Owes the State'; 'Land and Law as Agents in Educating the Indians'; 'International Arbitration'; etc.

Gates, SIR Thomas, English colonial governor of Virginia: d. after 1621. He sailed from England in May 1609, in charge of a colony of 500 emigrants to the New World, but his vessel, the Sea Venture, was stranded on the rocks of Bermuda. Here the passengers built two new ships and finally reached Virginia in May 1610. Gates went to England in the meantime and returned in 1611 with 300 more emigrants. He was made governor the same year and held that office till 1614, when he returned to England.

Gatesville, Texas, city and county-seat of Coryell County, on the St. Louis S. R.R., 80 miles north of Austin. It is situated in the fertile valley of the Leon River, and has considerable agricultural, stock-raising, and produce-shipping interests. Pop. (1900) 1,865.

Gath. See TOWNSEND, GEORGE ALFRED.

Gath (Heb. «wine-press»), one of the five cities of the Philistines which were presided over by so many princes or lords from the time of Joshua to a comparatively late period. It was situated on the borders of Judah, and was in consequence a place of much importance in the wars of the Jews and the Philistines. It is stated in Joshua that Gath was one of the cities in which, at the time of the conquest, there still remained some of the ancient Anakims or giants, and they appear to have perpetuated the race here till much later times, for it was from Gath that the renowned Goliath issued. The exact site of the ancient city cannot be determined with any degree of certainty, but some identify it with the eminence Tell-es-Sâfieh, about midway between Ekron and Ashdod.

Gath'mann Gun. See ORDNANCE.

Gatineau, gä-tē-nō, a river of Canada, in the province of Quebec, rising in a large lake of the same name, from which it flows south, and falls into the Ottawa opposite the town of Ottawa. Its total length is 450 miles.

Gatling, Richard Jordan, American inventor: b. Hertford County, N. C., 12 Sept. 1818; d. New York 1903. While a boy he assisted his father in perfecting a machine for sowing cotton seed, and another for thinning out cotton plants. Subsequently he invented a machine for sowing rice. Removing to St. Louis in 1844, he adapted this invention to sowing wheat in drills. For several winters he attended medical lectures in Cincinnati, and in 1849 removed to Indianapolis, where he engaged in railroad enterprises and real estate speculations. In 1850 he invented a double-acting hemp brake, and in 1857 a steam plow, which, however, he did not bring to any practical result. In 1861 he conceived the idea of the revolving battery gun which bears his name. Of these he constructed six at Cincinnati, which were destroyed by the burning of his factory. Afterward he had 12 manufactured elsewhere, which were used by Gen. Butler on the James River. In 1865 he improved his invention, and in the year following, after satisfactory trial, it was adopted into the United States service. It has also been adopted by several European governments. At the time of his death he was perfecting a few business formalities prior to placing his new motor plow on the market. Although best known as the inventor of a terrible death-dealing weapon, he was the gentlest and kindliest of men. The sight of returning wounded soldiers early in the Civil War led him to consider how war's horrors might be alleviated. By making war more terrible, it seemed to him nations would be less willing to resort to arms, and he accordingly devoted himself to the study of ordnance and ballistics, with this end in view.

Gatling Gun. See ORDNANCE.

Gatschet, Albert Samuel, American linguist: b. Berne, Switzerland, 3 Oct. 1832; d. Washington, D. C., 16 March 1907. He was educated at the universities of Berne and Berlin, and removing to New York in 1868 made a special study of the languages of the American Indians. In 1879 he became connected with the Bureau of American Ethnology. He wrote: 'The Klamath Indians of Southwestern Oregon'; 'A Greek Migration Legend'; etc.

Gatty, Margaret Scott, English writer for young people: b. Burnham, Essex, England, 3 June 1809; d. Ecclesfield, Yorkshire, 3 Oct. 1873. She was married to Rev. Alfred Gatty in 1839. Her career in letters was begun with 'The Fairy Godmother and Other Tales' (1851); but 'Parables from Nature' (1855–71) was the most popular and still holds its place in public favor. She edited 'Aunt Judy's Magazine' (1866–73).

Gauchos, gow'chōz, hybrid inhabitants of South America, mostly cattle-raisers of nomadic habits. They are natives of the pampas, and descendants of Spaniards and Indians. The white strain has largely faded out from them, and a modified Indian type has been developed which has an ethnological interest. As a distinct people, however, they may be said to be disappearing. They are now mainly confined to the Chaco region. Many of them possess figures and bearing which show a proud descent. They wear a costume picturesque in fashion and color, and their skill as horsemen and in using the lasso and bolas is remarkable. They subsist almost wholly on meat, and are noted for their hardiness, bravery, and free mode of existence.

Gauden, gâ'dĕn, **John,** English bishop: b. Mayland, Essex, 1605; d. 20 Sept. 1664. In the early part of his life he belonged to the popular party. After the outbreak of the civil war, he hesitatingly submitted to the Presbyterian discipline, omitted the liturgy from the Church service, and even subscribed to the covenant, although he secretly wrote a treatise against it. After the Restoration he was appointed chaplain to Charles II., and successively created bishop of Exeter and of Worcester. He claimed the authorship of the 'Eikon Basilike,' or the 'Portraiture of his Sacred Majesty in his Solitudes and Sufferings,' a work which was once almost universally attributed to Charles himself, and which in one year went through 50 editions. Hallam and Sir James Mackintosh pronounce his claim valid. Other works of his are: 'Cromwell's Bloody Slaughter House' (1660); 'Tears of the Church' (1659). See EIKON BASILIKE.

Gauge, gāj, the name of many different instruments and appliances used for measuring various dimensions, forces, etc. The various kinds of gauge are distinguished by means of special names indicating the use to which they are applied. Among the most important contrivances of this nature are the instruments fixed to engine boilers for registering the force of the steam and the level of the water. In one of its simplest forms the pressure or steam gauge consists of a bent siphon-tube, with two unequal legs, partly filled with mercury. The top of the shorter limb is connected to a short pipe, which enters that part of the boiler which contains the steam; the other end is open to the atmosphere. A stop-cock is generally placed between the gauge and the boiler, so that it may be put in communication with the boiler at pleasure. When the stop-cock is open, the steam, acting on the mercury in one leg of the gauge, presses it down, and the mercury in the other leg rises. The difference between the two columns is the height of mercury which corresponds to the excess of the pressure of the steam in the boiler above the pressure of the atmosphere. For high pressure engines, however, the steam-gauge usually works in the manner of an aneroid barometer, a pointer moving on a circular scale under the influence of the motion of a corrugated diaphragm; or, as in the Bourdon gauge, the tendency of a bent tube to straighten itself under the influence of the steam pressure communicates movement in a similar manner to a pointer or index hand. The water-gauge is a vertical glass tube called a gauge-glass, communicating above and below with the boiler. The gauge-glass is not fixed directly to the boiler, but to a brass column known as the gauge-column, communicating with the boiler by two copper tubes of considerable length, the upper leading to the steam space and the lower to the water space. These tubes are fitted with cocks or valves. Two gauge-glasses of different lengths are sometimes fitted to the one column. Gauge-cocks are used as checks on the water-gauges. There are usually three of them on the front of the boiler, one at the normal level of the water, one above, and one below. As applied to railroad gauge signifies the clear distance between the rails. The usual distance in the ordinary or narrow gauge is 4 feet 8½ inches. The broad gauge of the Great Western Railway of England was formerly 7 feet; the Irish, Indian, and Spanish gauge is 5 feet 6 inches. Special narrow gauges have been adopted for certain lines, especially for mountain and mineral lines, such as the 3 feet 6 inch Norwegian gauge. Gauge is also the name applied to various contrivances for measuring any special dimension, such as the wire-gauge, an oblong plate of steel, with notches of different widths cut on the edge, and numbered, the size of the wire being determined by trying it in the different notches till one is found which it exactly fits. The thickness of sheet-metal is tried by a similar gauge.

Gau'gengigl, Ignaz Marcel, American painter: b. Passau, Bavaria, 1856. He was a pupil of Diez and Raab at Munich, and set up a studio in Boston, Mass., in 1879. He paints preferably interiors, introducing numerous small figures. Among his picture titles are: 'My Studio,' 'The Duel,' and 'The First Hearing.'

Gaul, gâl, **Alfred Robert**, English composer and organist: b. Norwich, England, 1837. He was chorister and assistant organist of Norwich Cathedral 1846–59 and subsequently organist of St. Augustine's Church, Edgbaston, Birmingham. He has composed an oratorio, 'Hezekiah'; the cantatas 'Ruth' (1881), 'First Psalm,' 'Ninety-sixth Psalm,' 'Holy City' (1882), a widely popular work; 'Passion Music'; 'The Ten Virgins' (1890), dedicated to the choirs of America; 'Song of Life'; 'Una'; etc.

Gaul, Gilbert William, American artist: b. Jersey City, N. J., 31 March 1855. He was a pupil of J. G. Brown, and studied at the National Academy of Design, exhibiting first there in 1872. He was elected associate in 1880 and National Academician 1882. He is a scene painter often choosing battle subjects, and has won several medals, including two at the World's Columbian Exposition 1893. Among his works are: 'Indian Girl'; 'Coquette' (1880); 'Old Beau' (1881); 'Charging the Battery'; 'News from Home' (1882); 'On the Outpost' (1883); 'On the Lookout'; 'Guerrillas' (1885).

Gaul, Gallia, the country of the Gauls which extended in the times of the Romans, from the Pyrenees to the Rhine, and on the side of Italy, beyond the Alps to the Adriatic. It was divided into Gaul on this side (the Italian side) of the Alps (Gallia Cisalpina), and Gaul beyond the Alps (Gallia Transalpina).

Gallia Cisalpina extended from the Alps to the Adriatic Sea, and consequently comprised all Upper Italy as far as the Rubicon and Macra, on account of its adoption of the Roman toga was called *Gallia Togata*. It was divided into Liguria; Gallia Transpadana; Gallia Cispadana. Liguria was inhabited by the Ligurians, Gallia Transpadana principally by the Taurinians, Insubrians, and Cenomani; Gallia Cispadana by the Boii, Senones, and Lingones, all of them nations of Gallic descent.

Transalpine Gaul was also called *Gallia Comata* in distinction from *Gallia Togata*, because the inhabitants wore their hair (*coma*) long, or *Gallia Braccata*, because, particularly in the southern parts, they wore a peculiar kind of breeches (*braccoc*). Caesar, who conquered Transalpine Gaul at a later period, found it divided into three parts: Aquitania, extending from the Pyrenees to the Garonne, chiefly occupied by Iberian tribes; Gallia Celtica, from the Garonne to the Seine and Marne; Gallia Belgica, in the north, extending to the Rhine.

The Gauls were the chief branch of the great original stock of Celts. On the whole, a great resemblance appears to have existed among all the Celts; and although they were divided into numerous tribes, there were but few branches that were perceptibly different from each other. It is probable that coming from the east, they took their way along the south side of the Danube, having the numerous nation of the Thracians in their rear and the Germans on their side; but the period of this event is so remote that we cannot even venture a conjecture in regard to it.

A too great population (which is not uncommon in half savage and partly nomadic nations whose means of supplying their wants are very imperfect, and who require a great extent of country), and the pressure of German and Thracian tribes, caused general migrations among the Gauls about 397 B.C. Colonies from many tribes took their course over the Alps into Italy, and eastwards along the Danube. This passage of the Celtic Gauls over the Alps first brings that nation into the region of history.

Our accounts of the course of the eastern Gauls along the banks of the Danube are very imperfect; this, however, is evident, that their movements occasioned the migrations of the whole nations. One hundred years after the burning of Rome, the eastern Gauls, from 280–278 B.C., made three destructive irruptions into Macedonia and Greece, which had already been depopulated by former wars. Ptolemy Ceraunus, king of Macedonia, and Sosthenes, the commander of the army, fell in battle, and Greece trembled. But in an attack on the temple of Apollo at Delphi (which contained immense treasures, but was protected by its situation) the terrors of religion and the assaults of the elements (tempest and hail-storms) came over them; they were defeated, and hunger, cold, and the sword of the Greeks completed their destruction. Several tribes pursued their course into Asia Minor, where, under the name of Galatians, they long retained their national peculiarities, and preserved their language even to the latest period of the empire. The reaction of these migrations upon Gaul itself appears to have been considerable. The Gauls along the banks of the Danube and in the south of Germany disappear from that time. Tribes of German origin occupy the whole country as far as the Rhine, and even beyond that river. The Belgæ, who were partly German, occupied the northern part of Gaul, from the Seine and Marne to the British Channel and the Rhine, from whence colonists passed over into Britain, and settled on the coast districts. The Celtæ in Gaul, attained a higher degree of cultivation, to which probably their intercourse with the Greeks in Massilia (Marseilles), whose letters they used in writing their own language, and with the Carthaginians, in whose armies they frequently served as mercenaries, contributed in a great measure. But they were then hardly able to resist the Germans who lived on the other bank of the Rhine. Their kinsmen, the Britons, who painted their bodies, fought from chariots, and practised polygamy, were more fierce than the Gauls.

Meanwhile the Gauls of Cisalpine Gaul had taken up their residence in the fertile plains of Upper Italy. Rome trembled at the irruption of these barbarians into Italy; but Caius Marius saved the republic. In two bloody battles, at Aix (Aquæ Sextiæ) in 102, and at Vercelli in 101 B.C., he destroyed these nations. Only that portion of them which had remained in Gaul to await the issue of the expedition escaped the general ruin. Forty-three years after this event Caius Julius Cæsar received the proconsulship over the countries bordering on Gaul.

He resolved to subject all Gaul, and executed his purpose in less than nine years (58-50 B.C.), in eight bloody campaigns.

The religion of the Druids, being suppressed in Gaul by Tiberius and Claudius, gradually retreated into Britain, where, particularly on the small islands near the British coasts, the priests established their mysterious rites, of which in ancient times strange and dreadful accounts were current. The Britons also were soon conquered by the Romans. After the extinction of the family of the Cæsars, the Gauls once more made an attempt to recover their liberty by the aid of the Germans, but in vain. After this last effort they gradually became Roman citizens, and so entirely Romanized that even their ancient language, the Celtic, was supplanted by a corrupt Latin dialect, retaining, however, a considerable number of Celtic words, especially as roots, which, intermingled with Franco-Germanic words, formed the modern language. About the year 486 the Franks subdued the greater part of Gaul, and put a period to the dominion of the Romans in that country.

Gauley Bridge, W. Va., an important strategical point at the head of Kanawha Valley, and one of the three passes of the Alleghanies. It was the objective point of Gen. Cox in his campaign from the Ohio in July 1861, and was occupied by him and strongly fortified after he had driven Gen. Wise from the valley and eastward to Lewisburg. After the battle of Carnifax Ferry (q.v.) Rosecrans advanced to Sewell Mountain, confronted Gen. Lee, who had assumed command of the Confederate forces, for several days, and then fell back to Gauley Bridge disposing the greater part of his army from 5 to 12 miles in front of it, along the Lewisburg road. With Lee's assent Gen. Floyd, with about 5,000 men, crossed New River and moved down its south side to Cotton Hill, a bold height in the angle formed by the junction of the New and Gauley rivers. He got artillery in position commanding Gauley Bridge, the ferry across the Gauley, and the road leading to Rosecrans' camps. On the morning of 1 November the artillery opened fire, sunk the ferryboat and, with sharpshooters beyond New River, stopped the passage of Rosecrans' supply-trains. The contest on both sides, with artillery and musketry, across the narrow river was severe, and ended only by darkness. The next day it was resumed and continued for ten days, the trains moving only by night. Meanwhile Rosecrans was preparing to capture Floyd by moving a force on his left and rear, a movement in which Cox, who was in command at Gauley Bridge, was to co-operate. On the 10th Cox crossed his brigade in boats over New River, at and near its mouth, and drove Floyd from Cotton Hill, after a sharp fight of two days. The co-operative movement on Floyd's left and rear failed. Floyd became aware of it, and on the 12th retreated as rapidly as possible, abandoning wagons and supplies, and pursued as far as Fayetteville. He continued his retreat to Dublin, on the Virginia and Tennessee Railroad.

E. A. CARMAN.

Gauley Mountains, W. Va., a range in Kanawha and Fayette counties, extending eastward for about thirty miles, from the Kanawha River near Charleston, and divided near the middle into two ridges between which flows the Gauley River.

Gauley River, W. Va., an affluent of the Great Kanawha River. It rises in the Black Mountains in Pocahontas County, and after a course of 75 miles, first westward between the Gauley Mountains (q.v.), then southward, joins New River which, from the point of junction at Gauley Bridge, is called the Great Kanawha.

Gault, gâlt (originally a local name in Cambridgeshire, England, for clay), one of the subdivisions of the Cretaceous system (q.v.). The gault is a stiff, bluish-gray clay, which here and there contains indurated nodules and septaria. Now and again it becomes somewhat calcareous, or sandy and micaceous. In some parts of Sussex a band of phosphatic nodules occurs at its base. The deposit is of variable thickness — reaching in some places over 300 feet, while occasionally it hardly attains a greater thickness than 50 feet, and forms a well-marked geological horizon — forming the bottom member of the Upper Cretaceous rocks. It is abundantly fossiliferous, the remains being almost exclusively marine, only a few drifted land-plants having been met with. The gault is extensively employed in the manufacture of bricks and tiles; it forms a retentive and rather unproductive soil.

Gaulthe'ria, (named for Dr. Gaultier of Quebec), a large genus of evergreen shrubs, or under-shrubs, with small, axillary, nodding flowers, white, pink or red, having a corolla and calyx with five divisions, the former urn-shaped or companulate; and a berry-like fruit, red or blackish, consisting of a fleshy calyx enclosing a capsule. There are about 100 species, found mostly in the Andes, a few being Asiatic and North American. Of the latter, the best known is *G. procumbens*, the familiar aromatic or creeping wintergreen, known in different localities as checkerberry (a name sometimes applied to *Mitchella repens*), boxberry, spice-berry, ground-berry, mountain tea, and partridge-berry (q.v.). This plant is found in cool, damp woods, chiefly under the shade of evergreens, in Canada and the United States, extending southward along the Alleghanies. The leaves are mostly clustered at the top of branches rising from creeping stems; the flowers are white, the berries red and spicy, with a flavor (also characterizing the leaves) resembling sweet birch. The leaves of *G. procumbens* and *G. hispidula* contain an aromatic oil which has a greater density than any other essential oil. It contains about 10 per cent of a terpene called gaultherilene and about 90 per cent of methyl salicylate. Oil of wintergreen is colorless when fresh, but later becomes yellowish, and is used for flavoring candy and for disguising the taste of unpleasant medicines. This oil may be extracted from a few other plants, particularly sweet birch (*Betula lenta*). See WINTERGREEN.

Gaur, gowr, a very large, fierce, and untamable ox (*Bos gaurus*) found in the forests of India and Burma, called «bison» by Anglo-Indian sportsmen, and distinguished by the Malays into two varieties called «sladang» and «sapio.» Old bulls are sometimes six feet high at the shoulders, making them the largest of wild oxen. The horns spread laterally and curve

GAUR, GENET, ETC.

1. Gopher (Geomys bursarius).
2. Genet (Viverra genetta).
3. Gayal (Bos frontalis).
4. Galago (Otolicnus galago).
5. Gaur (Bos gaurus).
6. White-tailed Gnu (Connochætes gnu).

upward to the length ordinarily of 20 to 30 inches, and are large and flattened, while the ridge of the forehead between them leans forward decidedly and is covered with a mop of gray hair. The general color is smooth, shining, blackish brown, with the feet white. This magnificent animal, which is semi-domesticated to some extent in northern India and never in the south, wanders about the jungles in small shy herds under the leadership of a powerful bull, as is the habit of forest oxen generally. It is one of the foremost objects of rifle sport in India, and the best accounts of its habits are to be found in the books of sportsmen-writers, such as Baker, Kinloch, Shakspear, Hornaday, etc. The animal must be followed on foot, in which the aid of good trackers is essential; and when it has been overtaken it is usually hidden in some dense cover, whence it is likely to charge without warning. Its flesh is excellent. See GAYAL.

Gauss, Karl Friedrich, kärl frēd'rĭн gows, German mathematician: b. Brunswick 30 April, 1777; d. Göttingen 23 Feb. 1855. At 18, while a student at Göttingen, he solved a problem (that of the division of the circle into 17 equal parts) which had occupied geometers from the time of Euclid. In 1801 was published his 'Disquisitiones Arithmeticæ,' treating of indeterminate analysis or transcendental arithmetic, and containing, in addition to many new and curious theorems, a demonstration of the famous theorem of Fermat, concerning triangular numbers. He calculated, by a new method, the orbit of the newly discovered planet Ceres, and afterward that of Pallas, for which he received from the French Institute in 1810 the medal founded by Lalande. In 1807 he became professor of mathematics and director of the observatory at Göttingen, a position which he held till his death. In 1821, being charged by the government of Hanover with the triangulation of that country and the measurement of an arc of the meridian, he rendered the most distant stations visible by means of the heliotrope, an instrument of his invention for reflecting solar light; and in connection with Weber made valuable investigations concerning terrestrial magnetism. He was pronounced by Laplace to be the greatest mathematician in Europe. Among the more celebrated of his works are 'Theoria Motus Corporum Cœlestium' (1809); 'Intensitas Vis Magneticæ Terrestris' (1833); 'Dioptrische Untersuchungen' (1841); and 'Untersuchungen über Gegenstände der höheren Geodesie' (1844).

Gautama, gow'ta-ma, **or Gotama,** the patronymic of several celebrities connected with Hindu Vedaism, and of Siddartha Gautama, the founder of Buddhism. See BUDDHA.

Gautier, Emile Théodore Léon, ā-mēl tā-ō-dōr lā-ôn gō-tē-ā, French scholar and critic: b. Havre 8 Aug. 1832. He held official positions connected with the schools and libraries of his native place till his growing eminence as a writer brought him to Paris. His works, which place him among the very foremost authorities on mediæval European literature, include: 'Definition Catholique de l'Histoire' (1860); 'Benoit II.' (1863); 'Etudes litteraires pour la defense de l'Eglise' (1864); 'Epopées françaises' (1866–7); 'Vingt nouveaux portraits' (1878); 'La Chevalerie' (1884); 'Histoire de la poésie religieuse dans les cloitres des IXe et XIe siècles' (1888); 'Etudes et tableaux historiques' (1890).

Gautier, Judith, zhü-dēth, French novelist, daughter of Théophile Gautier (q.v.) and Carlotta Grisi, the famous Italian singer: b. Paris, France, 1850. She married Catulle Mendès, but was divorced. Her first work, under the name "JUDITH WALTHER," was 'The Book of Jade' (1867), a collection of prose and verse translated from the Chinese; it was followed by 'The Imperial Dragon' (1869), a Chinese romance, signed "JUDITH MENDÈS"; 'The Usurper,' a Japanese romance, crowned by the French Academy in 1875; 'Lucienne' (1877); 'The Cruelties of Love' (1878); 'Isoline' (1881); 'Poems of the Dragon Fly' (1884), adapted from the Japanese; 'Potiphar's Wife' (1884), a Persian romance; 'The Merchant of Smiles' (1888), a drama adapted from the Chinese; 'The Marriage of Fingal' (1888), a lyric poem.

Gautier, Théophile, tā-ō-fēl, French poet and prose writer: b. Tarbes, France, 31 Aug. 1811; d. Paris, 23 Oct. 1872. He was educated at the grammar school of his native town, and afterward at the College Charlemagne in Paris. He applied himself at first, but without much success, to painting; and then turned to literature. In verse he published: 'Albertus' (1830); 'Comedy of Death' (1832); 'Enamels and Cameos' (1856); his best poetry; etc. His novels and short stories include: 'Young France' (1833); 'Mademoiselle de Maupin' (1835); 'Fortunio' (1838); 'A Tear of the Devil' (1839); 'Militona' (1847); 'The Tiger's Skin' (1852); 'Jettatura' (1857); 'Captain Fracasse' (1863); 'Handsome Jenny' (1865); 'Spirite' (1866); etc. He was drawn early to feuilleton writing, and for more than 30 years contributed to the Paris newspapers criticisms on the theatre and the salon. He also wrote: 'Journey in Spain' (1843); 'Zigzags' (1845); 'Constantinople' (1854); 'Journey in Russia' (1866); etc., which rank among the most delightful books of modern travel. Still other works were an enlarged edition of 'Enamels and Cameos' (1872); 'The Grotesques' (1844); 'History of Dramatic Art in France' (1859); 'Balzac' (1858); 'Private Menagerie' (1869), biographical; 'History of Romanticism' (1872); 'Literary Portraits and Souvenirs' (1875); 'The East' (1877), the last two being posthumous. Gautier's whole philosophy is a philosophy of paradox, his ideal of life hardly more than a picturesque viciousness. His besetting sin was a desire to say something clever and wicked to shock the Philistines. See lives by Feydeu (1874); Bergerat (1878); Richet (1893); Brunetière, 'Evolution de la poésie lyrique' (1894).

Gauze, a light, transparent silk stuff, or sometimes a fabric of silk and cotton or silk and hemp, or of other material. In weaving gauze, at every third cast of the shuttle the warp-threads are turned or twisted after receiving the woof from right to left, and the reverse, alternately, between each throw of the shuttle, so that the weft-threads are separated from each other, the slight texture being thus produced. Gauzes are either plain or figured. The latter are worked with flowers of silver or gold, on a silk ground, and are chiefly made in China. For antiseptic purposes, etc., cotton gauze is specially made for the use of surgeons. Special fabrics to which the name is given are also manufactured to be made into light underwear. The term has further been extended to any slight open material, as bolting-cloth and wire-cloth for various purposes. A wide-meshed, unsized cheese-cloth, which is called gauze, is considered by surgeons to be the cheapest and most convenient material for dressing wounds, being comfortable and absorbing fluid without disagreeable matting.

Gavarnie, Cascade de, France, a waterfall in the Cirque de Gavarnie, Pyrenees. It is the second highest in Europe, being 1,385 feet in height.

Gavarnie, Cirque de, France, a natural amphitheatre in the Pyrenees. It is 2¼ miles in width and 5,380 feet in height.

Gavazzi, gä-vät'sē, **Alessandro,** Italian reformer: b. Bologna, Italy, 21 March 1809; d. Rome, 9 Jan. 1889. At 16 he became a monk of the Barnabite order, and subsequently was appointed professor of rhetoric at Naples, where he speedily acquired a reputation as an orator. On the ascension of Pius IX. to the papal chair, he devoted himself to the diffusion of political enlightenment and patriotic aspirations among the masses of the Roman population. Later he forsook the papal ranks and to Gavazzi's fervid and patriotic oratory may be attributed, in no slight degree, the universal spirit of self-sacrifice evoked throughout Italy during this period of her history. He was called Peter the Hermit of the national crusade. On the establishment of the republic at Rome he was appointed almoner-in-chief to the national army. Rome having fallen, Gavazzi went to England, where he delivered numerous addresses and lectures illustrative of the political and religious aims of his country. He twice visited the United States. He was the founder of the Free Christian Church of Italy in 1870, and author of 'Recollections of the Last Four Popes' (1859); 'No Union with Rome' (1871), etc.

Gaveston, găv'ĕs-tŏn (Fr. gä-vĕs-tôn), **Piers,** favorite of Edward II., king of England: d. 19 June 1312. He was a Gascon by birth, and on account of his father's services to Edward I. was chosen companion to the Prince of Wales, over whom he acquired a complete and very mischievous ascendency, wasting his resources, and breeding dissension between him and his father. Edward I. banished him in 1307, but died the same year, and Edward II. at once recalled him, made him Earl of Cornwall, and gave him in marriage his niece, Margaret de Clare. Intoxicated with his elevation and honors Gaveston became intolerably insolent and exasperated the nobles. He was again banished, again recalled, and, the barons having declared war, was captured, and executed near Warwick.

Gavial, gā'vĭ-al, or **Ghavial,** the common crocodile of northern India (*Gavialis gangeticus*), characterized by its greatly prolonged and slender snout, a peculiarity which increases with age and varies according to sex. In the male the nose is very much swollen, and can be inflated like a bag when the nostrils (at the extremity) are closed. The teeth are very numerous,— usually more than 100. The cranial structures accompanying these peculiarities indicate a separate family (*Gavialidæ*), which first appears in the Upper Cretaceous, and has had many fossil genera and species, among them an Asiatic monster (*Rhamphosuchus crassidens*) of the Pliocene which was 50 feet in length. The gavial inhabits chiefly the basins of the Ganges, Indus and Brahmaputra, and reaches a length of 20 to 25 feet. In the Ganges it of a deep sea-green color above, with numerous irregular brown spots, smallest and thickest about the jaws, and below pale yellowish white. It feeds on fish and is harmless, in spite of its huge size. Its habits are little known; and still less is known of a closely related but smaller gavial (*Tomistoma schlegeli*) of Borneo, and Sumatra.

Gavotte, ga-vŏt, or **Gavot,** originally a dance of the Gavots or people of the Gap, department of the Upper Alps in France. It was a peasant dance, not unlike a minuet, and happily uniting liveliness with dignity. It was popular from the 16th to the 18th century, and at one period was in favor at court. After undergoing modifications it fell into disuse. The name is also given to a kind of music at first intended for such a dance. It came into great favor and was a frequent movement in suites, sonatas, etc., having been used by Bach and other great composers. In our time it has again become popular.

Gay, Delphine. See Girardin, Madame de.

Gay, Edward, American painter: b. Dublin, Ireland, 1838. He came to the United States in 1848, studied art in Albany, N. Y., and as a pupil of Schirmer and Lessing at Carlsruhe; established a studio in New York; and was elected an associate of the National Academy of Design in 1868. In 1887 he obtained the Metropolitan prize for his picture 'Broad Acres,' now in the Metropolitan Museum, New York. His works have been prominent in exhibitions of the Water Color Society and the National Academy, and include: 'Washed by the Sea'; 'The Suburbs'; 'Where Sea and Meadow Meet' (Executive Mansion, Albany); 'The Waving Grain,' etc.

Gay, John, English poet: b. Barnstaple, Devonshire, England, baptized 16 Sept. 1685; d. London 4 Dec. 1732. In 1713 he published his 'Rural Sports,' which he dedicated to Pope. This compliment introduced them to each other, and proved the foundation of a friendship which lasted for life. In 1714 his caricature of Ambrose Philips' pastoral poetry was published under the title of 'The Shepherd's Week.' His pleasant mock-heroic poem, entitled 'Trivia, or the Art of Walking the Streets of London,' was published in 1715, and in that year also was acted his burlesque drama of 'What d'ye Call It?' followed by a farce, in conjunction with Pope and Arbuthnot, called 'Three Hours after Marriage.' The production of this play altogether failed. In 1720 he published his poems by subscription, in 1723 his tragedy, 'The Captives,' and in 1726 his well-known 'Fables.' His 'Beggar's Opera' was first acted in 1727 at Lincoln's Inn Fields, where it ran for 63 nights, but the lord-chamberlain refused to license for performance a second part entitled 'Polly.' The latter part of his life was spent in the house of the Duke of Queensberry, where he wrote his sonata 'Acis and Galatea' and the opera 'Achilles.' He was interred in Westminster

Abbey, where his monument bears a flippant epitaph taken from one of his letters to Pope. Among his smaller pieces, his two ballads of 'Black-eyed Susan' and ''Twas when the Seas were Roaring,' are much admired.

Gay, Sidney Howard, American journalist and author: b. Hingham, Mass., 22 May 1814; d. New Brighton, Staten Island, N. Y., 25 June 1888. Unwilling to take the oath to support the Constitution of the United States, which fostered and protected slavery, he gave up a legal career and devoted himself to anti-slavery journalism and lecturing. He became, in 1842, editor of 'The Antislavery Standard,' a position he retained till he joined, in 1857, the editorial staff of the New York *Tribune*, of which he was managing editor 1862–6. From 1867 to 1871 he occupied the same position on the Chicago *Tribune*, and for another two years was managing editor of the *Evening Post*. He was the author of Bryant & Gay's 'Popular History of the United States,' and in 1884 wrote the life of James Madison in the 'American Statesmen' series.

Gay, Walter, American artist: b. Hingham, Mass., 22 Jan. 1856. He is a nephew of S. H. Gay (q.v.), and W. A. Gay (q.v.). At 20 he went to Paris, where he studied art under Bonnat, and he has been a frequent exhibitor at the salon. Among his paintings, which have won many medals, are 'Benedicite,' now in the Museum of Amiens, France, 'Las Cigarreras' ('The Cigarette Sellers') in the Luxembourg, Paris; and canvases in the Metropolitan of Fine Arts, New York, the Museum of Fine Arts, Boston, and several noted collections in Europe.

Gay, Winckworth Allan, American artist: b. Hingham, Mass., 18 Aug. 1821. At an early age he became a pupil of Weir, professor of drawing at West Point, subsequently went to Europe, and passed five years there in study, a part of the time under Troyon in Paris. He paints exclusively in landscape. 'A Scene in the White Mountains,' a picture painted for the Boston Athenæum, is a good specimen of his method of treatment of mountain scenery. Some of his best works depict that region. But he has also painted views of Nantasket beach and rocks, which have attracted much attention, and some critics have pronounced coast scenery to be his proper specialty.

Gay-Lussac, Joseph Louis, zho-zĕf loo-ē gā-lü-säk, French physicist: b. St. Leonard, Haute-Vienne, France, 6 Dec. 1778; d. Paris 9 May 1850. In 1804 he was the first to make balloon ascensions for purposes of scientific investigation: became a member of the society of Arcueil, and was introduced to Humboldt, with whom he prosecuted an investigation of the polarization of light and other subjects. He also devoted much of his time to the study of chemistry, and to him we are indebted for the discovery of the hydro-sulphuric and oxy-chloride acids. In 1830 he became a member of the Chamber of Deputies, and in 1839 was created a peer of France. He enjoyed several official appointments, and was professor of chemistry at the Jardin du Roi.

Gay Head, a promontory and lighthouse on the western extremity of Martha's Vineyard, Mass. Lat. 41° 21′, lon. 70° 50′ W.

Gay-Lussite, gā'lŭ-sīt, a native hydrous carbonate of calcium and sodium, $CaCO_3.Na_2CO_3 + 5H_2O$. It was described by Boussingault from crystals found in a bed of clay in the bottom of a lake near Maracaibo, Venezuela. These are vitreous, white, monoclinic prisms, having a hardness of 2 to 3 and a specific gravity of about 1.94. It also occurs in the waters of a lake near Ragtown, Nevada. It was named after the French chemist, Gay-Lussac. The name "natrocalcite" has been applied to pseudomorphs of calcite, which were supposed to be after gaylussite, but which now seem proven to be after celestite.

Gaya, gī'ä, India, chief town of a district of the same name in Bengal. It is a place of the greatest sanctity, from its associations with the founder of Buddhism, and is annually visited by about 100,000 Hindu pilgrims, who pray for the souls of their ancestors at the 45 sacred shrines within and without the walls. In Gaya proper the Brahmans reside; adjoining is Sahibganj, the trading and official quarter. Six miles south is the village of Buddha-Gaya, the home of Buddha. (See BUDDHISM.) Pop. (1901) 80,383 for the district; city 15,000.

Gayal, gī'al, or **Mithan,** a tame ox (*Bos frontalis*) of northwestern India and the hilly regions of Indo-China, known principally in the herds of the semi-civilized hill-tribes, but which also exists wild in Tenasserim. These cattle are kept for the sake of their beef, gayals never being put to any sort of work, as are humped cattle. This ox is somewhat smaller than the gaur (q.v.), has proportionately shorter legs, rounder and shorter horns, a flatter forehead and greater dewlap. It will interbreed with the gaur and various other bovine species.

Gayarré, gā-ä-rā', **Charles Etienne Arthur,** American lawyer and historian: b. New Orleans, La., 9 Jan. 1805; d. 11 Feb. 1895. He was admitted to the bar in 1829; was several times a member of the Louisiana legislature; deputy State attorney-general (1831); secretary of state of Louisiana (1846–53). Among his works, which deal largely with the history of his native State, are: 'History of Louisiana,' in French (1830); 'Louisiana, its History as a French Colony' (1851); 'Philip II. of Spain' (1866); 'Fernando de Lemos,' a novel (1872).

Gay'ler, Charles, American playwright: b. New York 1 April 1820; d. Brooklyn 28 May 1892. He removed to the West, was a law pupil of Abraham Lincoln, was admitted to practice, in 1848 edited the Cincinnati *Evening Dispatch*, and in 1850 became connected with the New York press, to which he contributed for many years. He wrote for English and American production a large number of plays, according to some statements nearly 400. These include: 'The Heir of Glen Avon,' his earliest attempt, produced in 1839; 'Taking the Chances'; 'Olympiana'; 'The American Cousin at Home' (for E. A. Sothern); 'Night and Morning'; 'With the Tide'; 'Brom Bones'; 'The Connie Soogah'; 'Bull Run'; 'Inflation'; 'Lord Tatters, Irish'; and 'Fritz, our Cousin German,' his most successful work, written for J. K. Emmet and first produced at Buffalo, N. Y., in 1869

Gayley, Charles Mills, American educator: b. Shanghai, China, 22 Feb. 1858. He was graduated at the University of Michigan in 1878, and became professor of the English language and literature in the University of California in 1889. His publications include: 'Songs of Yellow and Blue'; 'Guide to Literature of Æsthetics'; 'English in Secondary Schools'; 'Classic Myths in English Literature'; etc.

Gaynor, William Jay, American jurist: b. Whitestown, Oneida County, N. Y., 1851. He was for a time a journalist, studied law and in 1875 was admitted to the bar, wrote on legal subjects, and was identified with many cases of importance. In 1893 he was elected a judge of the State supreme court. He became best known through securing the conviction of John Y. McKane of Gravesend for election frauds.

Gayoso, José Brunetti, hō-sā' broo-nĕt'tē gī-yō'sō, Duke of Arcos, Spanish diplomat: b. Madrid, 6 Feb. 1839. He was educated at the University of Madrid, was admitted to the bar, entered the diplomatic service in 1864, and was secretary of legation at various capitals. He became minister plenipotentiary to Bolivia in 1881, to Uruguay in 1889, Chile in 1893, and Mexico in 1898. In 1899 he was appointed Spanish envoy extraordinary and minister plenipotentiary to the United States.

Gaza, gä'zä, **Theodorus,** Greek scholar: b. Thessalonica, Macedonia, about 1400; d. Italy 1478. He fled about 1444 before the Turks to Italy, where he became teacher of Greek at Ferrara, next of philosophy at Rome. Gaza has been warmly praised by subsequent scholars, such as Politian, Erasmus, Scaliger, and Melanchthon. His principal work was a Greek grammar in four books, first published by Aldus Manutius at Venice in 1495. He translated into Latin portions of Aristotle, Theophrastus, St. Chrysostom, Hippocrates, and other Greek writers.

Gaza, gā'za, Syria, an ancient town, capital of the district of the same name, about 3 miles from the mouth of the river Gaza, 50 miles from Jerusalem, on the high road between Egypt and Damascus. The bazaar and markets are of considerable importance. Gaza is a depot for barley, and has many potteries. The district of Gaza occupies the southwest corner of Syria, having the Mediterranean on the west, the valley of the Jordan and of the Dead Sea on the east, and Arabia Petræa on the south. Pop. (1900) 34,500.

Gazelle, a small antelope of the genus *Gazella*, or some related genus, exemplified by the "ariel" or "dorcas" of the Saharan and Syrian deserts, famous in poetic literature. The group contains some 25 species scattered throughout all Africa and southern Asia; and as a whole is characterized by small or moderate size, a sheep-like dentition, sandy coloration with white belly, and the usual presence of dark and light stripes on the face and flanks. The horns are of fair length, ringed, lyrate and usually present in both sexes. The gazelle (*G. dorcas*), stands about 24 inches tall at the shoulders, and has horns about 13 inches long. It is of delicate build, and extreme swiftness, leaping high as it runs, so that at full speed it seems to skim the ground like a flying bird. Its color is a light fawn upon the back, deepening into dark-brown in a wide band which edges the flanks and separates the yellow-brown of the upper portions of the body from the pure white of the abdomen. The face is marked with two stripes of contrasting colors, and the hindquarters are white. The eye of any gazelle is large, soft, and lustrous, and has been long employed by eastern poets as the most flattering comparison to that of a woman. Gazelles feed generally at dawn and at evening, and approach water only once in 24 hours. They are hunted in various ways, and their flesh is excellent. This species is becoming rare, but may still be found throughout the Sahara, and in the stony deserts of Syria. Many local names have been applied to it in books of travel and reference, most of which belong elsewhere. Such are the "korin" or "corinne" of Senegal (*G. rufifrons*); the West African "mohr" (*G. mohr*), the largest (32 inches high) and tallest of the race; the "aoul" (*G. sœmmerringi*) of Abyssinia and Somaliland, the "dama" (*G. dama*) of the Sudan, and others formerly confused with *G. dorcas*. Still other species range the plains of Central and South Africa, where some, as the springbok (q.v.), formerly assembled in vast herds, as described under Antelope. Another group is formed by three similar Asiatic gazelles, — one common in Persia (*G. gutturosa*), and the others eastward, where the "goa" dwells on the high Tibetan plateau. Lastly in the Indian gazelle (*G. bennetti*), the "ravine-deer" of Indian sportsmen, we have a species with almost straight horns, which is about 26 inches tall, light chestnut in color with a blackish tail, and dwells in small bands in the dry plains along both sides of the Indus.

Gazette. *Gazzetta* was the name of a small coin once in use at Venice, and also of a kind of primitive newspaper, published there and sold for that sum. *Gazzetta*, Spanish *Gazeta*, French *Gazette*, are still used for a newspaper, but the term in England is confined to that paper of news published by authority of the government. The first 'Gazette' in England was published at Oxford 7 Nov. 1665. From that period the 'Gazette' has appeared regularly twice a week, and besides the notifications published by court and government, contains those required by law in private transactions. See Newspapers.

Gazetteer, a geographical dictionary. The first work of this kind with which we are acquainted is that of Stephen of Byzantium, who lived in the beginning of the 6th century. We have only an abridgment of it. The first modern work of the kind is the 'Dictionarium Historico-Geographicum' (Geneva 1565), by Charles Stephens, with additions by N. Lloyd (Oxford 1670, and London 1686). The works of Ferrari ('Lexicon Geographicum,' 1627) and Baudrand ('Geographia Ordine Literarum Disposita,' 1682) are full of the strangest errors. Those of Maty (1701), Thomas Corneille (1708), and Savonarola (1713) were based on the former, with additions and corrections. The 'Dictionnaire Géographique, Historique et Critique,' of La Martinière (1726), superseded all that had gone before it, though it retained many errors. The 'Geographisch-Statistisches Handwörterbuch' of the eminent German geographer Hassel (1817) was the result of laborious and judicious investigations. The 'Universal Gazetteer,' by Cruttwell (London 1808) and the 'Edinburgh Gazetteer'

(1817–22), once the principal works of the kind in English, were in course of years superseded by several others, among them Macculloch's 'Geographical Dictionary,' Blackie's 'Imperial Gazetteer' (Glasgow 1850), Lippincott's 'Pronouncing Gazetteer of the World' (Philadelphia 1855, with new editions and revisions), and Longmans' 'Gazetteer of the World.' The most valuable among European gazetteers further include the French 'Dictionnaire Géographique Universel,' Saint-Martin's 'Nouveau Dictionnaire de Géographie Universelle,' and Ritter's 'Geographisch-Statistisches Lexikon.' There are also gazetteers confined to individual States of the Union, and others to particular countries of the world.

Gears. See WHEEL GEARING.

Geary, John White, American military officer and politician: b. Mount Pleasant, Westmoreland County, Pa., 30 Dec. 1819; d. Harrisburg, Pa., 8 Feb. 1873. He was a lieutenant-colonel in the Mexican war; went to California and was appointed postmaster at San Francisco in 1849, being the first to hold that position in the city. In 1850 he was elected the first mayor of San Francisco, and in 1856 was made territorial governor of Kansas. When the Civil War broke out he enlisted in the Union army and became brigadier-general of volunteers 25 April 1862. He was in the battle of Cedar Mountain 9 Aug. 1862, and commanded a division at Chancellorsville, Gettysburg and Lookout Mountain. He also participated in Sherman's march to the sea. He was governor of Pennsylvania from 1867 till shortly before his death.

Gebhardt, Eduard von, ed'oo-ärd fōn gāb'-härt, German painter: b. St. Johannes, Esthonia, 13 June 1838. He studied at the St. Petersburg Academy in 1854–7, and later with Wilhelm Sohn at Düsseldorf, where he established his studio and attracted much attention by his religious works, in which he treated biblical scenes after the manner of the Dutch and Germans of the 15th and 16th centuries, imitating their introduction of costumes and other features contemporary to them. He also painted many scenes from the period of the Reformation. In 1873 he was appointed professor in the Düsseldorf Academy. His subjects include: 'Christ's Entry into Jerusalem'; 'The Rich Man and the Beggar Lazarus'; 'The Last Supper,' his chief work (National Gallery, Berlin); 'The Ascension,' one of his best canvases; 'Religious Conversation'; and 'The Reformer at Work.'

Geckos, gek'ōz, the small lizards of the family *Geckonidæ*, distinguished from other lizards by structural peculiarities which indicate that the group is a very ancient and distinct one. Externally their robust forms, short heads and thick, but fragile tails; the skin, in most soft and pebbled with minute bony concretions (osteoderms); the lack of eyelids, the ball of the eye being studded by a transparent watch-glass-like scale; and adhesive feet are so highly characteristic that a gecko is usually recognizable at a glance. The group consists of about 50 genera, comprising some 270 species, and they are scattered all over the warmer part of the globe, occurring even in New Zealand and many oceanic islands. Most of the species are small, the largest not much exceeding a foot. They dwell mainly in the woods, and among rocks, hiding by day, or basking quietly in the sun, and becoming active at night. They are carnivorous, the smaller eating insects, and the larger bigger insects and whatever else they can catch. They are well fitted for scrambling about tree-trunks and cliffs, as is seen in the agility of the common "tarentola," "osga" and other geckos of southern Europe, and the almost domestic "cheecha" (*Hemidactylus*) of Ceylon and India, which are numerous both outside and inside of farm and village houses, snapping up flies. They will climb a smooth wall or even a window pane without difficulty, and even run back downward along the smooth whitewashed ceiling. This is possible for them by the fact that the soles of the cushions of the toes are furnished with transverse lamellæ beset with tiny hair-like excrescences, between each two of which a vacuum is formed by the pressure of the foot on every step. Upon the differences in the arrangement of the pads and lamellæ are based generic distinctions. In addition to this facility of movement, one species (*Ptychozoön homalocephalum*), the flying or fringed gecko of the Malayan region, has a lateral parachute-like membrane assisting it to make long leaps from tree to tree.

Geckos are entirely harmless and could not inflict a painful bite if they tried; yet the peasants of Spain and Italy fear as poisonous even those which they see daily in their houses, and the Egyptians accuse them of leprosy. When encouraged they become tame and friendly and show considerable intelligence. Their voices produce a feeble clicking sound, often repeated, from which comes the term "Gecko" and such local names as "toco-toco" and the like. They reproduce by hiding among rotten wood two or three globular hard-shelled eggs, from which the young hatch, and are ready at once to begin to care for themselves. Consult Gadow, 'Amphibia and Reptiles' (1901); Gosse, 'A Naturalist's Sojourn in Jamaica' (London 1851).

Ged, William, Scottish goldsmith, inventor of stereotyping, b. Edinburgh 1690; d. there 19 Oct. 1749. In 1725 he took out a patent for his method of stereotyping, which was for long the only one in use. He met with such opposition in Edinburgh that he went to London, but there also failed to get his invention adopted. In 1731 he obtained a contract to print Bibles and prayer-books for the University of Cambridge, but only two prayer-books had been executed when the lease was surrendered. He stereotyped an edition of Sallust in 1744. Consult 'Memoir,' by Nichols (1781).

Geddes, gĕd'ĕs, **James,** American scholar: b. Boston, Mass., 29 July 1858. He was graduated from Harvard in 1880, was instructor in Romance languages at Boston University in 1887–90, assistant professor in 1890–92, and in 1892 was appointed professor. His writings include various monographs and articles for periodicals, and student's editions of Spanish and Italian classics.

Geddes, James Lorraine, American soldier: b. Edinburgh, Scotland, 1827; d. 1887. After residence in Canada, he studied in the British military academy of Calcutta, India, distinguished himself in the Punjab, and settled at Vinton, Iowa, in 1857. In the Civil War he served from 1861 to 1865, and attained the brevet rank of brigadier-general of volunteers. He wrote: 'The Stars and Stripes,' 'The Soldier's Battle Prayer,' and other war verse.

Geefs, Gillaume, gē-yōm gāfs, Belgian sculptor: b. Antwerp 10 Sept. 1806; d. Brussels 24 Jan. 1883. He became professor at the Academy of Antwerp in 1834. Among his most important works are the monument to the victims of the Revolution of 1830 at Brussels; a statue of Rubens in front of Antwerp Cathedral; statues of King Leopold, etc.

Geefs, Joseph, Belgian sculptor: b. Anwerp 25 Dec. 1808; d. there 10 Oct. 1885. He was a brother of Gillaume Geefs (q.v.). In 1841 he was appointed professor of sculpture in the Antwerp Academy, and in 1846 became a member of the Belgian Academy. Among his principal works are: A statue of Vesalius, at Brussels; one of Martens, the first Belgian printer, at Aelst; an equestrian statue of Leopold I., at Antwerp; and 'The Fallen Angel,' in the Brussels Palace of Fine Arts.

Geelong, gē-lŏng', Australia, a city of Victoria, on Corio Bay, 45 miles south of Melbourne. The gold discoveries in 1851 added to its prosperity. Limestone and a kind of marble are found in the neighborhood. The industries are the manufacture of woolen cloths and paper, meat preserving, tanning, rope making, fishing, etc. The city is lighted with gas, and has two parks, botanical garden, government buildings, a town hall, hospital, chamber of commerce, mechanics' institute, etc. Corio Bay is a favorite bathing resort. Pop., including suburbs (1901), 23,440.

Geelvink (gāl'vĭnk) **Bay**, an arm of the Pacific in New Guinea. Its entrance, about 155 miles wide, is protected by several islands.

Geertz, gārts, **Julius**, German painter: b. Hamburg 21 April 1837. He was a pupil of Günther and Martin Gensler at Hamburg, of Descoudres at Carlsruhe, and of Jordan at Düsseldorf, located his studio at Düsseldorf, and established his reputation by his skilful genre scenes, of which the 'Criminal after Condemnation' was the first to win prominent notice. His works, characterized in general by excellence of design and color, fidelity of interpretation, and a capital sense of humor, include: 'The Fly-catcher'; 'Die Wacht am Rhein'; 'A Prisoner of War'; 'The Village Hero'; 'Alms.' During a visit to the United States he painted portraits of Oswald Ottendorfer, Carl Schurz, and other German-Americans.

Geese, a large group of water-birds allied to the ducks and swans, and forming with them the family *Anatidæ*. It is not possible to separate geese and ducks into two well-defined groups. Generally speaking, however, geese are distinguished by their larger size; short, heavy bill, with reduced lamellæ; longer legs, placed nearer the centre of the body; and the absence of enlargements of the bronchial tubes. Some thirty species of true geese exist, and about a dozen others are usually known by that name. Males are called "ganders," and young birds "goslings." The most typical geese are those of the genus *Anser*, represented in Europe by the gray lag (*A. cinereus*), bean-goose (*A. segetum*) and white-fronted goose (*A. albifrons*). A variety of the last occurs also in North America. The gray-lag goose is the original of the domestic races of geese. In its wild state it ranges over nearly the whole of Europe and northern Asia, and was formerly an abundant breeder on the British Isles.

The best known wild geese in America are the Canada goose (*Branta canadensis*), the brant (*B. bernicla*) and the snow-goose (*Chen hyperboreus*). The former presents several varieties differing mainly in size, the Hutchin's and cackling goose of the West being not larger than big ducks. One form or another occurs all across the continent, breeding mainly north of the United States, migrating southward in the autumn, and wintering on the coasts and inland waters, where they are regularly hunted by sportsmen. In early spring the northward flight of these geese in their customary V-shaped rank is heralded as an indication that winter is over. The brent goose or brant is a smaller darker bird, breeding far northward and occurring along our coasts often in immense numbers during the winter, and also on the coasts of Europe, being everywhere a salt-water bird. The black brant of our western coast, and the bernacle goose (q.v.) of the north of Europe, are allied species. Several species of snow-geese or laughing geese, are found in America, most plentifully in the interior. Most of them are pure white in the adult state, more or less gray during the first year; but the blue goose (*Chen cærulescens*) is always bluish gray, with the head white in the adult.

In Patagonia and the adjacent islands are several peculiar geese in which the sexes differ totally in coloration, the males being white and the females brown; some of them are strictly upland birds. The largest known goose is the Chinese swan-goose (*Cygnopsis cygnoides*), which is supposed to be the parent stock of the domestic geese of some eastern countries. The peculiar Cape Barren goose of Australia (*Cereopsis novæ-hollandiæ*), an upland goose which has lost the power of flight, has the webbing of the toes greatly reduced and the bill very short and rounded. Another curious species is the spur-winged goose of Africa (*Plectropterus rueppelli*) which possesses hornlike weapons on the bend of the wing. This is a beautiful bird bred in captivity by fanciers for ornamental service.

Domestic Geese.— The breeding of geese is followed on a large scale in some countries and was formerly extensively carried on in parts of England, where the flocks were regularly tended by a gooseherd and driven daily to pasture and water. Geese are valuable not only for their flesh and eggs, but for the plumage, and where kept for the latter purpose are plucked four or five times a year. The feathers are used chiefly for stuffing pillows, etc.; but as a result of public sentiment against the use of the plumage of wild birds in millinery, the manufacture of artificial plumes and feather-ornaments for hats is becoming an important industry, and goose-feathers form the basis of most of these fabrications. Geese are often specially fattened for the table. The liver of a fat goose is often larger than all the other viscera. The celebrated *pâtés de foie gras* of Strasburg are made of goose-livers, which are brought to a state of abnormal enlargement by keeping the birds in an apartment with a high temperature and cramming them with food. The oily fat and preserved breasts of geese are German delicacies. Six standard varieties of domestic geese are kept in the United States, for practical purposes, as follows:

Gray Toulouse.— Derived from the neighborhood of Toulouse, France; compact in form; gray, with brown wing-quills, hazel eyes, and bills and feet deep orange; full weight, 20 pounds. They are late in maturing, and hence are often called Christmas geese; their flesh is not of the best, but they are good egg-layers. They are bred largely by farmers.

White Embden.— Large, tall, snow-white geese derived from Westphalia, weighing 18 to 20 pounds when adult; eyes blue, bills flesh-color; feet deep orange. They are highly regarded by farmers as practical birds.

Gray African.— Tall, with long necks and large heads, a large knob on the base of the bill and a heavy dewlap: general color gray, darkest on the back; eyes hazel; bill black; feet dark orange; weight, 18 to 20 pounds. These are by many raisers considered the most profitable of all geese to keep. They grow the heaviest in the shortest space of time, are ready for market in 10 weeks, and as compared with other geese give the most satisfactory returns for the least labor and time spent in growing them. They are first-class layers and their flesh is fine and nicely flavored.

Chinese Geese.— Small graceful geese in two varieties, brown and white, weighing as adults 12 to 14 pounds. In colors and the shape of the head and knobbed bill they resemble the African breed; the white variety is pure white throughout, with the bill orange instead of black. They are the most prolific layers of all the breeds, averaging 50 to 60 eggs a year; and are otherwise commendable, especially for the table.

Wild Geese.— Descendants of the American wild goose: weight 14 to 16 pounds. They are very generally bred throughout the country, and exhibit many good qualities.

Consult Weir, 'The Poultry Book' (New York, 1903).

Geezeh. See GIZEH.

Geffrard, zhĕ-frär, **Fabre,** Haitian president: b. L'Anse-à-Beau 19 Sept. 1806; d. Kingston, Jamaica 11 Feb. 1879. In 1843 he joined Gen. Hérard's insurrection against President Boyer, and as commander of Hérard's advance guard, annihilated Boyer's force at Numéro Deux. In the wars with Santo Domingo (1849, 1856) he fought with distinction, later led a successful insurrection against President Soulouque, and was president from 1859–67, when a conspiracy of Salnave, an army officer, obliged him to escape to Jamaica.

Gefle, yāf'lā, Sweden, a seaport town and capital of Gefleborg, and at the mouth of a river of same name in the Gulf of Bothnia. It stands on both sides of the river and two islands formed by it, consists of spacious and well-paved streets, and houses partly of wood and partly of stone; and has an old castle, ship-building yards, and an excellent harbor. Pop. (1900) 29,522.

The district of Gefleborg has an area of 7,614 square miles; a coast deeply indented by bays, and an interior partly mountainous and covered with pine forests, and containing a large number of lakes, which, with the streams between them, form a kind of continuous network. The rearing of cattle is the chief employment. The most valuable mineral is iron. Pop. (1900) 228,862.

Gefleborg. See GEFLE.

Gehenna, gē-hĕn'ạ. See HELL.

Gehennam, gē-hĕn'ạm. See TOPHET.

Gehlenite, gā'lĕn-īt (named by Fuchs after his colleague Gehlen), a grayish-green or brown tetragonal mineral; hardness 5.5 to 6; specific gravity 2.9 to 3.1; lustre resinous or vitreous; fracture uneven to splintery. It is composed of a silicate of calcium and aluminum, $Ca_3Al_2Si_4O_{10}$. This mineral has feeble double refraction. It is found in the Tyrol and in Banat, and occasionally occurs among the scoriæ of furnaces.

Geijer, gī'ĕr, **Eric Gustaf,** Swedish historian: b. Ransäter, Wermland, 12 Jan. 1783; d. Stockholm 23 April 1847. Beginning to lecture at Upsala in 1810, he was elected in 1815 assistant professor, and in 1817 professor of history at Upsala. Geijer exercised a marked influence on the poetic no less than on the historical literature of Sweden. Great as is the value of Geijer's historical works, he unfortunately did not complete any one of the vast undertakings which he planned. Thus, of the 'Svea Rikes Häfder,' or Records of Sweden (1825), which were to have embraced the history of his native country from mythical ages to the present time, he finished only the introductory volume. This, however, is a thoroughly good critical inquiry into the sources of legendary Swedish history. His next great work, 'Svenska Folkets Historia' (1832–6), was not carried beyond the death of Queen Christina. Of his other historical and political works may be mentioned 'The Condition of Sweden from the Death of Charles XII. to the Accession of Gustavus III.' (1838), and 'Feudalism and Republicanism' (1844). During the last 10 years of his life Geijer took an active part in politics; but, although his political writings possess great merit, the very versatility of his powers diverted him from applying them methodically to the complete elaboration of any one special subject. He was also known to his countrymen as a musician and composer of no mean order. His collected works were published by his son, with a biographical sketch (13 vols. 1849–56).

Geikie, gē'kĭ, SIR **Archibald,** Scottish geologist and scientific writer: b. Edinburgh 28 Dec. 1835. He entered the geological survey in 1855 and has since had a brilliant career of discovery and experiment, and held many important honorary positions. Among his publications are: 'The Story of a Boulder' (1858); 'Elementary Lessons in Physical Geography' (4th ed. 1884); 'Scenery of Scotland Viewed in Connection with its Physical Geology' (2d ed. 1887); 'Outlines of Field Geology' (4th ed. 1881); and 'Text-Book of Geology' (3d ed. 1893); 'The Ancient Volcanoes of Britain' (1897).

Geikie, James, Scottish geologist, brother of Archibald Geikie (q.v.): b. Edinburgh 23 Aug. 1839. He was educated at Edinburgh University in which he held the chair of geology in 1882. He is the author of: 'The Great Ice Age' (1874); 'Prehistoric Europe' (1882); 'Outlines of Geology' (1884); 'Fragments of Earth Lore' (1892); 'Earth Sculpture' (1898).

Geikie, John Cunningham, English Anglican clergyman: b. Edinburgh 26 Oct. 1824. He was educated at the University of Edinburgh, was pastor of Presbyterian churches in Halifax and Toronto, was ordained priest of the Established Church in 1876, and was successively curate of St. Peter's, Dulwich, 1876–9; rector of Christ's Church, Neuilly, Paris, 1879–81; vicar of St. Mary's, Barnstaple, 1883–5; and vicar of St. Martin-at-Palace, Norwich, in 1885–90. His publications include: 'The Life and Words of Christ' (1876); 'Old Testament Characters' (1880); 'The English Reformation' (1884); 'Landmarks of Old Testament History' (1895); 'A New Short Life of Christ' (1898); 'The Vicar and His Friends' (1901).

Geisha, gā'sha, a Chino-Japanese word, meaning "one with pleasing accomplishments." applied to Japanese singing and dancing girls who furnish entertainment in tea-houses and at social gatherings.

Geissler, Heinrich, hīn'rĭh gīs'lĕr, German mechanician: b. Igelshieb, Germany, 26 May 1814; d. Bonn, Prussia, 24 Jan. 1879. He became known as a maker of physical and chemical apparatus and principally as the inventor of Geissler's tubes (q.v.), an apparatus for producing light by an electric discharge in vacuo.

Geissler's Tubes, tubes made of very hard glass, and containing highly rarified gases. Each end of the tube has a platinum wire sealed into it to serve as electrodes. When a discharge of electricity is caused to take place in these tubes by connecting the electrodes to the terminals of a Ruhmkorff's coil or a Holtz's machine, very brilliant effects may be produced. The invention was named after Heinrich Geissler (q.v.).

Gela, jē'la, Sicily, a city of ancient Greece, situated on the island between Agrigentum and Camarina; founded in 690 B.C. by the Cretans and Rhodians. The colony was remarkably prosperous, and in 528 B.C. sent out a portion of its inhabitants, who founded Agrigentum. In 280 Phintias, the tyrant of Agrigentum, utterly destroyed Gela.

Gelada, gĕl'a-da, a kind of baboon (q.v.).

Gelasius (jē-lā'sĭ-ŭs) **I., Saint**, Pope: d. 19 Nov. 496. He succeeded Felix III. on 1 March 492. At the Council of Rome in 496 he distinguished the canonical books from the apocryphal of Scripture. He also regulated the canon of the Mass. He was succeeded by Anastasius II.

Gelasius II. (Giovanni di Gaeta, jō-vän'nē dē ga-ā'ta), Pope: d. Cluny, France, 29 Jan. 1119. He was cardinal and chancellor under Urban II. and Paschal II., and on the death of the latter was chosen pope by the party hostile to the Emperor Henry V. The imperial party at Rome under the Frangipani seized his person, but were forced to set him free by the menacing attitude of the mob. The new pope fled before the advancing imperial troops to Gaeta, where he first received his consecration, and whence he excommunicated Henry V. and Gregory VIII., the antipope Henry had set up. Soon after he was able to return to Rome, but ere long had to betake himself for protection to France, where he died in the monastery of Cluny.

Gelatine, jĕl'a-ten, or **Gelatin** (Latin, *gelatus*, "frozen," so named from the tendency which the substance has to congeal and become to a certain extent solid), in chemistry $C_{76}H_{124}N_{24}O_{29}$ (?). Animal glutin, obtained by treating bones with dilute hydrochloric acid, which dissolves the mineral constituents of the bone, consisting of phosphates and carbonates of calcium, magnesium, etc., and leaves the bone cartilage. This, when boiled for a long time with water, dissolves, and forms gelatine, which can be purified by dissolving in hot water and precipitating by alcohol. A pure variety is obtained from the swimming bladder of the sturgeon. Impure gelatine glue is prepared by boiling down pieces of hide, horn, hoof, cartilage, etc., with water under pressure. Pure gelatine is amorphous, transparent in thin plates, of a yellowish-white color; it has neither taste nor smell, and is neutral to vegetable colors; it is insoluble in alcohol and in ether. In contact with cold water it swells up, and is soluble in hot water. It is not precipitated by acids, except by tannic acid, which gives a flaky precipitate insoluble in water, alcohol, and ether. The aqueous solution of gelatine turns the plane of polarization to the left. Gelatine subjected to dry distillation yields methylamine, cyanide of ammonium, pyrrhol, etc.; by oxidation with sulphuric acid and manganese dioxide, or with chromic acid mixture, it yields hydrocyanic acid, acids of the fatty series, benzoic aldehyde and benzoic acid, etc. Gelatine boiled with caustic potash yields glycocine and leucine. Gelatine contains about 50 per cent. of carbon, 6.6 of hydrogen, and 18.4 of nitrogen. Moist gelatine exposed to the air rapidly putrefies, the liquid becoming first acid, but afterward it gives off ammonia. Gelatine gives no precipitate with lead acetate, alum, or ferrocyanide of potassium. A mixture of gelatine with potassium dichromate becomes, when exposed to the action of light, insoluble in water. The nutritious value of gelatine has been much overestimated. Isinglass is prepared from the form derived from the sturgeon's bladder; and gelatine is also made use of in photography (q.v.).

Gelatine Process. See PHOTOGRAPHY AND PHOTO-ENGRAVING.

Gelderland, hĕl'dĕr-länt, or **Guelderland**, a province of Netherlands, with the Zuyder Zee on its northern boundary. Area, 1,965 square miles. The surface is level, the soil of the north sandy, the southern part low, marshy, but when cultivated, fertile. The principal rivers are the Rhine and the Meuse. The capital is Arnhem (q.v.). (For history see NETHERLANDS.) Pop. 567,489.

Gelée, zhé-lā, **Claude.** See CLAUDE LORRAINE.

Gelert, Johannes Sophus, American sculptor: b. Schleswig, Denmark, 10 Dec. 1852. He studied in the Royal Academy of Fine Arts at Copenhagen in 1870–5, removed to the United States in 1887, received a gold medal and honorable mention at the World's Columbian Exposition (1893), a gold medal at the Nashville Centennial Exposition (1897), and honorable mention and a gold medal at the Paris Exposition of 1900. His works include the monument to the policemen killed by the Chicago anarchists, Haymarket Square, Chicago; statues of Beethoven and Andersen in Lincoln Park, Chicago; a statue of Grant at Galena, Ill.

Gellius, jĕl'ĭ-ŭs, **Aulus,** Roman author: b. possibly about 130 A.D. He studied rhetoric at Rome and philosophy at Athens, and practised as a lawyer at Rome. He is the author of 'Noctes Atticæ,' full of interesting observations and quotations, from the best Latin and Greek authors, relating to language, literature, history, and antiquities. This work was partly compiled in the winter nights during his residence at Athens. It is now of great value, as the authors from which he drew his materials are in a great measure lost. Among the best editions is that of Hertz (1883–5).

Gelon, jē'lŏn, tyrant of Gela and afterward of Syracuse: d. about 478 B.C. He was a scion of a noble family of the former city, and succeeded its tyrant, Hippocrates, in 491 B.C. Six years later he made himself master of Syracuse also, which then became the seat of his government, and to which he transferred the majority of the inhabitants of Gela. Gelon refused to aid the Greeks against Xerxes, as they declined to comply with his demand that he should be appointed commander-in-chief. The clemency and wisdom of Gelon rendered him so generally beloved that when he appeared unarmed in an assembly of the people, and declared himself ready to resign his power, he was unanimously hailed as the deliverer and sovereign of Syracuse.

Gelose, jē'lōs, a pectic substance containing carbon, 42.77; hydrogen, 5.775; oxygen, 51.455, prepared by Payen from a commercial article entitled Chinese moss, which consists of long white threads made up into bundles, and from various seaweeds. It is used for food, and is said to be the juice of a lichen growing on trees in the south of China and in the Philippine Islands. The moss, when boiled in water, dissolves, with the exception of 2 or 3 per cent of nitrogenized corpuscles and traces of other matter, and on cooling forms a transparent colorless jelly, which when dried constitutes gelose. It is distinguished from other bodies by certain characteristic reactions.

Gelsemium, jĕl-sē'mĭ-ŭm, yellow jasmine, the dried rhizome and roots of *Gelsemium sempervirens;* a southern climbing-shrub with a large woody underground stem and dark-green leaves, and bright, yellow sweet-scented flowers. It grows from Virginia southward in woods, and mounts to the top of tall trees. The active constituents contained in the underground stem are two alkaloids, gelsemine and gelseminine, the latter of which is the more potent. Gelsemium is an acute poison, acting both on the sensory and motor end-organs, causing anæsthesia and motor weakness. The early symptoms of large doses are loss of power in the muscles of the eye, causing drooping of the lids, dizziness, drowsiness, and disturbance of vision. In poisonous doses there is marked diminution in the force of the pulse and respiration, with difficulty of speech, coldness of the body surface and general loss of skin sensations. Death results from asphyxiation. Its most important medicinal use is in neuralgias, in sick-headache, and as a general nerve tonic.

Gemini, jĕm'ĭ-nī, the Twins (♊), the third sign of the zodiac. The sun enters this sign on or about 21 May, and leaves it on or about 21 June. The name belongs also to a northern constellation, of which the two chief stars are Castor and Pollux. They are very nearly equal in brilliancy, which fact probably suggested the name. Pollux is slightly the brighter. It is a quadruple star. Castor is one of the finest of the double stars. See ASTRONOMY.

Gemistus, jĕ-mĭs'tŭs, **Georgius.** See PLETHO, GEORGIUS GEMISTUS.

Gemmi (gĕm'mē) **Die,** Switzerland, a narrow pass, nearly two miles long, which crosses the Alps at a height of 7,553 feet, and connects the Swiss cantons of Bern and Valois.

Gemmules, jĕm'ūlz. (1) In actual biology gemmules are aggregations of cells set apart in the body of sponges and polyzoans to serve as reproductive agents. This is one of the most primitive forms of reproduction. (2) In philosophical biology gemmules are hypothetical, self-reproducing particles in the reproductive protoplasm (a structure which is assumed) supposed to be bodily transmitted from parent to child, and to carry such qualities as are inherited by offspring.

Gems are precious stones of small size, such as may be used for setting in a ring, or for any similar purpose of ornament. Like everything else of great value, precious stones have been imitated, and the practice has been carried on from the earliest times. The art of glass-coloring was known to the ancient Egyptians, who produced excellent imitations of the most beautiful gems. Among the Romans in the time of Pliny the manufacture of false stones was far advanced as a branch of industry. There existed several treatises on the subject, and Pliny declared that it was a difficult task to distinguish the false gems from the true. The alchemists of the Middle Ages, according to Aquinas, successfully fabricated artificial jewels, and he instances the jacinth, sapphire, emerald, topaz, and ruby, as being skilfully counterfeited. About the middle of the 17th century, false stones were no longer manufactured according to methods differing for each stone, but according to a general formula much the same as that followed at the present day.

Artificial Gems.— The base of all modern artificial gems is a peculiar kind of glass of considerable hardness, brilliancy, and refractive power, called paste or strass, which is distinguished from ordinary glass by the presence of 50 per cent of oxide of lead among its constituents. When the strass is obtained very pure, it is melted and mixed with substances having a metallic base, generally oxides, which communicate to the mass the various desired colors. We give a few details showing how the principal gems may be imitated. The diamond being colorless, pure strass simply cut into brilliants and roses is used as a counterfeit. The ruby is imitated by mixing 1,000 parts of strass, 40 parts of glass of antimony, 1 part purple of Cassius (a preparation of gold and binoxide of tin), and 1 part in excess of gold. Sapphires are counterfeited by 1,000 parts strass, and 25 of oxide of cobalt. Topaz — the same formula as for ruby, without the excess of gold, and heated for a less time. Emerald, 1,000 parts of strass, 8 oxide of copper, and 0.2 oxide of chromium. Amethyst, 1,000 parts strass, 25 oxide of cobalt, and a little oxide of manganese. Garnet, 1,000 parts strass, and a variable quantity of purple of Cassius according to the shade to be obtained. In all these preparations success mainly depends upon a thorough pulverization and mixture of the ingredients; the fusion should be long continued at a graduated and uniform maximum temperature, and the mixture be annealed in cooling. These imitations, which are made in immense quantities in large factories in France and elsewhere, are chiefly used in the manufacture of cheap jewelry.

Attempts have, however, been made with a fair measure of success to manufacture true gems by artificial processes. Of these processes we need only mention that introduced by the French chemists Frémy and Verneuil. They succeeded in manufacturing excellent rubies, very like the natural ones in shape and composition, by raising carefully to a red heat a mixture of alumina, barium fluoride, and a very small quantity of bichromate of potash. The rubies are found in a friable matrix. If a little cobalt oxide be present in the mixture, sapphires are obtained instead of rubies. Many experiments with a view to producing diamonds artificially have been made within recent years. From hydrocarbons, subjected to a very intense heat and enormous pressure, minute crystals have been obtained which are as hard as the natural diamond, scratching all other minerals, and not affecting polarized light. The process is, however, expensive, tedious, and dangerous, and the diamonds produced are as yet so small that it requires more than 1,000 of them to make a carat; only ½ carat has been produced, at an expense of $2,000; hence they represent nothing beyond a scientific value. A diamond exists in the meteorite from Cañon Diablo, Arizona, in the Kunz collection at the American Museum of Natural History, New York. This is the first diamond identified in a meteorite,— by Dr. G. A. Koenig, in 1891.

We come now to genuine precious stones which will be taken up in the order of their rarity and value:

Diamonds.— The diamond, although not the rarest nor the most valuable of precious stones, is often called "the king of gems." It consists of pure carbon, crystallized in what is known as the isometric system, almost always occurring in the form of a regular octahedron or some modification thereof. It is the hardest of all known substances, ranking as ten (10) in the scale of hardness. It possesses a higher refractive and dispersive power on light than any other gem, whence arise the extreme brilliancy, and the varied flashes of color, or "fire," that give it such beauty. Being carbon, it is combustible,— the only gem that is so,— burning to carbonic acid in oxygen, or even in air under suitable treatment; this property was discovered as long ago as 1691, by Cosmo I., of Tuscany, who ignited a diamond with a burning-glass. Its density is about 3.5. In color it varies much, from white or colorless to yellow, also brown, rarely green, blue, pink, rose-red, occasionally even black. Some diamonds phosphoresce upon friction, and glow strongly under the influence of violet and ultra-violet light, and the emanations from the new and singular element known as radium, or rather from its compounds. They are absolutely transparent to the X-rays, of Roentgen. All these properties serve as ready means for distinguishing real diamonds from the best imitations. The value of a diamond depends on several conditions, chiefly size, color, and brilliancy. As to size, they are rated by the carat (or karat). This was the name of certain small seeds, which when dried, are quite constant in weight, and were used in India for weighing gems. It has now become a fixed standard for this purpose, used among all civilized nations, as the "international carat." In 1871, the syndicate of jewelers, goldsmiths, and gem-dealers of Paris proposed to fix its value at .205 of a gram; and this was generally adopted in 1877, and accepted by the principal dealers of Paris, London, and Amsterdam,— the centres of the world's diamond trade. The English carat is equal to 3.1683 grains Troy (usually reckoned as 3.17 grains); so that there are 151½ carats in an English Troy ounce. The jewelers' carat is divided into halves, quarters, eighths, sixteenths, thirty-seconds and sixty-fourths. A quarter-carat is sometimes called a grain, though it is less than a true grain; and pearls are generally sold by the grain, in this sense. As to color, the highest value belongs to perfectly white stones, or to those of fine bright tints, whether rose, green, or blue. These last are very rare and command fancy prices. Yellow diamonds are much more frequent, but when of rich color, are valuable. Any half-way tints, however, such as yellowish whites, are far less desired. Some possess a delicate steely-blue tinge, sometimes a delicate opalescence, and are called "blue-white"; these are particularly the Brazilian stones from Bagagem, and are also notable for their phosphorescent property. Perfectly colorless and flawless diamonds are spoken of as of "first water," a term which varies, however, according to the class of goods carried by the dealer using it. Many of the African stones are what is called "Cape white," that is, faintly yellowish; these are indistinguishable from pure white ones by artificial light, but command much lower prices. The finest diamonds are not found in the Kimberley mines, but in the Orange River Colony and the Transvaal. Diamonds vary also in brilliancy, some having higher lustre than others. New South Wales yields small stones that are harder than usual, and at the same time exceedingly brilliant. All these natural qualities, together with perfection of cutting, enter into the estimate of values, and may cause very great differences. Of two diamonds of ten carats each, both flawless, one may be worth $600 and the other $12,000. Exceptional stones often bring special prices. Diamonds are occasionally found in many parts of the globe, but in only a few regions are they at all frequent or large, so as to be mined for. They were first obtained in India, then somewhat in Borneo, then in Brazil; more recently they are coming from New South Wales, and lately British Guiana is yielding a number. But all other sources are insignificant compared with the wonderful diamond mines of South Africa, which furnish 95 per cent of the world's supply, and have yielded since their discovery some 30 years ago, more diamonds than all other sources together in all past time. A few are found in Siberia, and in California; also along a line east of the Blue Ridge from Virginia to Georgia, and along another line from Wisconsin to southern Ohio; but these are only occasional, and are more interesting than important. The diamond seems to have been unknown to the ancients, outside of India, until about the beginning of the Christian era. The words rendered "diamond" in the Bible, and in classical writings prior to that time, refer to other hard minerals.

Rubies and Sapphires.— The ruby and the sapphire, transparent varieties of corundum (q.v.), the first being carmine red, and the second bright blue. Other colors also occur, as yellow, green, and purple, called respectively, Oriental topaz, Oriental emerald, and Oriental amethyst. Corundum crystallizes in the hexagonal system, and consists of alumina nearly pure. In hardness it ranks next below the diamond, being rated as 9 on the scale. The finest rubies are found in Burma, in the Mogok Valley, northeast of Mandalay. They are also mined in Siam, of a darker red, and in Ceylon, of a lighter shade. The Burmese rubies have a peculiar tint, called "pigeon's blood." Sapphires come principally from Siam and Cashmere, the finest tints being known as the cornflower and the velvet blue. Rubies of large size are extremely rare, and when they are as much as three or four carats in weight, they are worth from five to ten times the price of diamonds of the same size. Sapphires are found in Montana at several points; the finest are mined at Yogo Gulch, in Fergus County; these are of fine rich blue. Other mines are at Rock Creek, Granite County, where there is a great variety of colors; also at Cottonwood Creek, and along the bars of the Missouri, not far from Helena. True rubies have been obtained lately in the Cowee Valley, Macon County, North Carolina, though not in large numbers.

Emeralds.— Emerald and beryl are in fact the same mineral, a silicate of alumina and glucina. Beryl varies from blue through light green to yellow, when it is called golden beryl, and forms a gem resembling topaz. If colored a deep rich green by a little oxide of chromium, it becomes the emerald, a stone which when flawless, ranks in value with the diamond. The chief source of fine emeralds has long been the mines at Muzo, near Bogota, in Colombia, where they occur in a limestone rock. The mine has been worked by Europeans for three centuries, and previously by the native peoples of South and Central America. The emeralds known to the ancients came principally from Upper Egypt, near the Red Sea. These mines have been long abandoned and unworked, but are now being somewhat reopened. In the United States some very fine and large crystals of emerald have been found in Alexander County, N. C., though they were hardly clear enough to cut into gems. Very fine pale-green beryls (aquamarines) have been obtained in Maine, North Carolina, and Colorado, and golden beryls in Maine, Connecticut, and Pennsylvania. All the beryls crystallize in the hexagonal system, as six-sided prisms.

Chrysoberyl, a very hard gem, is a compound of alumina and glucina. It is a rare mineral, of various shades of yellow, brown, and light green. One variety contains minute impurities distributed between the layers of the crystal, and these layers so arranged by what is called "twinning," that when the stone is cut across the layers, the light is reflected or condensed in a transverse bright line; such a gem is called chrysoberyl cat's-eye.

Topaz is a rather complicated silicate of alumina, occurring in rhombic prisms and possessing a hardness of 8. It is generally yellow, also pale blue, pale green, pale brown, and white (colorless). The favorite tint is a peculiar yellow known as sherry-color. The finest come from Brazil and from the Ural Mountains; but some very handsome ones have been found in Colorado and Utah.

Tourmaline, another complex silicate of alumina, occurring in prisms of six, nine, or twelve sides, is usually black, but also of transparent red, green, and other colors, often singularly mingled in the same crystal. These are found in Brazil and Siberia, and also of great elegance at Paris and Auburn, Maine, Haddam Neck, Conn., and especially in San Diego County, California.

Garnet is the name of a group of minerals closely related in form and properties, but presenting a number of varieties. They are all very complex alumino-silicates, in which various metallic oxides enter as ingredients. The principal gem varieties are: almandine, or precious garnet, containing considerable oxide of iron; its color is a deep rather purplish or brownish red; pyrope, or Bohemian garnet, containing much magnesia, is a fine dark crimson, almost ruby color. These two are the red garnets of jewelry; when cut *en cabochon,* that is, not faceted but rounded, they are called carbuncles. Manganese garnet, or spessartite, is sometimes of a very beautiful orange-brown color; elegant gems of this kind have been found at Amelia Court House, Virginia. Uvarovite, or chrome garnet, is a rare variety of brilliant green color, resembling emerald, but the crystals are very small. Another green garnet of somewhat different composition, and with very brilliant lustre, from the Ural mountains, is called demantoid, or Uralian emerald. Much fine garnet is found in the United States. North Carolina yields a beautiful variety that has been called rhodolite,— a brilliant light red garnet, between almandite and pyrope in composition; these are largely mined in the Cowee valley, in Macon County. New Mexico and Arizona yield fine pyropes, often miscalled Arizona rubies, and equaling those of any other known locality. They are found where centipedes have carried them out in making the galleries of their hills.

Among the finest gem collections in the United States are the Tiffany-Morgan collection and the Bement-Morgan collections at the American Museum of Natural History, New York; the Isaac Lea collection, at the United States National Museum, Washington, D. C.; the Tiffany collection, Field Columbian Museum, Chicago, Ill.; the Tiffany collection, Golden Gate Museum, San Francisco, Cal.; and the Kunz collection, at the State Museum, Albany, N. Y.

Bibliography.— De Fontanelle and Malepeyre, 'Glass, Artificial Stones, etc.'; King, 'Precious Stones and Metals'; Kunz, 'Gems and Precious Stones of North America'; Smith, 'Catalogue of the Gems of the British Museum'; Streeter, 'Precious Stones and Gems'; Tassin, 'Descriptive Catalogue of the Collections of Gems in the United States National Museum; Kunz, 'Report Dept. Mining Statistics United States Geological Survey.' GEO. F. KUNZ,
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Gems, Engraving of, the glyptic art, or lithoglyptics; the art of representing designs on precious stones, either in raised work (cameos) or by figures cut into or below the surface (intaglios). The latter method was practised at a very early period, and probably had its origin with the Babylonians 4000 B.C., who worshipped the heavenly bodies, and were accustomed to wear figured talismans, which served as symbols of their influences. The Egyptians cut the hardest kind of stones for like purposes as early as 3000 B.C. The custom of wearing cut stones as seal-rings appears to have been general among the Greeks in the time of Solon. One of the earliest artists in this branch of whom mention is made is Mnesarchus, the father of the philosopher Pythagoras, consequently a contemporary of that Theodorus of Samos who engraved the ring of Polycrates, of which such wonderful stories are told by the ancients. These early works were probably intaglios; the artist made use of the lathe, the diamond-point, and by some it is thought, diamond-powder; but it is a question if the diamond was known before the 6th century A.D. Gem engraving flourished in Mycenæ, Smyrna, and ancient Greece, and from the time of Alexander the Great; but we can only judge of the works of Pyrgoteles, Apollonides, and Cronius from tradition, as there are no works of these masters extant. Pyrgoteles was distinguished for works in relief, and from his time the art may have risen gradually to that later degree of perfection of which we possess such rich specimens. The artists, some of whose names we learn from their works themselves, often took the masterpieces of sculpture for their subjects and models. Under the Roman emperors, in particular, this was very common. The chief early Greek engraver whose name is known from extant works of his is Dexamenos (late in the 5th century). The names of Dioscorides, Apollonides, Aulos, Hyllos, Cneius, Solon, remind us of the most perfect works in this branch of art, and many of the signed gems are forgeries or old gems with old names forged on them. But some of the greatest ancient works — the sardonyx of the Sainte Chapelle (Paris); the apotheosis of Augustus, at Vienna; the onyx at The Hague, representing the apotheosis of the Emperor Claudius; Achilles lamenting Patroclus; the head of Julius Cæsar — these, like the Brunswick vase and the Trivulcian and Neapolitan cups, bear no distinguished names. Pompey consecrated the dactyliotheca or collection of rings of Mithridates, as a votive offering in the Capitol, and Julius Cæsar, six tablets with six gems in the temple of Venus. At a later period the collections of Herodes Atticus, of Vespasian, etc., were celebrated; yet this general taste was not able to preserve the art from decline. Notwithstanding this decline, however, gems continued to be highly prized, even in the times of mediæval barbarism, and served to ornament the shrines of saints, and for royal badges, and ceremonial dresses, and thus passed safely through the ages of destruction and ignorance in which the finest statues were only valued as materials for mortar or for building, till ages arrived which could again appreciate their value. If we may judge from the remains which have come down to us, engraved gems seem to have been more common in the Byzantine empire than in the West.

The earliest gem-engraver of modern times is Vittore Pisanello, who lived in Florence about the year 1406. The first among the Germans was Daniel Engelhard, of Nuremberg, who died in 1512. The discovery of some fine specimens in Italy, particularly in Florence, and the display of gems by the Emperor Palæologus, at the Council of Florence in 1438, were perhaps the original cause of the taste of the Medici for engraved stones. The popes and that family were the first patrons of this art in modern times. A Florentine artist, generally called on account of his great skill, Giovanni delle Carniole ("of the Carnelians"), distinguished himself in this early modern period. There are few gems which can be ascribed to him with any confidence, except the famous carnelian in the Florentine Museum, with the portrait of Savonarola, bearing the inscription *Hieronymus Ferrariensis ordinis prædicatorum, propheta, vir et martyr.* This stone, which must have been engraved later than 1498, is given to Agincourt's work. Contemporaries and rivals of Giovanni were Nanni di Prospero delle Carniole, in Florence, whom Francesco Salviati directed in his works, and Domenico Compagnie (*dei camei*), a Milanese, whose portrait of Ludovico Sforza, called Moro, cut in a ruby, is still preserved in the Florentine Museum. After Bernardi (delle Carniole), Valerio Vicentino (under Leo X.) rendered himself famous as a gem-engraver. This art found patrons in all the Italian princes; the number of artists constantly increased, and the sphere of their work was extended. The names of these artists, however, are not generally known, because they are rarely put on the stones. Many gems, too, are still concealed in the cabinets of the wealthy or the treasuries of princes. Till these are accurately described, as those of the Ambrosian collection, it will be difficult to obtain a complete general view.

Subjects of antiquity were preferred by the artists of the 15th and 18th centuries, who treated them with such ability that it often requires the skill of the most accomplished connoisseur to distinguish them from genuine antiques. The dispute concerning the famous seal-ring of Michelangelo is well known. It is not improbable that this carnelian is the work of Pietro Maria da Pescia; as the figure of the fisherman in the exergue may indicate the artist who, with Michelino, belonged to the age of Leo X. In order to give the gems more completely the appearance of antiques, some artists engraved their names in Greek, but with so little knowledge of the language that they sometimes betrayed themselves by this artifice. To this time we must ascribe the gems with the name Pyrgoteles, which Fiorillo endeavors to prove werthe work of an Italian of Greek descent (Lascaris).

The art of engraving was also applied to glass and gold. The crystal box of Valerio Belli, the most skillful and industrious artist in this branch during the 16th century, deserves particular mention. It was intended by Clement VII. as a present to Francis I., when Catharine di Medici went to Marseilles in 1533. At present it is in Florence. The Milanese particularly distinguished themselves in gem-sculpture, as the wealth of the principal citizens of Milan enabled them to patronize this art. Jacopo da Trezza, the same artist who in 1564 executed for Philip II. the famous tabernacle of the Escurial, made the first attempts at engraving on the diamond in Milan. The greatest cameo work of modern times is the stone from the Florentine Museum, seven inches in breadth, on which Cosmo, Grand Duke of Tuscany, with his wife, Eleonore, and his seven children are represented. A Milanese, John Anthony de Rossi, who was a contemporary of the Saracchi family (about 1570), is the artist. The Saracchi were five brothers, and the crystal helmet of Albert of Bavaria is a proof of their skill.

Gem-engraving was popular in Germany in the 14th and 15th centuries, and in England, Natter, Pichler, and Marchant are considered the restorers of the art in later years in that country. The most eminent artist of more modern times is perhaps, Berini, a native of Rome, who, with Cervera and Giromelli at Rome, and Putinati, at Milan, produced very fine works. In our own times the demand for cameos and intaglios in the United States was greatest from 1870 to 1880. During that time more than 100 workmen found employment here,— many of them as portrait artists. Among these was Lebrethon, who had as a pupil our great sculptor Augustus Saint Gaudens; another, Zöllner, who engraved some fine and important cameos, took up brass working. Perhaps the greatest artist and the most active, L. Bonet, to-day has scarcely one sixth of his time occupied, whereas in the "Cameo age" he had the aid of nine assistants. In 1903 there appeared a slight revival of the wearing of antique and old-fashioned cameos of rather a pronounced form, and it is quite possible that the glyptic art is again on the way to favor.

A few of the gem collections are the famous Rev. C. W. King collection of antique gems, of the types used in his works; the Cesnola and other collections, at the Metropolitan Museum of Art; also a fine collection at the Boston Museum of Fine Arts; and the Maxwell Somerville collection, the types of his works, at the University of Pennsylvania, in Philadelphia, while the Walters collection, at Baltimore, Md., contains many of the finest gems in America.

Consult: Bellermann, 'Urim und Thummim, die ältesten Gemmen'; King, 'Antique Gems and Rings'; 'Handbook of Engraved Gems'; Middleton, 'The Engraved Gems of Classical Times'; Cicognara, 'Storia della Scultura'; Natter, 'Traité de la Méthode Antique de Graver en Pierre Fine, Comparée avec la Méthode Moderne'; Babelon, 'Le Cabinet des Antiques à la Bibliothèque Nationale.'

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Gems, Mythology of. The ancients believed that each month of the year was under the influence of a precious stone, and in modern tin s this superstition has found many devotees. It is quite the prevailing custom in many fashionable European capitals to wear birth-month stones, in preference to other jewels. The following list has been current for many years:

January	Garnet	Constancy
February	Amethyst	Sincerity
March	Bloodstone	Courage
April	Diamond	Innocence
May	Emerald	Success in love
June	Agate	Health and long life
July	Cornelian	Content
August	Sardonyx	Conjugal felicity
September	Chrysolite	Antidote to madness
October	Opal	Hope
November	Topaz	Fidelity
December	Turquoise	Prosperity

The seven gems which are supposed to be unde the influence of the seven chief planets are these:

Saturn	Onyx
Jupiter	Cornelian
Mars	Diamond
Sun	Sapphire
Venus	Emerald
Mercury	Loadstone or lodestone
Moon	Crystal

The legend of the diamond tells how Diamond was the name of a beautiful youth of the island of Crete, who was one of the attendants of the infant Jupiter in his cradle. Diamond, not to be subject to "the ills that flesh is heir to," was transformed into the hardest and most brilliant substance in nature. The diamond among the ancients had the virtue of bestowing victory and fortitude. It calmed anger and strengthened wedded love; hence it was called the stone of reconciliation. The diamond, too, among the Greeks was a symbol of severe and inexorable justice and of the impassibility of fate. Hence the judges of Hades were described as having hearts of adamant.

Gemsbok, gĕmz'bŏk, a large South African antelope (*Oryx gazella*), gray in general hue, but along the back, on the hindquarters, and along the flanks the color is deep black. It has a short erect mane, a long sweeping black tail, and long sharp-pointed heavy horns, nearly straight from base to tip, and obscurely ringed throughout the lower half. It is asserted that the gemsbok never drinks water, the moisture which it needs being obtained from the succulent bulbous plants on which it feeds. It is one of a group of large antelopes, including the oryx, beisa, addax, etc., which are sometimes called the gemsboks, and the numbers of all which are rapidly diminishing toward extinction. See ANTELOPE.

Gemünder, August, ow'goost gĕ'mün-dĕr, German-American violin-maker: b. Ingelfingen, Würtemberg, 1814; d. New York 1895. He studied the art of violin-making with Vuillaume at Paris; from 1846 to 1860 was at Springfield, Mass., where he won wide recognition for his violins; and in 1861 established his business in New York. His most important work was a copy of an Amati owned by Pablo Sarasate, the well-known Spanish violinist, who declared it equal to the original instrument.

Gemünder, George, German-American violin-maker: b. Germany 1816; d. New York

1899. He was a pupil of Baptiste Vuillaume of Paris, came to America in 1847, won the first prize with his violins at the Crystal Palace exhibition, London (1851), and in 1873 sent to the Vienna exhibition a copy of a Guarnerius declared by the jury of experts to be an original. It is said that his were the finest violins yet made in America. He published 'George Gemünder's Progress in Violin-Making' (1881). He was a brother of August Gemünder (q.v.).

Gendarmes, zhŏṅ-därm (Fr. "men-at-arms") were originally mounted lancers, armed at all points, and attended by five inferior soldiers, who were furnished by the holders of fiefs; these were replaced by Charles VII.'s *compagnies d'ordonnance*, which were dissolved in 1787, one company of gendarmerie being retained as the bodyguard of Louis XVI. Since the French Revolution, except for a short interval at the Restoration, the gendarmes have constituted a military police, which superseded the old *maréchaussée*, and comprises both cavalry and infantry; divided into legions and companies, and these latter into brigades, the organization of the force corresponds to the territorial divisions of the army. The men receive much higher pay than the rest of the army, of which, however, the corps is a part, its members being drafted from the line for this service. Germany also since 1808 has had its *gendarmen*. See POLICE.

Gender, in grammar, a difference in words to express distinction of sex. Strictly speaking there are but two genders, the *masculine* and *feminine;* words which did not belong to those classes were said to be *neutrius generis*, of neither gender; and from this phrase grammarians have, somewhat incorrectly, come to speak of this third class as being of "the neuter gender," and thus recognize three genders. That the distinction of sex is the origin of grammatical gender cannot be reasonably disputed, and as a consequence the principle must have been originally restricted to living beings, and practically to those in which the distinction of sex was readily perceived. In the lesser animals it would have been more difficult to ascertain the sex, and generally unnecessary to denote it. But correctness and utility are not the only ruling principles of language; they are often sacrificed to the love of imagery and personification. In the infancy of language, when everything that was seen to produce an effect was conceived as actuated by a conscious will, every prominent object was endowed with one or other sex, the choice depending on the association of ideas. Strength, freedom, magnitude and violence are the marked attributes of the male; weakness, subjection, timidity, and gentleness of the female. In Hebrew there is no neuter; in Sanskrit, Greek, and Latin, the majority of the names applied to inanimate objects are either masculine or feminine; and in the languages derived from the Latin — Italian, French, Spanish, and Portuguese — a neuter gender is not recognized. In German, as in the classical tongues, the names of inanimate objects are sometimes masculine and feminine as well as neuter. English, getting rid of the spurious distinction that encumbered the Anglo-Saxon, attributes sex only to living beings. In the highly inflected languages there are certain terminations distinctive of the different genders, the most characteristic in the Greek being *os*, masc.; *ē*, fem.; and *on*, neuter; and the Latin *us, a, um*. In English the distinction of gender is often marked by the termination, the most common being the affix *ess* derived from the French; or by a different word. In most other languages the adjectives, articles, and participles are inflected for gender; in English the gender of a noun only affects the pronoun substituted for it. See GRAMMAR; LANGUAGE.

Gender, a Javanese musical instrument. It consists of a row of parallel metallic plates supported horizontally by two strings passed through the respective nodal lines of the plates. Underneath each plate is an upright bamboo, containing a column of air of such a height as to reciproceate the sound of the plate above.

Gendron, Auguste, ō-güst zhŏṅ-drŏṅ, French painter: b. Paris 1818; d. there 12 July 1881. He was long a pupil of Delaroche, and several times visited Italy, where he painted his first important works. In addition to several canvases, including 'The Island of Cythera'; 'Tiberius at Capri'; 'Sunday in Florence — 15th Century'; he executed frescoes in the Louvre and the church of St. Gervais.

Genealog'ical Society, The New York, was incorporated in 1869, to procure and perpetuate whatever may relate to genealogy and biography. The 'New York Genealogical and Biographical Record,' now in its 28th volume, is published under its supervision. The society has published: 'Marriage from 1639 to 1801 in the Reformed Dutch Church, New York,' and other volumes. The society's building is at 23 West 44th Street.

Geneal'ogy (from the Greek *genos*, race, and *logos*, discourse), the systematical account of the origin, descent, and relations of families is an auxiliary of historical science. Genealogical knowledge becomes important in a personal or legal view, when family claims are to be established. Genealogy is founded on the idea of a lineage or family. Persons descended from a common father constitute a family. Under the idea of degree is denoted the nearness or remoteness of relationship in which one person stands with respect to another. A series of several persons, descended from a common progenitor, is called a line. A line is either direct or collateral. The direct line is divided into the ascending and descending. The ascendants are called, in general, *majores* (ancestors), and the descendants *posteri* (or posterity). The collateral lines comprehend the several lines which unite in a common progenitor. They are either equal or unequal, according as the number of the degrees in the lines is the same or different. The collateral relations on the father's side are termed *agnati*, on the mother's *cognati*. Children stand to each other in the relation either of the full blood or the half blood, according as they are descended from the same parents, or have only one parent in common.

For illustrating descent and relationship genealogical tables are constructed, the order of which depends on the end in view. In tables the object of which is to show all the individuals embraced in a family, it is usual to begin with the oldest progenitor, and to put all the persons of the male or female sex in descending, and then in collateral lines. Other tables exhibit the ancestors of a particular person in ascending lines, both on the father's and mother's side. In this way 4, 8, 16, etc., ancestors, are exhibited. The tables showing the succession of rulers contain merely the descent of the persons who have reigned in succession, or who have claims to the government. In connection with them stand the tables of disputed succession, which represent several lines of a family, or several collateral families, in order to deduce their rights of succession from their degree of relationship. Synchronical tables consist of the genealogies of several families placed together, in order to compare, with facility, relationships, marriages, divisions of inheritance, etc. Historical genealogical tables differ from mere genealogical tables, as they attach to the descent the biographies also of the members. The common form of genealogical tables places the common stock at the head, and shows the degree of each descendant by lines.

The earliest genealogical tables are perpetuated in the Biblical family records of succeeding generations, in graven stone memorials of ancient Egypt, Assyria, Persia, India, and other oriental countries. Genealogical knowledge was most important in the Middle Ages, when the nobility was distinct from the other classes. Ancestors were unblushingly and impudently fabricated, the absence of criticism and the desire to flatter important people causing the introduction of the most absurd fables into genealogy, especially after the 14th century. Few families, no matter however distinguished and noble, can trace their ancestry beyond or even as far as the middle of the 11th century. The advance of civilization and particularly the institution of corporations and guilds in the towns of the principal European nations, afforded a wider scope for genealogy, and in the 12th and 13th centuries, family names began to be more common. The oldest trace of family names according to Gatterer is in 1062 when a Henricus de Sinna is mentioned in Schannat's "Buchonia Veteri." After history in general had attained a more systematic character, the Germans in particular treated genealogy on a more scientific basis. Ruxner's "Turnierbuch" (1527), and Reusner and Hennings' genealogical tables which appeared about the end of the 16th century, are among the earliest published works, but are not conceived in an historical spirit. Duchesne, Saint Marthe, Hozier, Chifflet, Lancelot le Blond, etc., in France, and Dugdale in England, initiated a clearer and more accurate treatment of the subject. The first genealogists in Germany to base the science on documentary evidence were Rittershusius of Altdorf (d. 1670) and Spencer of Wittenberg (d. 1730). The lines laid down by them were followed and carried to higher perfection by König, Von Imhof, and especially by Hübner in his "Genealogische Tabellen" (4 vols. 1725–33; new ed. 1737–66), to which Lentz added "Erläuterungen" (Elucidations, 1756), and Sophia, Queen of Denmark, "Supplement-Tafeln" (1822–24). Gatterer founded the scientific treatment of the subject in his "Abriss der Genealogie" (1788), and was followed by Pütter in his "Tabulæ Genealgicæ" (1798), by Koch in his "Tables Généalogiques" (1808), Voigtel (1810), Hopf (1861), Von Behr (1870), Cohn (1871), and Oertel (1871), all in Germany.

The principal genealogical MSS. sources in Great Britain are the public records, heraldic registers, and the parish registers of births, marriages, and deaths. The chief printed collections of genealogical information are the well-known Burke, Debrett, and other like publications of "Peerages, Baronages, Baronetages, and County Histories."

In the United States, genealogy was generally neglected until the latter part of the 19th century, when the organization of patriotic, State and colonial societies, like the Society of the Cincinnati, the Holland Society of New York, the Southern Society, etc., aroused an interest in genealogy. Genealogical societies have been organized in several States and the subject has received more or less attention. New York society folks in 1901–2 began to take up genealogy as a special fad or hobby and numbers of persons adopted the study of family trees as a regular employment. The principal publications in the United States on genealogy are 'The New England Historical and Genealogical Register;' 'The New York Genealogical and Biographical Record;' 'The Heraldic Journal;' the various biographical dictionaries and cyclopedias; the printed transactions and archives of State and city historical societies; county, State, city, and town histories.

Genee, zhē-nā, **Rudolf,** German author: b. Berlin, Prussia, 12 Dec. 1824. He abandoned wood engraving for journalism, and then became an instructor in literature at Berlin. As a reader and interpreter of Shakespeare he attained distinction; but his plays — 'The Prodigy' (1854); 'A New Timon'; 'In Front of the Cannon'; 'The Hermitess"; and adaptations from Sheridan — gave him wider fame. His works in criticism, treating of German poetry, the drama, and kindred themes, are highly esteemed. 'Marienburg' is a successful historical novel by him.

Genelli, Bonaventura, bō″nä-vän-too'rä gā-nĕl'lē, German painter: b. Berlin 28 Sept. 1798; d. 13 Nov. 1868. He was the son of Janus Genelli (1771–1812), an engraver, with whom he early studied. His chief artistic training was obtained as a pupil of Johann Erdmann Hummel at Berlin and at Rome, where he resided in 1822–32, and executed numerous pencil and india-ink drawings which carried his name over much of the continent. From 1836 he was in Munich, often in poverty; for he received no public commissions and his work had as yet met its due recognition among but a few. In 1859 he was called by Grand-duke Charles Alexander to Weimar, where ample leisure was afforded him for his larger works in oil. He was a classicist like Carstens, whose methods he followed, and with him the chief thing was the rendering of line. Among his many works are the series of drawings for Dante's 'Divine Comedy,' and for Homer; other drawings in ink or water-colors, such as 'Hercules Playing the Lyre'; The 'Vision of Ezekiel,' and 'Æsop Telling His Fables,' and the pictures in oil: 'Abraham and the Angels'; 'The Battle of Lycurgus with Bacchus'; 'Bacchus among the Muses.' There is a biography of Genelli by Jordan (1869).

General, (1) A military rank and title. In the United States army, this rank, as distinguished from and superior to the major-general, was created for Washington by Congress, 3 March 1799. He died shortly after, the office remained vacant, and in 1802 it was abolished. It was revived in 1866 for Grant, and on his accession to the Presidency in 1869, was conferred on William T. Sherman. On his retirement, 1 Nov. 1883, the rank was allowed to lapse. In June 1888 it was revived for Philip H. Sheridan; but on his death in August it again became extinct. The highest army officer has now the title of chief of staff. See GENERAL STAFF, UNITED STATES ARMY.

(2) The name given to the general superior of religious orders and congregations of men in the Roman Catholic Church. The general is usually elected in general chapter, and holds office for three years. In the Society of Jesus the general is elected for life. The generals of regular orders have been granted by popes special privileges, as power of absolution in reserved cases in relation to their subjects. Several modern congregations of women have general superiors, but their canonical position is quite different from that of the generals of the orders of men.

General Assembly. See ASSEMBLY, GENERAL; PRESBYTERIANS.

General Confession, in the Roman Catholic Church, is a sacramental confession of all sins committed by the penitent since baptism, or since of an age to know what sin is, so far as he can remember. Such general confession is made by persons who have made no previous confession, who have wilfully concealed a mortal sin; or been wanting in true and supernatural sorrow for the sins confessed in a previous confession; or are desirous of reviewing their past life for the purpose of interior advancement in the spiritual life.

General Court, the official name of the legislature of Massachusetts. The old English name of the meeting of a body of managers or members of any corporation is "court"; as court of aldermen, court of directors, etc. So the meeting of corporators of the old Massachusetts Company was called a court; then the primary assembly of freemen under its charter was called the General Court; and the name was retained after it became a representative body. There was the further reason that it really was the supreme judicial as well as legislative body. See MASSACHUSETTS.

General Education Board founded in New York City, February, 1902, chartered by Congress 12 Jan. 1903, has for its objects: (1) The promotion of education within the United States of America, without distinction of race, sex or creed; (2) the development of the public school system, especially in rural districts; (3) the development of the principle of self-help by promoting increased local taxation, local contributions or other means for educational purposes; (4) the increased establishment of training schools for teachers, especially those designed to educate instructors of industrial and manual training; (5) co-operation with the organizations interested in educational work, so as to simplify and make effective the general work of education, avoiding unnecessary duplication; (6) the collection of full information and statistics in respect to educational matters in the districts covered by the operation of the board, which shall be kept at a general office; (7) to furnish the public with information, suggestions and counsel, and for this purpose to act somewhat as a clearing-house for educational statistics and data to be collated by the board; (8) to educate public opinion in all matters pertaining to the general cause of education by publication of reports through the daily press and by other means.

The organization received the cordial support and gifts of several philanthropists, including John D. Rockefeller, Sr., and among the members of the board are John D. Rockefeller, Jr., Daniel Coit Gilman, Morris K. Jesup, William R. Harper, Frederick T. Gates, Walter H. Page, Albert Shaw, Hugh H. Hanna, E. Benjamin Andrews, Starr J. Murphy, secretary and executive officer for the states of the north and west; Wallace Buttrick, secretary and executive officer for the states south of the Potomac and Ohio rivers, and Arkansas, Louisiana and Texas; George Foster Peabody, treasurer; Robert C. Ogden, president.

When the charter with its broad provisions was signed by President Roosevelt, John D. Rockefeller made a special gift of $1,000,000 for exclusive distribution in educational work among the southern states, where the operations of the board were mainly confined at first. The intelligence, fidelity and efficiency with which this trust was discharged led Mr. Rockefeller, 30 June 1905, to announce a further contribution to the General Education Board of a sum of $10,000,000 to be paid October 1 of that year, in cash, or at his option in income-producing securities, at their market value, the principal to be held in perpetuity as a foundation for education, the income, above expenses and administration, to be distributed to or used for the benefit of such institutions of learning, or employed in such other ways as the board may deem best adapted to promote a comprehensive system of higher education in the United States. On 6 Feb. 1907 he gifted securities to the market-value of $32,000,000, one-third of the income to be applied to the endowment fund, the balance as Mr. Rockefeller or his son may direct.

While the endowment is designed especially for colleges as distinguished from universities, there is no prohibition against making contributions to universities. The funds may be employed for approved non-sectarian as well as denominational schools, but in the case of the latter cannot be applied for specific theological instruction. In distributing the funds the board aims especially at favoring those institutions which are well located and which have a local constituency sufficiently strong and able to insure permanence and power. No attempt will be made to resuscitate moribund schools or to assist institutions which are so located that they cannot promise to be permanently useful.

Within these limits there are no restrictions as to the use of the income. It may be utilized for endowment, for buildings, for current expenses, for debts, for apparatus or for any other purpose which may be found most serviceable, thus providing for a great work in a practical way.

General Issue, in English law, is that plea which denies at once the whole declaration or indictment, without offering any special matter by which to evade it. It is called the general issue, because, by importing an absolute and general denial of what is alleged in the declaration, it amounts at once to an issue, or fact affirmed on one side, and denied on the other. This is the ordinary plea upon which most causes are tried, and is now almost invariably used in all criminal cases, when the prisoner at the bar pleads "not guilty"; to money counts the plea is "never indebted"; or to actions on simple contract *nunquam assumpsit* ("never undertaken"). This plea puts everything in issue, that is, denies everything, and requires the party to prove all that he has stated. It is a frequent question, What can be given in evidence by the defendant upon this plea? and the difficulty is, to know when the matter of defense may be urged upon the general issue, or must be specially pleaded upon the record. See PLEA; PLEADING.

General Par'esis (known also as general paralysis, softening of the brain, paralytic dementia, paralysis of the insane, etc.), a disease of the nervous system that usually begins in early adult life, progresses steadily with increasing mental enfeeblement, and leads to ultimate motor paralysis, decay of all of the mental faculties, and death within a period averaging from three to five years. From the type indicated in this brief general definition there are numberless variations. It is a disease which, when well advanced, is recognized with great ease, but in its early stages it may be extremely difficult to know. From the standpoint of the patient's family and friends it is important to be able to recognize the disease; for it is in this initial period that the patient often ruins his business, his friends, his family, and brings shame and discomfort to all those connected with him. Much of this might be averted if the layman were better informed of this early period of one of the worst scourges of modern times. The disease has probably existed for many centuries, but it is only within comparatively recent times that its true character has been recognized, and in its present extreme forms it seems to be a product of the modern complex social system. It has been aptly termed a disease of civilization and *syphilization*, an alliteration that contains much truth. General paresis may develop in almost any one, but there are certain necessary antecedents and numerous contributory factors. It is believed by most students of mental diseases that syphilis is one of the most important antecedents. Accurate statistics on this point are extremely difficult to obtain, but most alienists believe that from 60 to 90 per cent of patients who have developed paresis have had syphilis. This as a purely statistical argument is of course no proof that syphilis is the cause of paresis; for probably 99 per cent of paretics have had measles, or whooping-cough; yet the changes that are found in the blood vessels of the brain in paretics are very closely allied to changes in the blood vessels known to result from the poison of syphilis. The theory of the syphilis etiology is, therefore, probably true for most cases, but not necessarily so. Another extremely important item is a characteristic mental type. In an extremely large number of paretics the mental character has been that of great emotional activity. People who use their brains very hard, and who can key them up to a high pitch, seem to succumb to this disease more than those of evener temperamental tone. It is this type, as seen in actors, in salesmen, in active business men, who become infected with syphilis, that is peculiarly liable to the disease. It is also this temperamental type that indulges in excesses of various kinds — excesses of work, of play, of excitement, of worry, of alcohol, of venery — and thus are undermined the foundations of healthy nerve-tissue, leading to its premature decay.

General paresis is commoner in men than in women, the proportion among different peoples and races, and times, varying from 25–1 to 3–1. Although it is a disease usually beginning in the thirties or forties, juvenile forms are known, and sometimes the old man is a victim. It seems to be more prevalent in crowded communities, for there the stress of excitement and depression, of gaiety and sadness, of extravagance and destitution, is more pronounced, for both extremes of the mental pendulum must be considered in the estimation of the causes of paresis. The brilliant financier, or the actress who succumbs to this disease may be more in the public eye, and moralists may adorn a tale concerning their supposed profligacy, but the poor harassed workman, diseased through lack of knowledge, and drink-sodden to escape the reproofs of his conscience, may also be the victim.

The initial symptoms are usually very insidious, although occasionally the disease appears in full-blown vigor. The previously healthy, neat, and careful workman begins to forget things. There is a period of disturbed mentality. Noises affect him unpleasantly. Undue irritability is evidenced by unwonted explosions of anger. This state may be weeks or months in its evolution, and may be confounded with a condition of overwork or overworry. In fact, such a condition is present in many tired people who never develop paresis. Added to this there are vague apprehensions in the patient's own mind of his gradually declining power; headaches, neuralgias, and vague pains may also be present; and poor sleep may be another symptom of the early stage. All of these symptoms are common to many people who have overworked, and should not occasion alarm. But when, little by little, one shows increasing carelessness in his personal habits, such as neglecting to button his trousers, or permitting his food to spill on his clothing, when he shows signs of mental exaltation and dreams of wonderful things, then the true disease begins to show itself. From this point on there are countless variations, but in general the typical paretic behavior that leads the person into economic danger, if not disaster, is characterized by an expansive and exaggerated conduct. Buoyancy and elation, with great projects and sanguine hopes, mark the initial stages of the paretic's mental decay. He becomes restlessly busy, is continually entering into new schemes, is incessantly talking about his affairs with effusive geniality, not only to his friends, but to utter strangers, and he even communicates to others his closest domestic concerns. There is a gradual breaking down of the finest sensibilities and, closely following this, slight evidences of the loss of the most delicate motor adjustments become manifest. It is in this stage that the symptoms become unmistakable. The partial impairment of the motor functions shows itself in an increased lack of control of the finer motions of the tongue, the lips, and the hands. There is a fine tremor in the tongue when it is protruded; on showing the teeth, the angles of the mouth betray a fine tremor; and the handwriting is seen to be less firm and even, approaching that of the formative period of the man's youth. The mild grade of inflammation in the brain causes certain changes in the reflexes of the body. Thus, the pupils of the eyes are not apt to act as rapidly as in health; they may be unequal in size; they are sometimes very small and do not open wide in the dark as is usual. With these symptoms the diagnosis becomes moderately certain, and from this time on the mental degeneration becomes marked. The carelessness becomes slovenliness; the memory goes rapidly; the loss of the finer sensibilities deepens to obscenity, to faithlessness, to utter loss of the moral faculties; the buoyancy becomes foolishness, and big projects are often launched, resulting in financial ruin. Grandiose ideas usually enlarge, and the afflicted one dreams of millions of money, of being a king, or president, or Christ, or a god. His personal strength is like that of Samson, his beauty comparable to Apollo's; his voice, his oratory, his writing, his poetry, his acting are superb — in short, his whole personality is puffed up with an amazing exaltation of the ego. Exulting self-confidence dominates all his designs, and a restless, busy, subdued delirium actuates his every thought and movement. From this stage, usually termed the grandiose stage, and which may persist for from six months to a year or more, the mental deterioration commences to show itself in a gradually progressive dementia. Mental dilapidation becomes mental decay. The motor restlessness goes on to loss of power and a gradual paralysis of the motor functions begins, passing through the stages of progressively increasing inco-ordination to complete powerlessness. Tottering, shambling, stumbling incompetence finally advances to absolute motor impotence. This affects all of the muscles of the body, but is appreciated in the speech more readily and earlier than in other motor acts. The loss of ability to repeat the r's and l's, as in "truly rural," "artillery," etc., is an early sign of this speech-defect. Finally the only answer that can be obtained from the patient is that he is "all right." The lack of motor power further manifests itself in the increasingly diminished control of handwriting. The paretic is unable to keep to a line. His writing goes up and down, letters and words are omitted, the up strokes are very wavy, and the letters become unequal in size.

Thus the course of the disease progresses until, in from two to three years, on the average, the paretic is a bedridden dement, who dies of exhaustion or an apoplectic or epileptiform convulsion. Occasionally remissions of the disease occur. These are particularly trying to most of the paretic's friends, for hopes of recovery receive a sudden stimulus only to be destroyed after a period of from six months to a year or so. Occasionally the remissions last a number of years, but at the present time it is believed that general paresis is a necessarily fatal disease. Alienists have a habit of calling the recovered cases pseudoparesis, a justifiable procedure in view of the many uncertainties attending the diagnosis of mental disorders.

The main features of a central type of the disease are here given, but there are countless variations. Acute maniacal states sometimes occur, and the patient dies in a galloping frenzy in from three to six months. Occasionally a paretic is melancholic or stuporous throughout. A small proportion, one half per cent of the cases, show this type. Occasionally — and many modern alienists believe this to be more common at present — a gradually progressive dementia without grandiose ideas marks the entire course of the disease. Most cases of paresis have apoplectiform or epileptiform attacks at some period of the disease. A few begin in this manner. There are countless numbers of mixed forms, the details of which may be consulted in text-books on insanity. Here also the subdivision of the disease into stages may be found.

Of the treatment little may be added. The most essential step in relation to this disease is its early recognition. To be able to know what is the matter before the patient has ruined his business, or his family and friends, is the most important feature for the layman to grasp. The paretic himself is doomed, but it is not necessary for those dependent on him to suffer irretrievable loss because of his disease. The proper course to pursue is to place the patient in a sanatorium or asylum at the earliest possible moment, the place selected depending largely on the means of his friends or relatives. Consult: Maudsley, 'Pathology of Mind' (1895); Chase, 'General Paresis' (1902); Krafft-Ebing, 'Die progressive allgemeine Paralyse' (1894); Starr, 'Organic Nervous Diseases' (1903); Ziehen, 'Psychiatrie' (2d ed. 1902); Kraepelin, 'Psychiatrie' (1900); 'Journal of Nervous and Mental Disease,' for bibliography and recent studies. See DEMENTIA; INSANITY.

SMITH ELY JELLIFFE, M. D.,
Editor 'Journal of Nervous and Mental Disease.'

General Service and Staff College, United States army, a training school for young officers of the United States army, located at Fort Leavenworth, Kan. Graduates from West Point are sent here for a further study of the profession of arms, and a more practical and theoretical training from the standpoint of the officer. Upon completing the course of study an officer returns to duty with his regiment. The course of study (1903) is one year, but, after the graduation of the class for 1904, will be extended to two years. At graduation the student class is divided into two classes, the "distinguished" class and the "proficient" class, the former becoming available for detail at the War College at Washington. The books to be used during the school year of 1903–4 are as follows: 'Horses,' 'Saddles and Bridles,' 'International Law,' 'Manual of Military Field Engineering,' 'Military Hygiene,' 'Military Law,' 'Military Topography and Sketching,' 'Organization and Tactics,' and 'Service of Security and Information.' See ARMY OF THE UNITED STATES; ARMY WAR COLLEGE.

General Sessions, Court of. See COURT.

General Staff of the Army, in the United States. History evinces that most competent and courageous commanders have at times charged failure of their operations to lack of preparation for which they were not responsible, or to ill-considered interference by those in high public office. Each successive war has developed accusations of shortcomings which though often indefinite, pointed in the main to defective organization and administration at the War Department. No two nations seem to favor identically the same methods of military administration, yet all have the same objects in view — correct organization, modern equipment, preparedness to strike the first blow with an assured and continuous supply of men, money, and war stores, during hostilities. During the early years of the United States the army was insignificant in proportions, but the business of the War Department gradually grew in volume until it was necessary to adopt some measures to save the secretary of war from being crushed by the burden of current routine work. In groping for some method which would relieve the secretary, the bureau system with numerous semi-independent chiefs was introduced. These bureaus were few in number at the beginning but gradually grew until at the commencement of war with Spain there were 10 chiefs of bureaus directly connected with the administration and supply of the army, each working along his own lines without of necessity having any knowledge of the character and extent of allied work going on in other bureaus. The army is absolutely dependent upon these administrative and supply bureaus and success depends upon the co-ordinated total of all their efforts. During a long course of years a system of laws and regulations had grown up for the governance of these bureaus. These bureaus have been controlled by many talented officers through whose honest and laborious efforts success has been made possible in the wars of the century just closed. It has gradually come to be the conviction of a large and increasing number of thoughtful and discerning officers and public men that success has been wrought in spite of the system and not altogether because of it. Chiefs of bureaus found themselves constantly hampered by reason of lack of information. Not by law but as a matter of expediency all looked to the adjutant general for information, but chiefs of bureaus claimed that the secretary of war alone was competent to give them orders or instructions.

Nations which depend upon volunteer armies are apt to ignore the lessons of war and to consider that all that goes wrong is chargeable to unusual conditions and not to lack of previous preparation. This lethargy would have supervened at the close of the brief war with Spain had not the insurrection in the Philippines and the occupation of Cuba commanded further attention to military matters. In all armies there are many important duties which by common usage have become designated as general staff duties. Much of the employment of general staff officers is in the nature of co-ordinating the action of others, but a large part is original work of the highest type. It was the lack of a corps of this kind which was always keenly felt in American army administration. It should be understood that general staff duties were not wholly neglected but their performance was spasmodic, uncertain and without fixed responsibility because executed by officers of other corps or of the line, detailed individually or as members of temporary boards.

After a patient and exhaustive study of the situation the secretary of war concluded that the more important duties of a general staff could be performed by a war college and its governing board. In furtherance of this idea a board of officers was convened to consider and recommend regulations for the establishment of an army war college. After mature study of the situation the board formulated a memorandum of an order for the execution of the project but unanimously recommended that a general staff be established by appropriate legislation which would free it from the uncertain tenure adhering to the war college which exists only by executive authority.

A continuing study of the manifold questions arising in the course of army administration brought prominently into view the never ending controversy as to the proper place of the "Commanding General of the Army" in the new scheme. The commanding general had long complained of loss of prerogatives believed to appertain to his office, while the generals commanding the geographical departments rebelled at being deprived of all initiative and being practically under the control of bureau chiefs, each naturally interested in enhancing the usefulness and dignity of his own bureau. The only solution which suggested itself as a practical and possible adjustment was the abolition of the office of "Commanding General of the Army" and the substitution of the office of "Chief of Staff," with the introduction of a new corps composed of trained officers to assist him. Out of these studies and efforts have come the law known as the General Staff Bill, which passed the Congress and was approved by the President 16 Feb. 1903.

Under this law the chief of staff, regardless of his relative rank, is the adviser and representative of the secretary of war, occupying a position between that official and the staff bureaus as well as the line of the army. Instead of 10 chiefs of bureaus and their numerous assistants having frequent interviews with the secretary concerning military affairs, the chief of staff has authority to adjust professional matters in the secretary's name. Conflicting elements of the larger administrative questions are thus brought together and harmonized without taking up the valuable time of the civilian secretary, who must of necessity acquaint himself concerning numerous technical details before undertaking to decide matters at issue. This is a decided improvement over the methods in vogue during the existence of the office of "Commanding General of the Army," for notwithstanding the title and high rank of the distinguished officers who have occupied that position, their influence and power over the army as a whole was so restricted as to be entirely incompatible with the title of their office.

It was not presumed in making so radical a change in the American military system that the general staff corps will be a panacea for all the misfortunes which may overtake a nation in war. History teaches that previous preparation and planning such as will be undertaken by the general staff will tend to render success more certain, abbreviate the period of actual hostilities and thereby effect an enormous saving of life and treasure. Commercial interests of all modern communities have become so enormous and widespread that a long-continued war means national paralysis to the defeated nation. Through the agency of the general staff, military and political policies may be harmonized as becomes a republican form of government. With the war policy determined, the general staff will be responsible that each part of the army line and staff is promptly acquainted with its duty and that it does its full duty in the premises. The preparation of armies and their equipment rests with the chief of staff and the various staff corps and departments. The responsibility for manœuvring the armies and for success in battle rests with the various generals assigned to command them. In past wars it has been the custom to depend upon Congress at the last moment to enact legislation for armies and grant appropriations at a time when, by reason of popular excitement, members are least able to give to the grave questions involved the consideration necessary.

The duties of the general staff consist, in peace, to a great extent, of bureau work — including the collection of information, preparation of maps, drawing up schemes for the organization and concentration of troops, formulation of plans for the national defense and a study of the higher military science to keep pace with modern progress. Bureaus organized and prepared to handle any particular class of army business will continue to initiate action and control its affairs subject to the supervision of the chief of staff. It is in the many important matters where the work of several bureaus must be harmonized and brought into the same channel, that the general staff will find its greatest field of usefulness. The general staff will be acquainted with contemplated changes in the organization and stations of troops and by preparing timely schemes will ensure arrangements being made for transportation and supply in the most expeditious and economical manner. The arrangement of all these interlocking details is necessary to successful campaigns of any duration. Armies are constantly called upon to endure all kinds of hardships, to which they submit cheerfully so long as there is no suspicion that any one is at fault. It is expected that the American general staff will plan to minimize the chances of failure due generally to lack of previous knowledge and preparation. The statute contemplates that the general staff corps shall be composed of officers detailed for periods of four years, and it is necessary that a sufficient number be maintained on duty to furnish details with troops as well as for bureau work. This ensures a body of officers in touch and sympathy with the fighting portion of the army. The general staff corps has been so recently organized that it will require some time to develop methods of operation, but as the soldierly spirit, informed by experience derived from actual service with troops, will be the guiding impulse of this corps, the expectation that the country will be better prepared for campaigning at the outbreak of the next war than it has ever been in the past, is fully justified. See ARMY OF THE UNITED STATES.

W. H. CARTER,
Brigadier-General, Assistant Chief of Staff.

General Theological Seminary, a seminary of the Protestant Episcopal Church in the United States, established in 1817. Instruction was begun in New York city in 1819, but in 1820 the seminary was removed to New Haven. It was again re-established in New York in 1822. The gifts of Dean Hoffman to the school amounted to over $1,000,000, while in 1902 the total resources of the school were over $4,000,000. The theological course of the school extends over a period of three years, and there is a post-graduate course. The degrees of D.D. and B.D. are conferred. The control of the seminary is vested in a board of trustees composed of the bishops of the Church, 25 members elected by the general convention and certain other members elected by various dioceses. There are about 150 students in regular attendance.

Genera'tion, popularly used as a measure of time, and usually represents about 30 years, the period which man requires to attain maturity, and the age at which, as a general rule, fruitful marriages are contracted. This secondary sense of the term is thus indirectly derived from the primitive meaning, which has reference to the origin of living things. In the higher animals and plants the offspring is due to the congress of distinct individuals or elements. (See REPRODUCTION.) Alongside of this process, sometimes even concurrently with it, new forms may arise by fission, or by budding; by a process akin to the latter, as in the parthenogenesis of bees, etc.; or by a combination of the sexual and asexual processes, alternate generation.

Generation, Spontaneous. See SPONTANEOUS GENERATION.

Gen'erator, (1) An apparatus for generating carbonic acid gas for charging soda-fountains or bottles with aërated water. (2) In chemistry, a term used to denote the elements or compounds from which a more complex substance is obtained. Thus ethyl, alcohol, and acetic acid are the generators of acetic ether; and benzoic acid and glycocoll are the generators of hippuric acid. (3) In distilling, a retort in which volatile hydrocarbons are distilled from liquid or solid matters. (4) In electricity, a dynamo-electric machine (q.v.). (5) In steam, a vessel in which steam is generated from water, for use in a steam-engine, a heating apparatus, etc. The term was first applied to the Perkins steam boiler, in which water in small quantity was heated to a high temperature. It is now specifically applied to a class of instantaneous generators. The name is now rapidly coming into use for all apparatus for generating steam, being held to be more correct than the usual term. See STEAM.

Genesee (jĕn-ĕ-sē') River, a remarkable stream rising in Pennsylvania, and flowing nearly 200 miles north through western New York into Lake Ontario, seven miles north of Rochester. The Genesee is famous for its extraordinary falls. Three of these occur within a distance of 1½ miles, two are respectively 68 and 90 feet high, and the Portage Falls are 110 feet high. The river has also a sheer fall of 95 feet at Rochester, utilized for water-power; and another cascade, a few miles below, is almost as high.

Geneseo, N. Y., a village and county-seat of Livingston County, 30 miles from Rochester, on the Genesee River and the Erie R.R. The State Normal School and Wadsworth Public Library are situated here. It is an agricultural town and manufactures gloves, mittens, flour, and machines. Pop. (1900) 2,400.

Gen'esis (Greek), creation, birth, origin. The first book of the Pentateuch is named in the Hebrew canon *B'reshith* (in the beginning), from the expression with which it commences; from the 70 translators of Alexandria (those who produced the Greek version known as the Septuagint) it received the name it is now commonly known by. Genesis consists of two great but closely connected divisions: (1) The history of creation, the fall of man, the flood, the dispersion of the human race, chap. i–xi. (2) The history of Abraham, Isaac, Jacob, and Joseph, including notices of the descendants of Abraham and Isaac in their collateral lines, chap. xii.–l. It would be entirely to mistake the character of the history of Genesis to view it as having other than a sacred purpose; yet even in a secular point of view there is no record that can be brought into competition with it. There is absolutely nothing in the whole range of ancient literature which could supply its place if this document were lost; while it is further to be observed, that if confidence cannot be placed in its authenticity, no reliable information exists on many subjects with which it is desirable man should be acquainted, and after which there is an intense longing in the human mind; as, for instance, the origin and early history of the race, a subject which, without the information supplied by Genesis, must be involved in impenetrable darkness.

Genêt, or Genest, Edmond Charles Edouard, ĕd-môṅ shärl ā-doo-är zhĕ-nā, French diplomat: b. Versailles, France, 8 Jan. 1765; d. Schodack, N. Y., 14 July, 1834. In 1777 he translated into French a Swedish history of King Eric XIV. of Sweden, in 1789–92, was French *chargé d'affaires* at St. Petersburg, and from 1793–4, when he was recalled at Washington's request because of attempts to compel the United States to a war with England, was French minister to the United States.

Genet, jĕ-nĕt', a civet (q.v.) of the genus *Genetta;* also a trade-name for the fur of this animal, or of some other fur like it. The best known is the common genet *(G. vulgaris)*, of the Mediterranean region, called «berbe» in the south of France. It is a very beautiful and graceful animal, gray, with many dark patches, and a full furry tail, banded with black and white. The size is about that of a house-cat. Their fur is made up into tippets, muffs, etc., but is of no great value, and often domestic cat-skins are substituted under the same name.

Genet'ic Psychology, the science of the mind as dealing through observation, and where possible, through experiment with the growth and development of consciousness or intelligence in dumb animals, children, and adult human beings. It is one branch of that experimental psychology which the German philosopher Lotze was the first to inaugurate.

Gene'va, Ill., a city and county-seat of Kane County, about 33 miles from Chicago, on the Chicago, B. & Q., and Chicago & N. R.R.'s. It was settled in 1832 and was incorporated as a city in 1887. It is a popular residential section for Chicago merchants. The manufactures include windmills, glucose, sadirons, flour, and boxes. The city owns and operates its own electric-light plant and water supply. Pop. (1900) 2,446.

Geneva, Neb., a city and county-seat of Fillmore County, 60 miles west of Lincoln, on the Burlington & M. R. R.R. The State Industrial School for Girls is located here. Pop. (1900) 1,534.

Geneva, N. Y., city in Ontario County, on Seneca Lake and the Seneca and Cayuga Canal; and on the Lehigh Valley and the New York Central R.R.'s; 50 miles southeast of Rochester. Geneva has extensive manufactories of stoves, steam boilers, optical goods, cereals, canned goods, etc. There are also large nurseries and greenhouses here, occupying about 10,000 acres of land. The city is the seat of Hobart College, established in 1822 by the Protestant Episcopal denomination. The Delancey Divinity School, the Delancey School for Girls, and the State Agricultural Experiment Station are located here. Geneva was chartered as a city in 1898 and is governed by a mayor, elected every two years, and a unicameral council. The city owns and operates the waterworks. The assessed property valuation is $6,000,000. The population in 1890 was 7,557 and in 1903 11,228. In the 18th century the Indian village of Kanadesoga was located near the present site of Geneva. General James Clinton attacked and destroyed the village in 1779.

Geneva, Switzerland, a canton, bounded on the north by the canton of Vaud and the Lake of Geneva, and on the east, west, and south by the territories of France. In addition to the territory thus bounded, the communes of Celigny, Le Coudre, and Petit Bois, enclosed by Vaud, belonged to this canton, which is one of the smallest in the Swiss Confederation, the area being only 108 square miles. The whole canton belongs to the basin of the Rhône, and the only streams of importance are that river and the Arve, which joins it a little below the town of Geneva, the capital of the canton. The territory of Geneva having, by the arrangements of the Congress of Vienna, obtained an accession of 15 communes, detached from France and Savoy, was admitted a member of the Swiss Confederation in 1814, and ranks as the 22d canton. A constitution, somewhat aristocratical in its nature, was framed, and continued in force till 1830, when a considerable modification of it took place. In 1841, in consequence of a popular tumult, the original constitution was abandoned for one in which the democratic principle is completely predominant. This new constitution was modified under popular pressure in 1847. All religious denominations are declared to have perfect freedom, but two of them are paid by the state — the Roman Catholics, amounting to rather more than a third of the population, and the Protestant National Church. The language spoken is French. Pop. (1900) 131,674.

Geneva, Switzerland, the capital of the canton of the same name; at the western extremity of the Lake of Geneva, where the Rhône issues, here crossed by several bridges, and dividing the town into two portions. The more important public buildings are the Cathedral or Church of St. Pierre, a Gothic structure of the 10th, 11th, and 12th centuries; the town-house in the Florentine style; the Musée Rath, containing a collection of pictures, etc.; the university building, nearly opposite the botanic garden, rebuilt in 1867–71, and containing the public library, founded by Bonivard in 1551, and now numbering over 90,000 volumes; and the Museum of Natural History. In literature and science Geneva has long occupied a distinguished place, and it has been the birthplace or the residence of many eminent men, including Calvin, Beza, Knox, Le Sage, Necker, De Candolle, Rousseau, Sismondi, etc. Geneva early adopted the principles of the Reformation, and chiefly through the teaching of Calvin the town acquired an important influence over the spiritual life of Europe, and became the centre of education for the Protestant youth of Great Britain, France, and Germany. Pop. (1901) commune, 105,139, including suburbs.

Geneva Arbitration, or **Geneva Award,** the settlement of the Alabama claims by five arbitrators, appointed by the President of the United States, the queen of Great Britain, the king of Italy, the president of the Swiss Confederation, and the emperor of Brazil. These rulers, in the above order, named as arbitrators Charles Francis Adams, Lord Chief Justice Sir Alexander Cockburn, Count Federigo Selopis, Mr. Jacques Staempfli, and Baron Itajuba. J. C. Bancroft Davis, and Lord Tenterden, respectively, represented as agents the United States and Great Britain. The tribunal met at Geneva, Switzerland, 15 Dec. 1871, and Count Selopis was made president. The United States claimed damages both for direct and for indirect losses, and for injuries occasioned by 13 vessels. The tribunal decided to allow only direct losses caused by the Florida and the Alabama, with their tenders, and by the Shenandoah during part of her cruise. Various rules of international law were laid down which supported most of the contentions of our government. On 14 Sept. 1872, the tribunal "awarded to the United States a sum of $15,500,000 in gold as the indemnity to be paid by Great Britain to the United States as the satisfaction of all the claims referred to the consideration of the tribunal." The English representative cast the only dissenting vote, but Great Britain accepted the decision and paid the award within a year.

Geneva Bible, a translation of the Bible into English, made and published at Geneva, chiefly by English Protestant refugees. It was the first English Bible which adopted the Roman instead of the obsolescent black type, and the first which recognized the division into verses; it was the first also which omitted the Apocrypha. From its stating (Genesis iii. 7) that our first parents made themselves "breeches," it is sometimes called the Breeches Bible. See BIBLE.

Geneva College, Pa., a coeducational institution in Beaver Falls, founded in 1848 under the auspices of the Reformed Presbyterian Church; reported at the end of 1900: Professors and instructors, 15; students, 206; volumes in the library, 4,500; productive funds, $114,000; grounds and buildings valued at $175,000; income, $11,000; president, W. P. Johnston, A.M., D.D.

Geneva Convention (1864 and 1868), international agreements for mitigating the sufferings of war. The first was initiated by the efforts of two Genevans: a physician named Dunant, who wrote a sickening description of the military hospitals at the battle of Solferino; and a public-spirited citizen named Moynier, who formed societies in various places to urge the neutralization of field ambulances, and called the attention of European governments to it. The majority of these sent representatives to an international conference held at Geneva under the presidency of Gen. William Henry Dufour, the eminent Swiss soldier and statesman. The agreement adopted was signed 22 August; all the European states have since joined in it, and Persia has acceded. The articles are in substance: (1) Ambulances and military hospitals shall be inviolable while containing sick or wounded; (2) so shall their staff; (3) whether they are occupied by the enemy or not; (4) if the attendants choose to leave the hospitals, they can only take their private property, not the relief appliances, except ambulances and their contents; (5) a house with a sick or wounded soldier shall be neutral and not subject to have soldiers quartered in it, or to requisitions with specified exceptions; (6) the convalesced shall be sent back to their own country under parole for the remainder of the war; (7) hospitals and ambulances, to claim these rights, must carry a uniform flag with a red cross on a white ground as well as their national flag, and the staff must wear a like badge on their arms; (8) special arrangements to be made by the commanders. In 1868 a second convention at Geneva adopted a supplementary convention, to extend the principles of the first to naval warfare, and amplify the first. It provided on the latter point that the medical and surgical staff should receive their regular pay if they remained after occupation by the enemy, and if they left should do so at a time fixed by the commander; that military requisitions should be modified according to the expenditures of the given places in harboring the wounded, and to charities extended toward them; that the paroling home of convalesced soldiers shall not include officers, as they could make their knowledge very serviceable without serving in the field. The marine rules were, that hospital ships, merchant vessels with wounded on board, and boats rescuing men in the water, shall be inviolable, on consideration of carrying their red-cross flag and their crews wearing the red-cross arm badge, that government hospital ships shall be painted white with a green stripe, and private societies white with a red stripe; and that whenever one party in a naval war has sound reason to believe the other is abusing the convention, the first may suspend it till the other proves its honesty, and if proof is not given, may suspend it for the duration of the war. See RED CROSS SOCIETY; WAR.

Geneva, Lake of, or **Lake Leman** (Latin, *Lacus Lemanus*), the largest of the Swiss lakes, extending in the form of a crescent, with its horns pointing south, between France and the cantons of Geneva, Vaud, and Valais; length, 55 miles; central breadth, about 6 miles; area, 331

GENEVA, SHOWING MT. BLANC.

square miles; greatest depth, 900 feet. It is 1,150 feet above the sea. On the north the shore is low, and the ground behind ascends gradually in beautiful slopes. On the south, and particularly at the east end, the shore is rocky and abrupt, and lofty precipices often rise sheer from the water's edge. It contains various species of fish. The water is remarkably pure and of a beautiful blue color. The Rhône, which enters the eastern extremity, a muddy, turbid stream, issues from the western extremity perfectly pellucid, and likewise of the finest blue.

Geneva, University of, a Swiss university founded in 1559, as the Academy of Geneva, and called a university only since 1873. It has 1,100 students, mostly from abroad, and the principal studies are medicine and philosophy. Women have of recent years been admitted on the same conditions as men. It is the European centre of French Protestant culture and influence.

Geneviève, zhĕn-vē-āv, **Saint,** the patron saint of Paris: b. near Nanterre, Paris, 423; d. Paris 3 Jan. 512. When yet very young she took a vow of perpetual virginity and subsequently she went to Paris. The city was about to be deserted when Attila with his Huns broke into France; but Geneviève assured the inhabitants of complete security if they would seek it in fervent prayers. Attila took his course from Champagne to Orleans, returned hence into Champagne without touching Paris, and was defeated in 451. By this event Geneviève's reputation was established. In a time of famine she went along the river Seine from city to city, and soon returned with 12 large vessels loaded with grain, which she distributed gratuitously among the sufferers. Her remains were placed in the subterranean chapel which Saint Denis had consecrated to the apostles Paul and Peter. Clovis by her request built a church over it, which was afterward called by her name, as was also the abbey founded there. Another church, consecrated to this saint, was built near the church of Notre Dame. By a decree of the National Convention, 1791, this edifice was named the Pantheon, but its original name was restored officially in 1851. Her relics, which were preserved in the former till its destruction at the Revolution, are now in the church of Saint Etienne du Mont. Her fête is held on 3 January.

Geneviève, Saint, Duchess of Brabant, wife of Siegfried, count palatine in the reign of Charles Martel (about 750). Being accused by her intendant Golo of adultery during her husband's absence, on his return she was condemned to death; but the vassal to whom her execution was entrusted allowed her to escape, and she lived six years in a cavern upon nothing but herbs. She was finally found, and carried home by her husband, who in the meantime had become convinced of her innocence. This legend is the subject of one of the finest and most perfect of the German popular tales, which appears to have been written by Emmich about 1472. The story has been retold by Tieck and Maler Müller, and dramatized by Raupach.

Genga, Girolamo, jē-rō'lā-mō jĕn'gä, Italian painter and architect: b. Urbino 1476; d. 1551. He was for many years a pupil of Luca Signorelli, whom he assisted in numerous pictures, and also of Perugino; painted a 'Resurrection' in the Church of Saint Catharine of Siena at Rome; and found a generous patron in the Duke Francesco Maria of Urbino, who finally appointed him court-architect. Among his architectural works were the church of St. John the Baptist at Pesaro, the restoration of the palace courtyard there, and the bishop's palace of Sinigaglia. With the versatility of the Renaissance, he wrote on the fine arts, and was a musician and sculptor.

Genghis Khan, jĕn'gĭs khăn, or **Jenghis Khan,** Mongol conqueror: b. near the Onon River, Mongolia, 1162; d. 18 Aug. 1227. His father was chief over 30 or 40 clans, but paid tribute to the Tartar Khan. He succeeded his father when only 14 years of age, and made himself master of the neighboring tribes. A great number of tribes now combined their forces against him. But he found a powerful protector in the great Khan of the Karaite Mongols, Oung, or Ung, who gave him his daughter in marriage. After much intestine warfare with various Tartar tribes Genghis was proclaimed Khan of the United Mongol and Tartar tribes.

He now professed to have a divine call to conquer the world, and the idea so animated the spirit of his soldiers that they were easily led on to new wars. The country of the Uigurs, in the centre of Tartary, was easily subdued, and Genghis Khan was now master of the greatest part of Tartary. In 1209 he passed the great wall of China, the conquest of which country occupied him more than six years; the capital, Yenking, now Peking, was taken by storm in 1215 and plundered. The murder of the ambassadors whom Genghis Khan had sent to the king of Kharism (now Khiva) occasioned the invasion of Turkestan in 1218 with an army of 700,000 men; and the two cities of Bokhara and Samarcand were stormed, pillaged, and burned. Seven years in succession was the conqueror busy in the work of destruction, pillage, and subjugation, and extended his ravages to the banks of the Dnieper. In 1225, though more than 60 years old, he marched in person at the head of his whole army against the king of Tangut (southwestern China), who had given shelter to two of his enemies. A great battle was fought, in which the king of Tangut was totally defeated with the loss of 300,000 men. The victor remained some time in his newly subdued provinces, from which he also sent two of his sons to complete the conquest of northern China. At his death in Mongolia, his immense dominions were divided among his four sons. A great part of the empire, however, came into the hands of Kublai, who is considered as the founder of the Mongol dynasty in China. The only memorial of the conqueror now known to exist is a granite tablet discovered among the ruins of Nertschinsk. The inscription in Mongol has been deciphered by Schmidt of Saint Petersburg. It had been erected by Genghis Khan in commemoration of his conquest of the kingdom of Saratogal (better known as Karakitai).

Genii, jē'nĭ-ī, among the ancient Romans, were protecting spirits, who were supposed to accompany every created thing from its origin to its final decay, like a second spiritual self. They belonged not only to men, but all things animate and inanimate, and more especially to places, and were regarded as effluences of the divinity, and worshipped with divine honors. Not only had every individual his genius, but likewise the whole people. The statue of the national genius was placed in the vicinity of the Roman forum, and is often seen on the coins of Hadrian and Trajan. The genius of an individual was represented by the Romans as a figure in a toga, having the head veiled, and the cornucopia or patera in the hands; while local genii appear under the figure of serpents eating fruit set before them. Quite different are the genii whose Arabic name, *Djinn* or *Jinn*, was translated by the Latin term *genius*, for want of a better word, or from the casual similarity of the sounds. See FAMILIAR SPIRITS.

Genista, jē-nis'ta, a genus of low, branching sometimes spiny shrubs, belonging to the pea family, with simple leaves and yellow flowers. There are about 80 species, a few of which are cultivated for ornament. See BROOM; DYEWEED.

Genius, in Roman mythology, a tutelary deity. See GENII.

Genlis, Stéphanie Félicité Ducrest de St. Aubin, stā-fā-nē fā-lēs-ē-tā dü-krā dė sāṅ ō bāṅ zhōṅ-lēs, COMTESSE DE, French writer: b. Champcéri, Burgundy, 25 Jan. 1746; d. Paris 31 Dec. 1830. At the age of 16 she was married to the Comte de Genlis, and in 1770 was made lady-in-waiting to the Duchesse de Chartres. In 1782 the Duc de Chartres, afterward known as Egalité, appointed her "governor" of his children, including Louis-Philippe. She wrote a variety of works for her pupils, among others: 'Theatre of Education' (1779–80), a collection of short comedies; 'Annals of Virtue' (1781); 'Adèle and Theodore, or Letters on Education' (1782); 'The Vigils of the Château' (1784). On the breaking out of the Revolution she took the liberal side, but was ultimately compelled to seek refuge (1793) in Switzerland and Germany. When Bonaparte became consul she returned (1799) to Paris and received from him a pension. Her writings fill some 90 volumes. Among them are: 'Précis de la Conduite de Madame de Genlis' (1795); 'Chevaliers du Cygne' (1795); 'Madame de la Vallière'; the romance, 'Mademoiselle de Clermont' (1802); 'Memoirs' (1825); 'Baron d'Holbach's Dinners.' The last contains a great deal of curious but malicious information concerning the freethinkers of the 18th century.

Gennesaret, jě-něs'a-rět, **Lake** or **Sea**. See GALILEE, SEA OF.

Genoa, jěn'ō-a (ancient GENUA), Italy, a fortified city, situated on the Gulf of Genoa, at the foot of the Apennines, the capital of the province and the most important seaport. While worthy of its title, "Genoa the Superb," as viewed from the sea, it is in reality built awkwardly on irregular rising ground, and consists of a labyrinth of narrow and intricate streets. Of the palaces the most famous are the ducal palace formerly inhabited by the doges, now appropriated to the meetings of the senate; and the Doria, presented in 1529 to the great Genoese citizen Andrea Doria, whose residence it was during his presidency of the republic. The palaces Brignole-Sale, Reale, Durazzo-Pallavicini, Spinola, Balbi-Senarega, and others possess great interest on account of their historical fame and architectural beauty. Many of them contain galleries of paintings: the Brignole-Sale has works by Van Dyck, Rubens, Albrecht Dürer, Paolo Veronese, Guercino, etc. Among the churches are the Cathedral of St. Lorenzo, in the Italian Gothic style; the Church of St. Ambrogio (1589), containing pictures by Guido Reni and Rubens. The marble municipal palace, built in the Late Renaissance style, with a magnificent vestibule, courtyard, and galleries, and the palace of the Dogana must also be mentioned. Genoa has a university, founded in 1243, a library of 116,000 volumes; also numerous technical schools, and institutions of higher education. The hospital, the asylum for the poor (capacity 2,200), the deaf and dumb institution, and the hospital for the insane are among the finest institutions of their kind in Italy. There are numerous excellent philanthropic foundations, as the Fieschi, an asylum for female orphans. The public library contains 50,000 volumes; and there are the Academy of Fine Arts, founded (1751) by the Doria family; the Carlo Felice Theatre, one of the finest in Italy; and the Verdi Institute of Music. Genoa is the commercial outlet of a wide extent of country, of which the chief exports are rice, wine, olive oil, silk goods, coral, paper, macaroni, and marble. The imports are principally raw cotton, wheat, sugar, coal, hides, coffee, raw wool, fish, petroleum, iron, machinery, and cotton and woolen textiles. The annual exports of Genoa are valued at nearly $20,000,000, the imports are returned at more than $75,000,000. Pop. (1901) 234,800.

The history of Genoa may be traced back in legendary traditions to a time preceding the foundation of Rome. It was one of the most considerable cities of the Ligurians, and is mentioned by Livy (under the name of Genua) as being in friendly relations with Rome at the beginning of the second Punic war. It was subdued and partly destroyed during that war by a Carthaginian fleet under the command of Mago. The Romans rebuilt it, and it afterward became a Roman municipium. After the decline of the Roman empire in the West it fell into the hands of the Lombards, and with them became subject to the Franks. After the downfall of the empire of Charlemagne, Genoa erected itself into a republic, and till the 11th century shared the fortunes of the cities of Lombardy.

If Genoa had adopted a wise colonial system she would have held the first rank among the commercial nations at the end of the Middle Ages. After the conquest of Constantinople by Mohammed II. in 1453, the Genoese soon suffered for the aid they had imprudently afforded the Turks. Mohammed took from them their settlements on the Black Sea in 1475, and at length all access to this branch of trade was denied them by the Turks.

While the power and commercial rank of Genoa were attaining their height by means of their foreign trade and acquisitions of territory the city was internally convulsed by civil discord and party spirit. The hostility of the democrats and aristocrats and the different parties among the latter occasioned continual disorders. In 1339 a chief magistrate, the doge, was elected for life by the people, but he had not sufficient influence to reconcile the contending parties. A council was appointed to aid him; yet after all attempts to restore order to the state, there was no internal tranquillity; indeed, the city sometimes submitted to a foreign yoke in order to get rid of the disastrous anarchy which the conflict of parties produced.

In 1528 the disturbed state regained tranquillity and order which lasted till the end of the 18th century. The form of government established was a strict aristocracy. The doge was elected to be the head of the state. The nobility were divided into two classes — the old and new. To the old belonged, besides the families of Grimaldi, Fieschi, Doria, Spinola, 24 others who stood nearest them in age, wealth, and consequence. The new nobility comprised 437 families. The doge might be taken from the old or new nobles.

Little by little Genoa lost all her foreign possessions. Corsica, the last of all, revolted in 1730 and was ceded in 1768 to France. When the neighboring countries submitted to the French in 1797 the neutrality which the republic had strictly observed did not save the fluctuating government from ruin. Bonaparte gave to them a new constitution formed on the principles of the French representative system. Two years afterward a portion of the Genoese territory fell into the hands of the Austrians; but the fate of Genoa was decided by the battle of Marengo. A provisional government was established, and in 1802 it received a new constitution as the Ligurian republic and acquired some increase of territory, and had in 1804 a population exceeding 600,000. Its naval force, which was so formidable in the Middle Ages, at last dwindled down to a few galleys and barques; the land force became almost equally insignificant.

On the overthrow of the French empire Genoa was occupied by the British, with whose permission the ancient constitution was re-established. But the Congress of Vienna in 1815 assigned Genoa with its territories to Sardinia, stipulating that it should have a sort of representative constitution. In 1821 it joined for a moment the revolutionary movements of Italy. In the spring of 1849, after the defeat of Charles Albert at Novara and the conclusion of a truce with the Austrians, a revolutionary outbreak took place, the national guards occupied the forts, and the garrison was compelled to withdraw. A provisional government was formed and the independence of the republic was proclaimed. But a large body of Sardinian troops under Gen. Della Marmora, soon appeared before the city; a bloody struggle ensued and the forts and principal points of the city were taken by the royal soldiery. Meanwhile a deputation was sent to Turin, which returned with the amnesty of the king, excluding the chief leaders of the movement, who, however, escaped on board an American vessel. In April the city was disarmed and the monarchical government restored. Following the fortunes of the Sardinian states, Genoa became a portion of the kingdom of Italy. Pop. (1901) 234,710.

Genoa, Gulf of, a large indentation in the north shore of the Mediterranean, north of Corsica, having between the towns of Oneglia and Spezia a width of nearly 90 miles.

Genre (zhŏn-r) **Painting**, in art, from the French *genre* (sort or kind), which was originally employed to designate pictures of which the subjects were copied directly from nature, such as landscapes, scenes of every-day life, animals, fruit, and even portraits; in contradistinction to those which were more the product of the imagination, such as historical, religious, and purely ideal paintings. The term is now restricted to denote scenes of every-day life, such as Hogarth and Wilkie loved to depict. A genre painter is not confined to low subjects, nor need his paintings be vulgar in the ordinary acceptation of the word, though the great modern masters in this style, the Dutch, have owed their inspiration and fame to scenes of very humble and often coarse life. This style of painting was not unknown to the ancients. Pyreicus, a Greek painter of the time of Alexander the Great, painted barbers' shops, cobblers' stalls, and the like, and according to Pliny, his pictures were highly prized. In Italy the painters who have worked in this style are Caravaggio, Manfredi, Salvator Rosa, Benedetto Castiglione, etc. But the art received its highest development in the Netherlands; Teniers the younger, Jan Van Mill, D. Ryckaest, Rembrandt, Nicolas Maas, Gerard Dow, Jan Steen, the Van Ostades, Brauwer and Bega, are among the best exponents of the style. In Spain the most notable genre painters are Velasquez and Murillo; and in Great Britain, after Hogarth and Wilkie, already mentioned, come Leslie, Mulready, Maclise, Egg, Millais, Faed, and others. The British school has sought to lend a dignity to the style by the introduction of the dramatic element. See Painting.

Genseric, jĕn'sėr-ĭk, king of the Vandals: d. 477 A.D. Under Genseric the Vandals first became formidable at sea, and gained possession of parts of the islands of Sicily, Sardinia, and Corsica. In 455, on the invitation of the Empress Eudoxia, Valentinian's widow, who sought his assistance against Maximus, he landed at Ostia and marched to Rome, which he stormed and gave up to pillage for 14 days. On his departure he carried off the empress herself and her two daughters, one of whom he married to his son Hunnerich.

Gen'tian, the dried rhizome and root of *Gentiana lutea*. This is the yellow gentian of Europe, a tall mountain perennial, growing abundantly in southern and middle Europe and Asia Minor. The chief source of supply to the drug market is collected from Switzerland, southern France, and the hilly portions of Germany. The main constituent of the root is a bitter glycoside, gentiopicrin. It also contains sugar, gums, and salts. The action of gentian is that of a simple bitter and it is used to improve the appetite and thus secondarily affect the general constitution.

Gentile, Da Fabriano. See Fabriano, Gentile da.

Gen'tiles, in Scripture, all the nations of the world, excepting the Jews. In modern usage all the nations excepting Jews and Mormons. In the Old Testament it is the rendering of the Hebrew word *goim*, peoples, nations, the plural of *goi*, a nation, a people. At first it was used as a mere ethnological word, and quite respectfully, but as the Jews became more conscious of their privileges they employed it more and more scornfully of the nations around (Gen. x. 5; Isa. lxvi. 19; Jer. xiv. 22). In the New Testament Gentiles is the rendering of the Greek *ethne*, the plural of *ethnos*, a number of people living together, a nation. St. Peter, moved by a vision, was the first of the Twelve to preach to the Gentiles (Acts x.), but the Apostle of the Gentiles was Saint Paul (Gal. ii. 15).

Gentry, Meredith Poindexter, American politician: b. Rockingham County, N. C., 1809; d. 1866. In 1839 he was elected to Congress as a Whig, and he was also a representative from Tennessee in 1841–3, 1845–7, and 1847–53. In 1862 and 1863 he was a member of the Confederate Congress. He was a student of political history and well known as a speaker both in and out of Congress, a eulogy of Henry Clay being among his noteworthy public utterances.

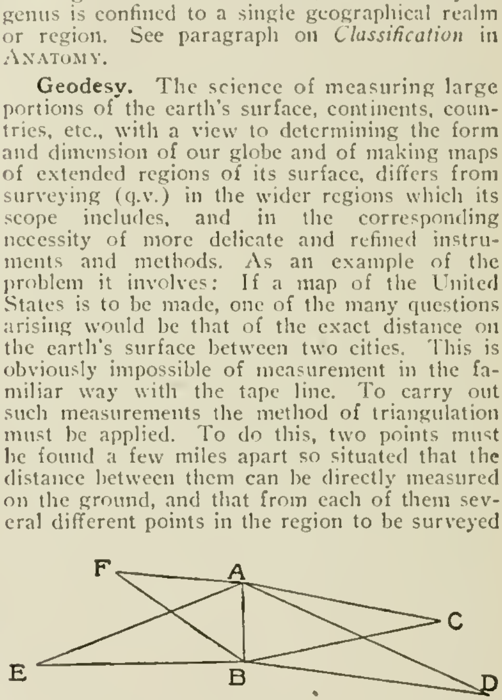
Gentz, Wilhelm Karl, vĭl'hĕlm kärl gĕnts, German painter: b. Neuruppin, Brandenburg, 9 Dec. 1822; d. Berlin 23 Aug. 1890. He traveled in Spain, Morocco, and Egypt, depicted Oriental civilization and the life of the desert with increasing insight and success, and at first turned his attention to the rendering of biblical scenes in the spirit of the actual East. Of the works of this period are: 'Christ in the House of Simon'; 'Christ among the Pharisees and Publicans.' Despite the skill with which he rendered the brilliant light effects peculiar to those regions, his work was slow in making its way. Ultimately, however, he was ranked not at all inferior to the most distinguished French colorists. He was a professor in the Berlin Academy, from 1877 a member of the Senate; and obtained the great medals of Berlin (1866), Vienna (1873), and Munich (1876). In 1873 he visited Palestine to make local studies for his greatest achievement, 'Entry of the German Crown Prince into Jerusalem, 1869,' which was completed in 1876 and hung in the National Gallery of Berlin. Other of his canvases are: 'Mecca Caravan at Prayer'; 'Meeting of Two Caravans in the Desert'; 'Evening on the Nile'; 'Funeral Celebration at Cairo'; 'Serpent Charmer'; 'Alley of Sphinxes in the Thebaid'; 'Bazaar in Algiers'; 'Palm Sunday in Early Christian Times.' He published 'Briefe aus Aegypten und Nubien' (1853).

Genuflection, jĕn-ū-flĕk'shŏn, the act of bending the knee in reverence or adoration. In the Roman Catholic Church the members genuflect when passing before the tabernacle where the Blessed Sacrament is reserved. If the Blessed Sacrament is exposed a double genuflection (on both knees) is usual. Genuflection is used at various times during the church services. The early Christians prayed standing on Sundays, and from Easter till Pentecost, and only bent the knee in sign of penance; hence a class of penitents were known as *Genuflectents.* In the rubrics of the Anglican Church double genuflection, or kneeling, is enjoined in some parts of the service.

Genung, John Franklin, American clergyman and scholar: b. Wilseyville, N. Y., 27 Jan. 1850. He was graduated from Union College in 1870, from the Rochester Theological Seminary in 1875, and from the University of Leipsic, Germany, in 1881; was for a time active in the ministry of the Baptist Church, and later was appointed professor of rhetoric in Amherst College. His publications number: 'Tennyson's In Memoriam: Its Purpose and Structure' (1883); 'Practical Elements of Rhetoric' (1886); 'Hand-Book of Rhetorical Analysis' (1888); 'The Epic of the Inner Life,' a new translation, with annotations, of the Book of Job (1891); 'Outlines of Rhetoric' (1893); 'The Working Elements of Rhetoric' (1902).

Genus, jē'nŭs, in zoology and botany, a systematic term applied to any group of species (q.v.) lower in rank than a tribe, sub-family, or family. A genus may be composed of a single, several, or many species. Genera usually differ from species in structural details, while species differ in size or color, or in the structure of some special organ or portion of the body. It is, however, often difficult to draw the line between genera and species. As an example of a genus may be cited *Equus*, or the horse genus, represented by *Equus caballus*, the domestic horse; *Equus asinus*, the ass; *Equus zebra*, the zebra, etc. A genus may be represented by species inhabiting different continents, but usually a genus is confined to a single geographical realm or region. See paragraph on *Classification* in ANATOMY.

Geodesy. The science of measuring large portions of the earth's surface, continents, countries, etc., with a view to determining the form and dimension of our globe and of making maps of extended regions of its surface, differs from surveying (q.v.) in the wider regions which its scope includes, and in the corresponding necessity of more delicate and refined instruments and methods. As an example of the problem it involves: If a map of the United States is to be made, one of the many questions arising would be that of the exact distance on the earth's surface between two cities. This is obviously impossible of measurement in the familiar way with the tape line. To carry out such measurements the method of triangulation must be applied. To do this, two points must be found a few miles apart so situated that the distance between them can be directly measured on the ground, and that from each of them several different points in the region to be surveyed



are visible. Let AB be the two points chosen and C, D, E, F, etc., some of the distant points. The line AB is called the *base line* of the triangulation, and is measured by means of rods closed in wooden cases to protect them from rapid changes of temperature, which are successively placed end to end from the point A to the point B. Recently it has been found that steel tape can be used much more expediently and with all the precision that is required for the purpose. Having found the exact length of the base line, a theodolite is mounted at A and vertical rods or signals are erected at B C, so that the angle BAC can be measured with the greatest possible exactness. Then the theodolite is carried to the point B and the angle is measured in like manner. If practicable the theodolite may also be mounted at C in order to measure the remaining angle of the triangle. The sum of the angles should come out 180°, this being the sum of the angles of any plane triangle. These three measurements will show any error in the measurement of the angles. Knowing the three angles and of the side of the triangle, the computation of the two remaining sides is a very simple one in trigonometry.

Commonly there will be a number of points, C, D, E, F, etc., which can be determined at the same time. Having done this, any of the lines from A or B to C, or between any two of the other known points, may be used as a new base line and the distance of yet other visible points measured in the same way. These, again, can be used as new base lines, and so on indefinitely. This method is especially expeditious in mountainous regions, where observations can be made from peak to peak at distances sometimes exceeding 100 miles.

Measures of this sort have been carried on or are in progress in most civilized countries. In our own country a system of triangles has been extended from the Atlantic to the Pacific coast, near the parallel of 40° latitude, by the United States Coast and Geodetic Survey. The same survey has carried a line of triangles along the Gulf of Mexico and up the Atlantic coast to the Eastern States, and they are in progress through other parts of the country. The result of these measurements is that the exact position on the earth's surface of a great number of high or prominent points are defined so that they can be laid down on maps. This done, the process of triangulation and surveying can be applied to determine the position of intermediate points, cities, towns, etc., and to determine the course of rivers or valleys.

In order to obtain the most exact result from a geodetic survey of the kind described, the exact form and size of the earth must be known. These cannot be determined in the best way through observations in any one country, but require a combination of the geodetic surveys of various countries as widely separated as possible. With a view of securing co-operation in the solution of the problem, an International Geodetic Association was formed, comprising the United States and the leading countries of Europe. This association, represented by members from the various countries, meets from time to time to carry out the co-operative work of the association, and decide upon the best way of combining the several geodetic surveys.

A fundamental point in which geodesy differs from surveying is in the combination of measurements of the earth's surface, with observations of the stars; the object of the combination is the determination of the curvature of the earth's surface and the size of our globe.

The principle involved will be readily seen by a little careful thought. It is obviously impossible to determine with any exactness the curvature of the earth's surface by observations made solely on that surface. But the surface of the ocean, which is taken as the basic one, is everywhere perpendicular to the plumb-line. It follows that the angle between the directions of the plumb-line at two points will be equal to the curvature of the ocean surface between the points. By skilful astronomical observations it is possible, on any part of the solid earth where an instrument can be mounted, to determine the exact declination in the celestial sphere from which the plumb-line points, which is, in fact, the zenith. The declination of the zenith is the latitude of the place; it follows, that if the latitude of two points north and south of each other is accurately determined, and found to be one degree, for example, the distance between them is the measure of one degree on the earth's surface. This distance can be determined between any two points which are connected by a geodetic measurement. The difference of longitude may also be determined astronomically by telegraph and by geodetic measurement of the earth's surface. The relation between the two measures shows the curvature in the east and west direction.

One of the most difficult questions connected with the figure of the earth is that of the exact ellipticity or flattening of our globe. The precise figure of the earth itself does not admit of definition on account of the irregular outlines of the mountains. Hence, as a basis of all exact statements, geodesy takes, as a standard body representing the earth, the figure that would be formed by the surface of the ocean if the continents were removed so that the ocean would cover the whole globe. It is clear that if the earth did not rotate on its axis, the form assumed by an ocean covering it would be that of a sphere. But, owing to the rotation, the equatorial regions of the earth are expanded and the polar regions contracted so that the ideal form is that of an ellipsoid. If all parts of the earth were of the same density this ellipsoid would be easily determined; but owing to the inequality of density of different parts of the earth, the figure of the ocean itself is not an exact ellipsoid. The best that can be done is to make the calculations assuming it to be such, and to make the best allowance that we can for such small deviations as may be discovered.

When Newton propounded the law of gravitation, the flattening of the earth at the poles was seen to be a natural result. But the French contended that the earth was actually elongated toward the poles. To settle the question one of the most celebrated expeditions in geodetic history was sent to Peru to measure an arc of the meridian near the equator, and another expedition went to Lapland to measure one near the poles. The results showed Newton's theory to be correct, and since that time there has been no doubt on the subject. But the difficulty of determining the exact length of a degree and the irregular variations in the figure of the earth, which we shall soon mention, are such that the determinations by geodetic measures have not been altogether satisfactory. Another method is afforded by the force of gravity, as determined by the length of the seconds pendulum. It is well known that gravity is less in the equatorial regions of the earth than at the polar regions, from two causes. One is the centrifugal force of the earth's rotation, and the other is the greater distance of the centre of the earth's surface at the equator. The result is that a clock pendulum, swinging exact seconds near the pole, would lose several seconds a day when taken to the equator; hence, a pendulum which would beat exact seconds must be made continually shorter as we approach the equator. The determination of its length in various latitudes thus becomes an important problem in geodesy. When it is known, the ellipticity or flattening of the earth may be determined from it.

What makes all the problems associated with this so complex are the small irregularities in the direction and force of gravitation wherever measures and determinations have been made. It is always found that when the latitudes of places are determined by the direction of the plumb-line, which is the only astronomical method, they seldom agree with the differences between the places as determined by geodetic measurements. The reason is, that the plumb-line is deflected by the attraction of mountains and denser portions of the interior of the earth which do not admit of exact computation. These irregularities are greater in mountainous regions, in the Himalayas sometimes rising to 30 seconds. But even in plain countries deviations of 2 or 3 seconds are found. The errors arising from these deviations would not be important in themselves, the difficulty being that they operate like a small error in a foot rule when the latter has to be used for measuring a very long stick of timber. In such a case an error even so small as one eighth of an inch in the rule would amount to an error of a foot in measuring a pole 100 feet long. As the measurement of a whole continent, even of the earth itself, has to start from short base lines, the error may be multiplied many fold in the final result.

Simon Newcomb.

Geodetic Arcs. Historical and other evidence clearly indicates that from the earliest times man has inquired and speculated about matters relative to the shape and magnitude of the earth, but it is also evident that his original crude ideas were not developed up to the point of even a fair approximation to the facts until advancing civilization developed the simpler operations of land surveying into the application of the more complicated principles of geodetic science.

The practice of land surveying appears to have originated at a very ancient date. In a papyrus manuscript bearing a date earlier than 1700 B.C., the author states that his work is a compilation from older manuscripts. According to this work and others of a similar character and of equal antiquity, the practice of land surveying tended to change the original conception of the Ionic Greeks—a circular flat earth surrounded by water—to a conception that recognized the earth as a sphere; but the important step from plane to spherical surveying does not appear to have been made until the time of Aristotle (384-322 B.C.); while the honor of the first actual application of the principles of the new science of geodesy to measurements made for determining the curvature of the earth's surface, belongs to the members of the Alexandrian School. This work, comprising two measurements of the earth's radius, was accomplished about the beginning of the 2d century B.C. The principle employed consisted in the measurement of a long north and south line according to some predetermined unit of length, and then observing the altitude of the sun or some star as seen from the two ends of the measured line. The difference of the measured altitudes gave the curvature of the arc of the great earth-sphere represented by the measured line, expressed in degrees, and from these values the circumference or the radius of the sphere was computed.

It is very remarkable that this principle is practically the same as that employed for the same purpose at the present time, although in its modern application a greater accuracy is attained by the addition of a great mass of details in the accessory methods.

After the measurements made by the Alexandrian School, about a thousand years elapsed before a similar attempt was made by any body of scientific men. This work was executed by the Arabs in Mesopotamia, about 825, and was followed after another long lapse of eight centuries, through the middle ages, by several measurements executed by various nations, the principle of geographical triangulations being introduced in connection with refined measurements about the year 1617.

Modern geodesy, or the science as it exists at the present time, however, really began with the discovery of the law of gravitation by Newton during the latter part of the 17th century, when he demonstrated, that on account of its revolution on its axis, and its lack of perfect rigidity which subjected it to its own attraction, the earth must assume the form of a sphere slightly flattened at the poles. This theoretical form was apparently contradicted, however, by the measurement of a meridional arc in France between 1683 and 1716, which indicated the form of the earth to be that of an elongated sphere. In order to settle the subsequent controversy relative to the matter, and in the interest of science in general, two geodetic expeditions were placed in the field—one in the equatorial region of Peru (1735-1741), and the other in the polar region of Lapland (1736-1737). The data obtained from the work of these expeditions showed that one degree of arc in Lapland was greater, therefore flatter, than one degree of arc in Peru, and not only conclusively proved the correctness of the Newtonian theory, that the curvature of the earth's surface was flatter near the poles than near the equator, but served to establish a sure foundation on which the theory and practice of geodesy has continued to advance with ever increasing accuracy in its results.

On account of the methods employed, the earlier measurements were confined to meridional arcs, but the modern methods of measurements and computations are such, that the measurements of arcs of parallel of latitude and oblique arcs are also utilized in the determination of the size and shape of the earth. The instruments and methods used for this purpose are the same as those employed in the work of primary triangulation designed as a basis for an accurate map, and nearly all the geodetic arcs obtained in recent years have been measured during the progress of surveys made chiefly for the construction of accurate maps and other practical purposes, by the more important nations of the world. See articles under the titles: Coast and Geodetic Survey, Methods and Publication of; Geological Survey, Methods and Publication of; and Map.

The accompanying map shows the principal modern geodetic arcs which have been completely measured in different parts of the world, and affords a comparison of the work done by the United States with that of foreign countries. The two arcs already completely measured in the United States are those of the thirty-ninth parallel of latitude, and the eastern oblique arc. The arc along the thirty-ninth parallel extends across the country from Cape May, N. J., to Point Arena, Cal., a distance of 2625 statute miles (4225 kilometers). Its triangulation includes 10 base lines having an aggregate length of 53.5 miles, one of them being nearly 11 miles long. In the Rocky Mountain region many of the triangle sides are over 100 miles in length, and some of the triangulation stations are more than 14000 feet (4300 meters) above the level of the sea. To fix the position of this arc on the surface of the earth, and to determine the true direction of the lines of triangulation, the latitude was accurately determined at 109 stations, the longitude at 29 stations, and the azimuth at 73 stations.

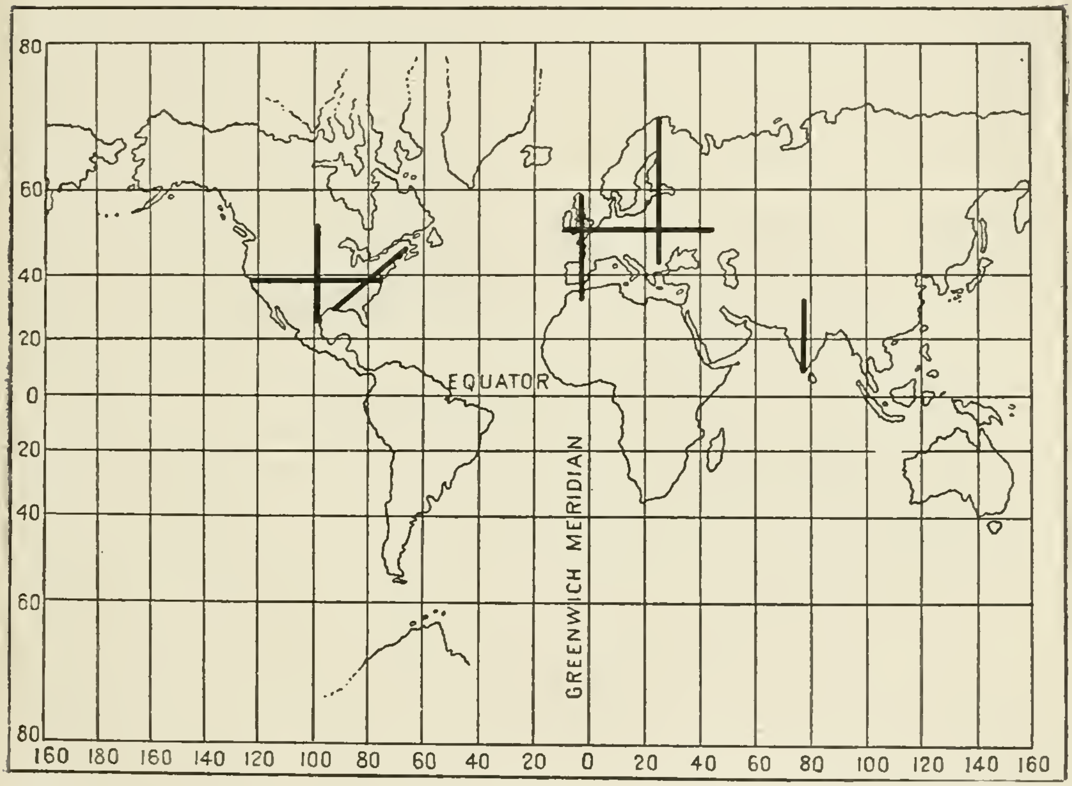
The eastern oblique arc extends from Calais, Maine, to New Orleans, La., a distance of 1623 miles (2612 kilometers). The triangulation includes six base lines. The latitude was determined at 71 stations, the longitude at 17, and the azimuth at 56. The measurement of the arc is a result obtained from the triangulation which forms the primary control of the surveys of the Atlantic Coast executed by the United States Coast and Geodetic Survey.

Of the work now in progress, the principal measurement is that of an arc of the ninety-eighth meridian west of Greenwich. This work is practically completed within the limits of the United States, and preparations are being made for its extension northward into Canada, and southward into Mexico.

The principal arcs measured in foreign countries are the Anglo-French meridional arc extending from the north of the British Isles southward through France and Spain into Africa; the great Russian meridional arc extending from the Arctic Ocean to the northern boundary of Turkey; the European latitudinal arc extending from the southern part of Ireland eastward into central Russia; and the great Indian meridional arc extending from the southern point of the Peninsula of India northward to the Himalayas.

The total length of all the arcs completely measured in all parts of the world during the modern period amounts to a little more than two-fifths of the girdle of the earth along a great circle.

The exact form of the earth as given by these measurements is such, that with considerable exactness all parallels of latitude are circles, and all meridional great circles are ellipses. The dimensions and form of the spheroid, or more properly, ellipsoid of revolution given by these coordinate circles and ellipses are usually stated in terms of its equatorial and polar radii, or diameters, and the two most notable computations of these dimensions are those made by Bessel in 1841, and those made by Clarke in 1866. The dimensions as determined by these computations and the compression values deduced therefrom, which are applied to all calculations in connection with modern geodetic work, and in the preparation of maps for exact surveys, are given in the table on the following page, both the Bessel and Clarke computations being given in meters and English statute miles.



	Bessel (Meters)	Clarke (Meters)	Bessel (English statute miles)	Clarke (English statute miles)
a. Equatorial Radius	6377397	6378206	3962.72	3963.23
b. Semipolar Axis....	6356079	6356584	3949.48	3949.79
Difference a—b .	21318	21022	13.25	13.44
Compression $\frac{a-b}{a}$..	$\frac{1}{299.12}$	$\frac{1}{295.00}$	1 statute mile = 5280 feet = 1609.347 meters.	

Both sets of dimensions very closely approximate to the truth, but the number of recent measurements is insufficient to determine which of the two is more nearly correct. It is quite probable that the true dimensions lie between the two. A very clear idea of the small amount of flattening at the poles indicated by the figures of either set may be had by constructing a globe approximately five feet in diameter. In order to represent the shape of the earth, the equatorial diameter of the globe will have to be made one-fifth of an inch longer than its polar diameter. The consequent distortion from a perfect sphere will be unappreciable to the eye unaided by the use of measuring instruments.

In the case of the earth itself the amount of distortion can be determined only by the use of the most delicate astronomical instruments, and by linear measurements with errors no greater than one in one million. See articles: GEODESY; MAP; and PROJECTION.

Geodetic Surveying. See SURVEYING.

Geoffrey (jĕf'ri) **of Mon'mouth** (called also GEOFFREY AP ARTHUR), English chronicler: b. probably at Monmouth about 1100; d. Llandaff 1152 or 1154. According to Leland he was educated at Monmouth, in a convent of the Benedictines, whose society he entered. He was afterward made archdeacon of Monmouth, whence he was, in 1152, raised to the bishopric of Saint Asaph. The state of affairs in North Wales induced him to retire to the court of Henry II. He wrote various works; but his 'Historia Regum Britanniæ' is his most important production. This is now known to be, as the compiler states, chiefly a translation from Armorican manuscripts discovered in Brittany by Walter Calenius, an archdeacon of Oxford. It contains a pretended genealogy of the kings of Britain from the time of the fabulous Brutus, or Brute, the Trojan, to the death of Cadwallader, king of Wessex, in 688. It was first printed by Ascenius, at Paris, in 1508. An English translation by Aaron Thompson, at London in 1718, was reprinted in Bohn's Antiquarian Library, 1848. We are indebted to Geoffrey for preserving, and perhaps reconstructing, the legends of Arthur and his knights, the exquisite fiction of Sabrina introduced into Milton's 'Masque of Comus,' the subject of Shakespeare's 'King Lear,' and many of the finest episodes in Drayton's 'Polyolbion.'

Geoffrin, Marie Thérèse Rodet, mä-rē tā-rēs rō-dā zhō-frăṅ, the holder of a noted Parisian literary salon: b. Paris 2 June 1669; d. there 6 Oct. 1777. By the grace and vivacity of her manners, aided by a refined and cultivated taste, she drew around her all the fashion, wit, and learning of Europe. Early left a widow, with an opulent fortune, her charities to the poor, and her benevolent aids to literature, endeared her as much to society as her wit and virtue delighted. In her house the best society in Paris was assembled. Cultivated minds of every description found access to her. None could there claim a preference: the mistress of the house herself was far from desiring any precedence; she was only amiable and animating. Three of her friends, Thomas, Morellet, and D'Alembert, dedicated particular writings to her memory, which, with her treatise, 'Sur la Conversation,' have been republished.

Geoffroy Saint Hilaire, Etienne, ā-tē-ĕn zhō-frwä săṅ-tē-lār, French naturalist: b. Etampes, France, 15 April 1772; d. Paris 19 June 1844. He was educated at the colleges of Navarre and Lemoine, and became a favorite pupil of Haüy. At the age of 21 he obtained the chair of zoology in the Parisian Jardin des Plantes. As a member of the Egyptian expedition in 1798 he founded the Institute of Cairo, and returned about the end of 1801 with a rich collection of zoological specimens. In 1807 he was made a member of the Institute, and in 1809 professor of zoology at the Faculty of Sciences. He devoted himself especially to the philosophy of natural history. Among his principal works are: 'The Principle of Unity in Organic Composition' (1828); 'Philosophy of Anatomy' (1822); 'Natural History of the Mammifers' (1819–37); 'Ideas of Natural Philosophy' (1838).

Geoffroy Saint Hilaire, Isidore, French physiologist and naturalist, son of the preceding: b. Paris 16 Dec. 1805; d. there 10 Nov. 1861. He devoted himself to natural history, and in 1824 was appointed assistant to his father at the Jardin des Plantes. He was elected to the Academy of Sciences in 1833, and afterward became successively inspector-general of the university, member of the council of instruction, and professor of zoology at the Academy of Sciences. One of his chief works, 'History of Anomalies of Organization in Man and the Animals' (1832–7), adds valuable confirmation to the theories of his father. He was the means of founding the Acclimatization Society of Paris. He paid much attention to the domestication of foreign animals in France, as appears from his treatise 'Domestication et Naturalisation des Animaux utiles' (1854), and advocated the use of horse flesh as food in his 'Lettres sur les substances alimentaires' (1856). He also published an excellent life of his father under the title 'Vie, Travaux, et Doctrine scientifique d'E. Geoffroy Saint Hilaire' (1848).

Geognosy, jē-ŏg'nō-sĭ, a name under which are included those branches of geology which have to do strictly with the elements of which the earth, the sea, and the air are composed, and their various combinations. Hence it more particularly deals with rocks and rock-forming materials, and embraces much that is included in the study of petrography (q.v.). See GEOLOGY.

Geographer of the United States. The Continental army in the Revolution had a geographer to make maps and plans; and on 4 May 1781 Thomas Hutchins (q.v.), a protégé of Franklin's, was on his recommendation appointed geographer to the Southern (Greene's) army. After the peace, Hutchins was retained as United States geographer, in connection with the surveys of the western lands ceded by the

States; the first official note of the office is in the draft of the general land bill reported 26 April 1785, where it is referred to as existing, and shortly afterward Hutchins is referred to as occupying it. He was to supervise the State surveyors appointed by Congress, suspend them if unsatisfactory, and report to Congress. He was reappointed in 1788, for two years, but died the next year.

Geograph'ical Conquests. The 3d century after the discovery of America drew to its close with a veil of darkness still shrouding half the globe from the eye of civilized man. A Strabo or a Ptolemy, if questioned in 1800 as to how much of the earth's surface he could describe with accuracy, would have had to confess that he was quite familiar with only one of the grand divisions, and that one embracing only a tithe of the land of our planet. He might perhaps have claimed that he could make a tolerable map of South America, whose interior had been partly opened up by the zeal of the Jesuit missionaries. It would, however, have been full of great voids representing regions unknown to him. He would have been able also to construct a map of Asia, approximately reproducing its main features, but his outlines would have been merely the framework of blurred and empty pictures. The Himalayas had not been measured — the Andes figuring as the highest mountains on the globe. There was a boundless area within the Chinese empire untrodden by Europeans. In Asiatic Turkey, Persia, and in Afghanistan, in Turkestan, and the Pamir, there were whole regions removed from the ken of cartographers. Scant information existed regarding Japan, Farther India, and the Malay Archipelago; next to nothing was known about Korea, and the interior of Arabia was almost a blank. Australia was still floating as a cloud on the horizon. Most of the lands north of America had not yet been discovered, and the Antarctic realm had barely been touched.

The accurate knowledge of Africa was limited in the main to a narrow strip along the coast. As for the interior, comprising about one fifth of the earth's land surface, geographical learning had hardly begun to outgrow its mediæval estate. Cartographers had been groping their way amid the confused reports of traders, slave dealers, and missionaries. The feature of Equatorial Africa regarding which the most correct conjecture had obtained for centuries, was the source of the Nile, which river, in accordance with the teachings of Ptolemy and the old Arab geographers, was represented on the maps as issuing from some lakes in the heart of the continent, fed by the Mountains of the Moon. Geographers knew of a great river that flowed by Timbuktu, the Queen of the Desert, and which they called the Niger, a name handed down from the time of the ancients. It had long been supposed that this stream had a western course and that the Senegal and Gambia formed its delta. A counter theory was that it flowed east to a large lake, a view based in part on vague reports about Lake Tchad. Still another theory regarded the Niger as one of the great arms of the Nile. The Kongo was known only in the last portion of its interminable course, though as far back as the 17th century the opinion had been entertained that it issued from the same quarter of the continent as the Nile. The Sahara remained untraveled by Europeans, except near its margin, and the great lakes of Africa were known only through tradition or vague report.

In North America, the region between the Mississippi and the Pacific and north of New Mexico still belonged in great part to the realm of fancy. British America remained in great part unexplored, and the coast of Alaska had barely been grazed. There were whole regions, like the Adirondack wilderness, included within the bounds of the original States of the American Union, which were still sealed to geographers.

Nearly 300 years after the tracing of the coast line of Africa was completed by the voyages of the Portuguese, the systematic exploration of the interior may be said to have commenced in 1788 with the foundation in London of the African Association, an event which inaugurated a new era in the history of geographical discovery. This society had the good fortune to command almost at the start the services of the intrepid Scotchman, Mungo Park. Before this, it is true, the pioneer of modern African exploration, Sir James Bruce, had made his memorable journey along the Blue Nile, and the ornithologist, Le Vallant, had traveled in the hunting grounds of South Africa. Just before we hear of Mungo Park, the record of discovery also tells of a narrow wedge driven toward the heart of the continent in the journey of Browne from Assuan to Darfur. The African Association assumed for one of its first tasks the unraveling of the mystery of the Niger. The journeys of Mungo Park (who perished in the stream in 1806), of Clapperton and Denham, and of Lander, covering together the period from 1795 to 1830, revealed the course of the river. The French, meanwhile, explored the Senegal and Gambia. At this time English explorers began to push from the Guinea coast into the warlike kingdoms of Ashanti and Dahoney. In 1826 the ill-fated Laing, and in 1828 Caillié, succeeded in reaching Timbuktu, that mysterious seat of Islamism which had for centuries fascinated geographers. (See Figs. 1 and 2.)

The close of the 18th century was the beginning of a new era in the annals of American exploration. The travels of Alexander von Humboldt between 1799 and 1804 in the basins of the Orinoco and Magdalena, and in the Andes and Mexican Cordilleras, mark an epoch in the history of geography and natural science. His work was taken up and extended to other regions, especially Brazil, by eminent naturalists like Maximilian of Wied, Spix, Martius, Auguste de Sainte-Hilaire, Orbigny, and Pöppig. These had worthy successors in the brothers Schomburgk (British Guiana), Darwin (Patagonia, Tierra del Fuego), Ave-Lallemant (Brazil), Tschudi (Andes, Brazil), Castelnau (Brazil, Bolivia, Peru), and Burmeister (Brazil, Argentina).

By the acquisition of the Louisiana territory in 1803 the United States came into possession of a boundless domain, in great part as far removed from the knowledge of white men as the heart of Africa. (See Figs. 5 and 6.) An exploring expedition was immediately sent into this *terra incognita* under Lewis and Clark, who proceeded up the valley of the Missouri, crossed the divide of the Rocky Mountains, and followed the Columbia down to the sea. The explorations of Pike, Long, Bonneville, Catlin, Nicollet, and Frémont, the opening of overland routes to Utah and California, and the government survey for a Pacific railway made deep rifts in the trans-Mississippi region; but its greatest wonders were to remain enshrouded till the tide of colonization had begun to sweep over the whole area. It was not till 1832 that the Mississippi river was traced to its source by Schoolcraft.

The exploration of the Arctic regions, in the hope of finding a north water route for the trade with the East, had lost much of its fascination by the 18th century. Russia alone prosecuted it systematically in the course of that century, accomplishing a great work in tracing the coast line of Siberia. About the beginning of the 19th century the idea of a Northwest Passage was revived in England and the dream of reaching the pole began to be entertained. (See FIGS. 3 and 4) A great and persistent onslaught on the frozen North was inaugurated in 1818. The labyrinth of islands, peninsulas, and ice-bound passages north of the American continent yielded up its intricacies to the assaults of Parry, the two Rosses, Sir John Franklin (to whose tragic end Arctic discovery owed much of its rapid progress), McClure, Kane, McClintock, and Hayes. The exploration of Arctic British America was prosecuted on land with heroic energy by Franklin, Back, Richardson, Beechey, Dease, Simpson, and Rae. Parry in an attempt to reach the pole in 1827 dragged his sledges over the floating ice fields to the parallel of 82° 45', eclipsing all previous records by more than a degree of latitude. In 1831 James Clark Ross solved the mystery of the position of the north magnetic pole, which he located in the peninsula of Boothia. McClure entered the Arctic Ocean through Bering Strait in 1850, proceeded east, was beset for years in the ice, joined hands in 1854 with an expedition which had come in the opposite direction, and thus carried off the laurels of the Northwest Passage. While a great breach was being made in the Arctic fastnesses, Bellingshausen, Weddell, Dumont d'Urville, Sir J. C. Ross, Wilkes, and others extended geographical discovery into the Antarctic regions. Ross discovered Victoria Land, with its active volcanoes, and in 1842 advanced beyond the 78th parallel. During this same period the cruel depths of Australia, whose coast had been explored by Flinders in 1801-3, were invaded by Sturt, Eyre, and the ill-fated Leichhardt.

A flood of light was thrown on the geography of Northern and Central Asia in the first half of the 19th century by the journeys of Ermann, Humboldt, Middendorf, Huc (who entered Lhassa, the holy city of Tibet), and others; while men like Webb, Moorcroft, and Wood scaled the heights of the Himalayas and the Pamir, and reached the head streams of the Indus, Ganges, and Amu Daria. From 1848 Mount Everest, with the 29,002 feet given to it by the trigonometrical measurement of Sir Andrew Waugh, figured as the highest point on the globe. Among the naturalists who were attracted to the Himalayas, the name of the botanist Hooker stands pre-eminent. The most distinguished traveler in southwestern Asia in the early part of the century was Burckhardt, who succeeded in entering the holy places of Mecca and Medina. In 1829 Ararat was ascended by Parrot. In 1832-3 Alexander Burnes performed his famous ride from India to Bokhara. The travels of Crawfurd and MacLeod in the second quarter of the century dispelled in part the obscurity hanging over farther India. Between 1835 and 1849 the naturalist Junghuhn explored Java and parts of Sumatra. Among his successors in the Malay Archipelago were St. John and Wallace.

Down to the time of the French Revolution, Europe had hardly dared to cast a covetous eye on the interior of Africa. Portugal, England, and France held sway at a few stations along the coast. The sturdy Boers near the Cape of Good Hope, alone represented actual colonization by Europeans. The Revolution brought in its train Bonaparte's conquest of Egypt, the first great onslaught on African territory on the part of Christendom in modern times. The consequences of the French domination, brief as it was, were far-reaching in the loosening of Turkey's hold upon that country. Another result of the wars of the Revolution was the supplanting of Dutch dominion at the Cape by that of England. An army of ardent missionaries now made their way into the interior of South Africa. While England was laying the foundations of an empire at this end of Africa, France suddenly invaded the north and conquered Algeria (1830-48). A few years before this invasion, Mehemet Ali, viceroy of Egypt, brought Nubia and Kordofan under his sway. This ambitious potentate, who, for the first time since the days of Saladin, made the aggressive power of Africa felt in another continent, in his role of modernizer of Egypt, sent various scientific expeditions to explore the Nile, which was now traced almost to the equator. To this period of African exploration belong the travels of Rüppell, the brothers Abbadie, Beke, and Krapf in Abyssinia.

With the middle of the 19th century commences an extraordinary era in the history of geographical discovery. The world begins to close in upon the dark interior of Africa which is assailed on every side, and in the course of a generation the great features of the continent are unfolded almost in their entirety. In 1847 the German missionaries Krapf and Rebmann discovered the snow-capped peaks of Kilima-Njaro and Kenia, near the equator. In 1849 Livingstone discovered Lake Ngami, in the heart of South Africa, at a distance of 1,000 miles from Cape Town. In the course of the next seven years he extended his explorations to the Upper Zambesi, of which mighty stream hardly anything had hitherto been known, followed it up, struck out west along the edge of the Kongo basin (a circumstance unknown to him), made his way to the Portuguese possessions on the Atlantic, then, turning back, followed the Zambesi down stream, discovered the Victoria Falls, the rival of Niagara, and came to the shores of the Indian Ocean. While Livingstone was drawing a luminous trail across South Africa from sea to sea, Heinrich Barth was lifting the veil from the depths of the continent on the other side of the equator by his extraordinary journeys in the west half of the Sudan. In the sixth and seventh decades of the century large accessions were made to the knowledge of the

FIG. 1.—Africa as known in 1800. The darkened portions in this and succeeding maps show the unexplored areas

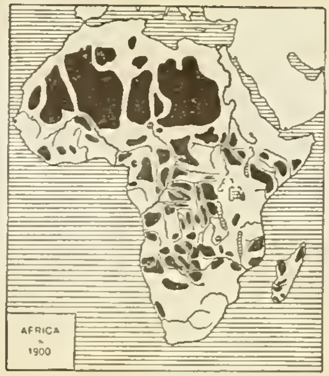


FIG. 2.—Africa as known in 1900

FIG. 3.—Arctic Regions as known in 1800

FIG. 4.—Arctic Regions as known in 1900

FIG. 5.—North America as known in 1800

FIG. 6.—North America as known in 1900

Nile basin and the surrounding regions, including Abyssinia, by the travels of Petherick (who explored the basin of the Bahr-el-Gazal), Munzinger, Beurmann, Heuglin, and others. In the meanwhile the French were pushing into West Africa on the side of Senegambia, Du Chaillu traveled in the country back of the Gabun and through the wilds of the Ogowe, the home of the gorilla and the pygmy Obongo; Burton scaled the peak of Kamerun, and Von der Decken explored what is now British East Africa.

Just as Barth was emerging from the scorching suns of Central Africa, laden with the knowledge of countless peoples, in another continent three equally intrepid Germans proceeded to explore the most elevated region of the globe. The brothers Schlagintweit crossed the Himalayas and the Karakoram, traversed the lofty plateau of Tibet, and surmounted the Kuenlun, reaching heights to which no traveler had ever climbed.

Soon after Livingstone's traverse of South Africa, the beginning was made of those discoveries which unraveled the most interesting problem presented by the geography of that continent. In 1858 Burton and Speke, despatched by the Royal Geographical Society in quest of a great reservoir of fresh water which was believed to exist somewhere in the region whence the Nile issued, discovered Lake Tanganyika. Before the close of that year, Speke discovered a still larger lake, the Ukerewe, or Victoria Nyanza, which he assumed to be a reservoir of the Nile, though as yet its outlet remained to be found. To what river system, if any, Lake Tanganyika belonged was a problem which was to wait still many years for a final solution. In 1859 Livingstone came to the shores of a third great lake, the Nyassa, a feeder of the Zambesi. Within the next five years the question of the sources of the Nile was approximately settled by the explorations of Speke, Grant, and Baker. The last named, ascending the river from Egypt in 1864, discovered the lowest of the Nile reservoirs, the Mwutan Nzige, or Albert Nyanza. What Ptolemy had laid down on his famous map 1,700 years before was found to be substantially correct, and the discovery later on of snow-clad mountains near the Albert Nyanza, culminating in Ruwenzori, substantiated what the Greek had taught regarding the Mountains of the Moon.

The problem of the Nile was closely interwoven with that of the Kongo, the greatest mystery that still confronted geographers outside of those presented by the polar regions. The Nile question, indeed, could not be regarded as completely settled till the watershed between the two rivers had been determined. Of the Kongo basin, equal in extent to that of the Mississippi, but a mere fraction was known to the world. A boundless maze of tropical forests and rivers had thus far escaped the eye of Europeans. Geographers were not even agreed as to whether the Kongo issued from the heart of the continent or whether it was not rather in the nature of a coast river. Livingstone applied himself with heroic resolution to the task of ascertaining the parting of the waters that found their way to the Mediterranean and those that flowed toward the Atlantic. In 1867–8 he discovered the Chapula, the east head stream of the Kongo, and its two large reservoirs, Mweru and Bangweolo, and in 1871 stood on the banks of the great river that hurries past Nyangwe, but not possessed of the information that would assure him beyond doubt that it could be no other than the Kongo.

During these years wide explorations were made in Central Africa, north of the equator, by Rohlfs, Nachtigal, and Schweinfurth. Nachtigal, a worthy successor of Heinrich Barth, succeeded in making his way into Wadai, a Mohammedan state in Sudan, a goal the pursuit of which had cost the lives of two eminent explorers, Vogel (1856) and Beurmann (1863). Schweinfurth penetrated into the cannibal regions west of the equatorial Nile, and in 1871 came to the Welle, whose west course convinced him that he had traveled beyond the bounds of the Nile.

These journeys were coincident with a remarkable epoch in the geographical annals of America. The explorations of Dall revealed the extent of the Yukon; the mountain systems of the West were explored by Wheeler, Whitney, and Hayden; Powell discovered the grand cañon of the Colorado; Washburne and Hayden made known the marvels of the Yellowstone. The knowledge of British America was at this time greatly extended by the travels of Bell, Selwyn, Dawson, and others. Simultaneously with the exploration of the mountains of North America, the geological structure of the Andes was laid bare by Reiss and Stübel, who ascended the volcano of Cotopaxi to its summit.

While the rest of the world was engaged in prying open the recesses of the continents, the Russians were displaying extraordinary activity in the exploration of their vast Asiatic domain and the regions bordering on it. In the first 15 years of the reign of Alexander II., Semyenov, Valikhanov, Radlov, Ostensacken, Syevertsov, Fedtchenko, and Kaulbars assailed that mighty mountain barrier composed of the Altai, Alatau, Tian-Shan, Alai Tagh, and the Pamir, which shuts off the elevated desert region of Central Asia from the plains of western Turkestan and Siberia. During the same period Shishmarev, Mattussovski, and Pavlinov penetrated into Mongolia, and Palladius into Manchuria. The Russian advance into Central Asiatic highlands met with a prompt response from beyond the Himalayas, whence Hayward, Shaw, and Forsyth pushed into eastern Turkestan, while the pundit Nain Singh made a memorable traverse of Tibet.

When Japan and China, soon after the middle of the 19th century, opened their portals to the world, the work of exploration, previously inaugurated by dauntless missionaries and naturalists, proceeded with a new impetus. Great journeys were made in China by Blakiston, Pumpelly, Ney, Elias, Bastian, Cooper, and Richthofen, who belong to the foremost ranks of Asiatic explorers. In the decade beginning with 1861 explorations were made in the Caucasus, by Radde, in northern Arabia by Palgrave, and in Turkestan by Vámbéry and Lagrée, and Garnier traced the course of the Mekong as far up as the Chinese province of Yunnan. Contemporaneous with these travels were the remarkable journeys performed in Australia by Burke and Willis, MacKinlay, Stuart, and Forrest, whose exploits were emulated by Giles and Warburton.

The year 1871 is memorable in the history of geographical discovery for the dramatic episode of the finding of Livingstone by Stanley. The meeting by the waters of Tanganyika was followed by the exploration of the north end of the lake which was found to have no outlet in that direction. Livingstone then returned to the scene of his recent labors, the Luapula-Lualaba basin. On 1 May 1873, he expired on the shores of Lake Bangweolo, which he had discovered and which he had become convinced belonged to the Kongo system. In 1874 Cameron discovered that Lake Tanganyika was connected by an outlet, the sluggish Lukuga, with the river formed by the Lualaba and Luapula. This river (which Livingstone had reached in 1871 at Nyangwe) was found by Cameron to flow at too low a level to admit of its belonging to the Nile system. This fearless traveler was prevented by the hostility of the natives from descending the stream and verifying his belief that it was the Kongo. It was reserved for the dauntless spirit of Stanley to bring the mightiest of African rivers within the ken of mankind. In November 1876 he embarked at Nyangwe in a fleet of canoes, and performing an unprecedented voyage which twice carried him across the equator, he reached the tides of the Atlantic in August 1877. And now came the great task of exploring the Kongo tributaries, which enlisted the energies of Stanley, Capello and Ivens, Buchner, Pogge, Wissman, Grenfell, Wolf, Brückner, and Van Gèle.

While the veil was being lifted in this quarter, new light was thrown on the regions west of the Upper Nile by the travels of Junker, Casati, Gessi, and Lupton, the country between the Ukerewe and the coast was opened up by Fischer, Thomson, and Johnston, the naturalist Emil Holub traveled in the Zambesi region, and the explorations of Brazza between the Ogowe and the Kongo laid the foundations of a new French colony. Between 1878 and 1881 Serpa Pinto made his traverse of South Africa, Oskar Lenz performed a journey from Tangier to Timbuktu and thence to the Senegal, and Matteuci crossed from Egypt to the Gulf of Guinea. At this time began the extraordinary career of Emin Bey (Eduard Schnitzer), administrator, explorer, naturalist, and linguist, in the region of the equatorial Nile. This heroic commander, the peer of the great Gordon, was cut off for years from the world by the Mahdist uprising, till at last Stanley succeeded in reaching him by way of the Kongo and Aruwimi, an exploit which recalled the days of the Conquistadores. In 1887 the Rudolf lake was discovered by Teleki. In 1889 Meyer reached the summit of Kilima-Njaro.

During the years which revealed the sources of Africa's greatest rivers the exploration of the mighty tributaries of the Amazon was prosecuted by Chandless. A little later Crevaux won laurels in the same field, and to him succeeded Karl von den Steinen and Ehrenreich.

The decade which witnessed the solution of the Kongo problem, the last great mystery that had remained hanging over the equatorial zone, was marked by renewed activity in Arctic research. The passage leading north from Baffin Bay, beginning with Smith Sound, appeared to promise access to an open polar sea, the theory of whose existence had been put forth by Kane. The American expedition under Capt. Hall in 1871 proceeded up this channel, and the splendidly equipped British expedition under Sir George Nares in 1875 followed in its wake; but Kane's theory was not verified. Some of Nares' men in 1876 reached the parallel of 83° 20', eclipsing Parry's record by more than half a degree. Lieut. Lockwood of the ill-starred Greely scientific mission in 1883 made a farther gain of four minutes. In 1873 the Austrian expedition of Weyprecht and Payer discovered Franz-Josef Land. In 1878-9 Nordenskjöld immortalized himself by accomplishing the Northeast Passage.

While Stanley and his successors were opening up the exuberant forest realm of Equatorial Africa, the arid expanse of Central Asia, stretching from the Pamir on the west to the highlands of Manchuria on the east, and embracing the desert of Gobi (Shamo), the Tarim basin, with the Takla Makan desert, and the ranges of the Tian-Shan, Kuenlun, Altyn Tagh, and Nan-Shan, was attracting the most intrepid explorers from all parts of the world. This illustrious roll includes the great Przhevalski (whose name is borne by the former town of Karakol, in Turkestan, where he died in 1888); Sosnovski, Mushketov, Kostyenko, Potanin, Regel, the pundit Krishna (who removed the long-existing doubt regarding the identity of the Sanpo and Brahmaputra), Pyevtsov, Bell, Bogdanovitch, Roborovski, Carey, the brothers Grum-Grzhimailo, Rockhill, Younghusband, Bonvalot, and Henry of Orleans. These had distinguished successors in the last decade of the century in Dutreuil de Rhins, Littledale, the young Swedish geologist Sven Hedin, Obrutchev, Futterer, Holderer, and Deasy. Among the host of ardent explorers who have traveled in China since 1875 are Sosnovski, Baber, Gill, Széchényi (son of the great Hungarian patriot, Count Stephen Széchényi), Kreitner, Easton, Hosie, Colquhoun, Henry, and Younghusband. It is only since 1880 that the geography of Korea has emerged from its obscurity.

In the last quarter of the 19th century the dimensions of the unknown in Alaska, the Northwest Territories, and Labrador were vastly reduced by the explorations of Muir, Allen, Schwatka, Dawson, Ogilvie, Russell, Low, and others. In 1888 the first crossing of Greenland's great ice cap (in its southern part) was accomplished by Nansen. In 1892 Peary and Astrup made a sledge journey of more than 1,000 miles over the northern end, and determined the extension of the island in that direction. In 1893-5 the gap between the North Pole and the highest latitude ever before reached (Lockwood's 83° 24' in 1883) was bridged almost half over by Nansen's drift voyage and sledge journey, which carried him to the parallel of 86° 14'. This record was eclipsed in 1900 by the expedition of the Duke of Abruzzi, which reached 86° 33'. The results of these expeditions render it improbable that any extensive land mass remains undiscovered within the Arctic Circle. As the physical conditions prevailing at the North Pole cannot be materially different from those observed in the near vicinity, the reaching of the pole itself may now be regarded as a goal belonging to the realm of adventure rather than to that of scientific discovery.

In the same year in which Peary and Astrup crossed the fathomless ice cap of Greenland the gigantic glaciers of the Karakoram were explored by Sir William Martin Conway, who climbed to an elevation of about 23,000 feet, eclipsing the record of all former travelers. In 1897 Aconcagua, probably the loftiest peak of the Andes, was scaled to its summit by Zurbriggen, the Swiss guide, and Vines, the geologist of Fitzgerald's expedition, the elevation obtained for it by barometric measurement being 23,080 feet. In 1898 Conway accomplished the ascent of Illimani, one of the rivals of Aconcagua.

At the close of the 19th century the attention of the world was once more turned, after a long interval, to the Antarctic regions. The British expedition under Borchgrevink succeeded in locating the south magnetic pole, and attained to the parallel of 78° 50', surpassing by 40' the "farthest south" achieved by Ross in 1842. Within the Antarctic Circle remains by far the greatest unknown area on the globe. Outside of the polar realms the physical map of our planet, barring minor details, is nearly complete. When the 19th century opened, geographical science had half a world to conquer. At its close this conquest may be said to have been well-nigh achieved.

Geographical Distribution of Animals. It is a familiar fact that certain kinds of animals dwell in very limited districts, others in larger areas, perhaps throughout a whole continent; but that any considerable change in one's location on the face of the earth brings him into contact with a more or less different fauna. This is the more certain and conspicuous if a sea or mountain range or desert intervene between the two points of observation. In general it is plain that species of animals of all sorts have, as a rule, a comparatively limited habitat; genera often a more extended one; while the higher groups may have a wide or even cosmopolitan range. These areas of life for similar animals are more likely to spread in directions of latitude than of longitude, so that the northern hemisphere (*Arctagæa*) is more different faunistically on the whole from the southern one (*Notogæa*) than are, for example, Europe and the United States. The science which deals with the causes and principles of this body of facts is called Zoogeography, under which head the subject is considered in detail.

Geographical Societies are associations formed with the view of obtaining and disseminating geographical knowledge. This is attained, in the first instance, by members undertaking distant travels, at their own expense in some cases, in others assisted by the funds of the society or grants from government; and, in the second instance, by lectures delivered and works issued under the auspices of the society, or by papers read and commented on at the periodical meetings. In point of seniority the first of these associations is the Société de Géographie of Paris, founded in 1821. The German Gesellschaft für Erdkunde held its first sittings in Berlin in 1828, under the presidency of Ritter, and has counted among its members many of the most famous of modern geographers. By far the most important of these institutions, however, is the Royal Geographical Society, established in London in 1830. The principal travelers and geographers of Great Britain, or indeed of the world, are or have been connected with this society, and such names as those of Livingstone, Burton, Baker, Speke, Barth, Wallace, Cameron, Stanley, Thomson, Johnston, Bent, Curzon, Markham, Nansen, and many other well-known travelers, are to be found attached to papers in its 'Journal' (1831–80, 50 vols.) and 'Proceedings' (ceased in 1892), or in the 'Geographical Journal,' which it has issued since 1893 in monthly parts, and which includes the society's proceedings. It has a capital of $200,000, and large sums are devoted annually to aid the cause of geographical research, or as awards and recognition of services rendered to the science. The Russian Geographical Society, founded at St. Petersburg in 1845, has greatly extended our knowledge of Central Asia and Asiatic Russia. Following the lead of other nations, Italy has her Società Geografica, founded at Florence in 1867, and issuing an annual 'Bollettino.' The American Geographical Society (q.v.) was founded at New York in 1852. The Royal Scottish Geographical Society was founded in 1884. It publishes an excellent monthly magazine, and its members number between 1,500 and 1,600. The Royal Geographical Society has a membership of between 3,000 and 4,000.

Geographical Society of Baltimore, organized in 1902 for the study of geographical science. It acquired over 1,000 members during the first year of its existence. Daniel C. Gilman was the first president of the Society.

Geographical Society, The American, a society established in 1852 to encourage geographical exploration and discovery and to disseminate new geographical information. See AMERICAN GEOGRAPHICAL SOCIETY.

Geographical Society, The National, an American organization with headquarters at Washington, D. C. It was formed in 1888, and offers annual lecture courses in Washington upon popular geographical subjects. The 'National Geographic Magazine' is published monthly by the Society, which had 3,000 members in 1902.

Geographical Society of Philadelphia was organized in 1891, and in 1893 a charter was granted to the Geographical Club of Philadelphia, of which Angelo Heilprin was the first president. The present title was resumed in 1897. The Society confers annually the Elisha Kent Kane gold medal, as a reward for geographical work. In 1902 the Society had 430 members.

Geographical Society, Royal, was founded at London in 1830 to aid in scientific research in geography, and received a charter in 1859. It has published numerous papers, books, and magazines, and expended large sums of money to encourage research. See GEOGRAPHICAL SOCIETIES.

Geography, by derivation, means "description of the earth." Humboldt's interpretation, which, beyond the gathering of data for mapping the topographical and drainage features of a region, added a study of meteorological and climatic conditions, of the character of soils, and of the distribution of life both animal and vegetable, was the first true impulse given to modern geographical research. For a comprehensive knowledge of the earth the aid of all branches of natural science is sought. Geography, while it is specifically the science or knowledge of the earth, is dealing with phenomena and studying laws which belong to the universe. One of its important functions is the investigation of the reciprocal relations existing between man and his physical surroundings. The average text-books have fallen far below such a standard. Cartography and statistics form the sum and substance of these treatises. Maps constitute an essential feature of geography, but are commonly read with less intelligence than the working drawings of an engineer or architect. Lists of cities with their populations, and the names of rivers, bays, mountains and islands are of great value in the way of information, but they are of secondary importance. It concerns the student of geography less to know that New York is a city of three millions and a half of inhabitants and the greatest seaport of America than to discover the causes which have led to such growth and development. The physical or social reasons for the fixing of political boundaries are of greater interest than the mere location of or changes in the boundaries themselves. Happily a change for the better may be observed. The recognition some years ago of the scientific and practical value of geography by German scholars, and the systematic work done by them have already borne fruit. Departments of geography have been established in universities and higher institutions of learning. Geographical societies have been organized in all the leading countries of the world, and a broader interest in the subject has been aroused.

Historical.— When Columbus (q.v.) made his first voyage of discovery, popular belief maintained that the earth was flat, though the scholars of the time recognized its spherical form. The first people to add to a knowledge of distant lands were the Phœnicians. They had founded colonies as early as 1200 B.C., and exerted much influence upon the progress of civilization. Herodotus, the father of history and geography, and himself a great traveler, records a Phœnician expedition in the 7th century B.C., which, staring from the Red Sea, returned by way of the Pillars of Hercules and the Mediterranean, having circumnavigated Africa. While the story has been doubted, the incidents of the narrative give it much color of probability. Herodotus leaves an account of the conception of the earth's extent in the 4th century B.C. The scanty knowledge of the time comprised the coast regions of the Mediterranean Sea extending vaguely to the north and south, with the Atlantic Ocean and the Persian empire constituting the western and eastern boundaries. Strabo's voluminous work on geography, at the dawn of the Christian era, itself a valuable treatise, is of special importance in affording a glimpse of the efforts of earlier geographers, whose books are lost. Eratosthenes, the most remarkable of these scholars, made wonderful advances in mathematics and astronomy. He measured the obliquity of the ecliptic, described the earth as a sphere revolving on its own axis, and constructed maps with parallels of latitude and longitude. Beyond influencing the belief of a few learned contemporaries, his work was practically unavailing. Ptolemy, who lived in the 2d century A.D., was the supreme authority in astronomy and geography, not only in his own time, but during the Middle Ages. In accordance with his system, which was really a compilation of the views of earlier writers, the centre of the universe was the earth, around which the various heavenly bodies revolved. The travels of Marco Polo in the 14th century and the introduction of the mariners' compass were instrumental in changing the whole history of the human race. See EXPLORATION.

Though the knowledge of our world progressed by leaps and bounds, it is interesting to note what a large proportion of that knowledge has been the result of modern investigation. Explorers on the sea had by the end of the 18th century become familiar with the range of the ocean, the outline of the continents and many islands, but at the beginning of the 19th century four fifths of the land area were unknown. Africa, with the exception of a narrow rim of coast, was indeed a "Dark Continent." Little had been added to our knowledge of Asia since the days of Marco Polo. West of the Mississippi, North America was a *terra incognita*, and the existence of the Rocky Mountains was not suspected. Even the coast of Australia was not completely traced, and nothing had been learned of its interior. South America, which was better known than any continent except Europe, is now the least explored of all the large land masses. With the advent of the 20th century scarcely one eleventh of the land surface remains unexplored. Excepting a few interior tracts, the only portions yet unconquered lie around the North and South Poles, and these are rapidly yielding to persistent effort.

While the unity of geography should never be overlooked, the subject is commonly divided into different branches, the chief of which are mathematical, physical, and political geography.

Mathematical Geography considers the earth as a globe, with its motions and their effects, and teaches the methods of representing the whole or portions of the earth's surface on globes or maps. Observation and careful measurements have proved the earth to be spheroidal in shape. As it is flattened at the poles, it is not a perfect sphere, nor even a perfect ellipsoid, but a ball with slight irregularities of surface. Its longest diameter is 7,926.6 miles, and its shortest 7,899.6 miles. The circumference is approximately 24,000 miles.

The axis of rotation of the earth is its shortest diameter. The ends of the axis point to opposite parts of the sky, and these, called the poles of the heavens, seem to stand still while the rotation of the earth causes an apparent revolution of the sky from east to west. The whole system of determining position and direction is established by the earth's rotation. The great circle midway between the poles is the equator. Great circles extending north and south through the poles are meridian circles. Distance from the equator toward either pole is called latitude, and is measured along a meridian. Zero is at the equator, and the quarter circle north or south is divided into 90°. Small circles parallel with the equator are parallels of latitude. The equator and parallels are continually moving from west to east, and the meridians, which cross them at right angles, are carried in succession directly beneath the sun. All points on any meridian turn around the axis at the same rate, but the actual distance traversed varies from nothing at the poles to more than 1,000 miles per hour at the equator. The uniform rotation of the earth provides a means of measuring time. The sun crosses the meridian or midday line of any place midway between the hours of rising and setting, and the interval between 2 successive noons is called a day, which is divided into 24 equal parts or hours. It is always noon on some meridian, but never on more than one at the same instant. As a complete rotation through 360° occupies 24 hours, meridians 15° apart vary one hour in local time. A person traveling toward the east completely around the world gains a day, but if he make the same journey in a westerly direction he loses a day. Distance east or west is measured on the equator or a parallel, and is called longitude. Some prime meridian, usually that of Greenwich, is the zero, and measurements are made 180° east and west. The length of a degree of latitude is a little more than 69 miles, but as the meridians converge toward the poles, degrees of longitude diminish in length as the distance from the equator increases. If the latitude and longitude are unknown, the former is determined by observing the altitude of the pole of the heavens, while the latter is obtained by comparing, with the aid of a chronometer, the exact moment at which the sun crosses the meridian with the local time of the prime meridian at the same instant. Tables, showing the relative positions of heavenly bodies for each day in the year, are calculated in advance and enable captains of vessels to find their position at sea. See EARTH.

The imaginary network of meridians and parallels can be actually drawn upon a globe. The outline of the continents and the location of places may thus be depicted with great accuracy. A map is much more convenient than a globe, but, as the surface of a sphere cannot be spread out flat, no map is ever absolutely correct. Various projections are employed to modify the distortion. Mercator's projection, and others similar in plan, are modifications of the result obtained by drawing lines from the centre of a sphere through the parallels and meridians to the surface of a cylinder touching the sphere at the equator. This style of projection is employed for navigators' charts, for while areas are distorted, a straight line drawn between any two points correctly represents direction. Several hemispherical projections upon a flat background are used. These, though approximately preserving dimensions, distort directions. For limited areas the conical projection is of value. The meridians and parallels appear as they would if traced on a transparent cone placed on the globe.

Physical Geography deals with the earth in its relation to nature. The surface is irregular, the hollows being filled with water, and the projecting parts forming the dry land. It is surrounded by a gaseous envelope. The solid portion is often called the geosphere or lithosphere; the liquid layer, the hydrosphere; and the outer mantle, the atmosphere. See AIR; ATMOSPHERE; VAPOR.

The earth is believed to be a cooling and contracting body. With a reduction in size the outer crust becomes wrinkled. The crests of these wrinkles protrude above the water, which fills the troughs. Though many changes have affected these ridges and furrows, the general arrangement of the elevated and depressed portions of the earth is believed to have been nearly permanent. Without altering the relative positions of the exposed land masses and the oceanic basins, a comparatively slight increase in the depth of the latter would cause more land to be uncovered. Or were the bed of the ocean to be raised slightly, the sea would flow over the coast regions and accessible low-lying valleys. Were the solid crust uniformly smooth, it would be completely drowned by a continuous sea about two miles in depth.

By the present arrangement, the land area constitutes 28 per cent of the surface. The ocean covers about 72 per cent, but by evaporation and condensation, some of the water is distributed over the continents to be retained in lakes or returned to the sea by rivers. Though special names are given to different portions of the ocean, it is a continuous body of water.

The surface temperature of the ocean varies with the latitude. Ice floes and icebergs form in the polar seas, while an average temperature of 80° is maintained in the tropical ocean. The daily or seasonal range is not great in any latitude. Even in the tropics heat does not extend far below the surface, and the ocean as a whole is a mass of cold water.

The amount of dissolved salts in sea water averages 3.5 per cent. The salinity is not uniform, as portions are regularly freshened. These are chiefly the belts of equatorial rains, the regions affected by the melting ice of the polar seas, and those near coasts receiving the drainage of large land areas. As heat expands sea water, thus reducing its density, it generally happens that the surface water is salter than the colder layers below. The distribution of heat and the modification of climate effected by ocean currents is of vast importance. Nearly half the sun's heat in the Torrid Zone is carried to higher latitudes. The Arctic regions receive more heat from the Gulf Stream than they do directly from the sun. The western coast of Europe from the North Cape to Gibraltar has a climate much warmer than that of the opposite coast of North America, and this work of the Gulf Stream is in a measure duplicated on the western coast of North America by the Japan current. Cold currents from the southern ocean soften the climate of the western tropical coasts of Africa and South America. If the water completely covered the earth, a double wave caused by the attraction of the moon would, on account of the earth's rotation, travel around the globe every day. This ideal arrangement of tides is not realized except in the southern ocean, and, with a general movement to the west, the tidal wave is deflected northward in the other oceans.

In determining the height of mountains or any part of the land surface, it is necessary to have some common level as a basis of comparison. For this purpose the surface of the sea has been chosen, but on account of the many movements to which the ocean is subjected and because of the attraction exerted by elevated land masses, its surface is not level, and all comparative heights are of doubtful value. Efforts have been made to determine the mean level of the whole surface. While much has yet to be accomplished in securing the requisite data, it has been quite clearly shown that such a line lies about 10,000 feet below present sea-level. The abysmal area below this line is of equal extent with the area above it. As the exposed continental area occupies 28 per cent of the earth's surface, it follows that 22 per cent is covered by water less than 10,000 feet in depth. Quite a large part of this region slopes gently away from the coast line to a depth of 100 fathoms, forming the continental shelf. The area of this submerged shelf is very nearly the same as that of the low costal plains of which it is a continuation. Were the level of the sea to be reduced 600 feet, 10,000,000 square miles would be added to the land area, and the present exposed surface would sustain a loss somewhat greater were the sea to rise an equal amount. The proportion of land is much greater in the northern than in the southern hemisphere, and the large land masses have their greatest width in the north.

The destructive agencies are so active that in a short time all the land would disappear and be distributed over the bed of the ocean, were it not for the upheavals due to the contraction of the crust. From causes, concerning which all geologists do not agree, lines of weakness are developed, and portions of the crust are forced up into mountain ranges or broad plateaus, while other adjacent portions are depressed. The outer rocks or those forming the slopes of a young mountain range are composed of the sediment of older rocks. They are the result of processes of destruction and reconstruction, which are to be at once renewed. For no sooner are new areas exposed than the sun either by direct heat, or through the agency of wind, frost, rain, or running water, proceeds to carve the surface into new forms, carrying away the waste to cover the rocks with soil for the support of vegetation or to fill up the hollows of the sea. Rain not only attacks the rocks by force of impact and solution, but by moving broken fragments from higher to lower levels it uses them as cutting tools. The surface water and that flowing from springs form little streams, which uniting produce rivers. In its upper course, which is the steepest, the work of a stream is purely destructive. It is cutting a gorge or valley in the high land. As the slope becomes more gradual, it is alternately depositing its load of stones and gravel or sweeping them away to some lower point. In its final stretch through a nearly level area it is building up an alluvial plain. Deltas and many interior valleys, like that of the Mississippi, are thus formed. Rivers carry away immense quantities of solid material, and are continually cutting down or extending their basins. The tendency of river work is to reduce the land to a dead level, and a subdued surface is usually an indication of old age.

Relief, or the vertical aspect of a land area, is the result of the forces of upheaval and erosion, which are continually at work. The arrangement of mountains, plateaus and valleys varies in the different continents, and upon the arrangement, climate, the possibilities of development, and the history of a country largely depend. The principal mountain ranges are, however, so disposed that all of the large drainage areas are tributary to the Atlantic Ocean or its arms. Asia, the largest continent, has the greatest average elevation and the highest point of land.

The many changes in the inorganic world profoundly affect the organic world and the distribution of life. In turn, the very processes of nature are largely influenced by living organisms. The spread of any species, animal or vegetable, is promoted or retarded by such geographical features as oceans, mountains, plains, deserts, and climate, but marine animals, by withdrawing dissolved carbonate of lime from the sea water, have constructed mountains of limestone, and vegetation retards the work of denudation, regulates rainfall and modifies the rate of evaporation. Plants alone are able to construct organic from inorganic material, and animal life is dependent directly or indirectly upon plants for food.

All plants and animals are adapted to certain environments and could not live if the essential conditions were changed, but every form of life does not of necessity reach every region suited to it. Natives of one country when carried to another frequently develop with amazing rapidity, even to the extent of crowding out indigenous species. In the tropics, the forests contain a variety of forms, and the large animals live singly or in families. In the temperate zones many plants and animals for mutual protection are gregarious. Forests often contain only one kind of tree, and the variety is never great. Grasses do not grow singly as in hot climates, but form a sod. Animals move in herds and fish in shoals.

Natural distribution has been greatly modified by man. In some regions the large land animals have been exterminated, and vast forest tracts have been removed. Domestic animals and cultivated plants have replaced the native species. Man alone of living creatures is able to rise superior to his environment, to conquer and control adverse geographical conditions. This faculty is acquired, and is the result of long development. Primitive man was undoubtedly as helpless as other animals. The same sort of barriers that retard the migration of species, have also affected the growth of nations, and no thorough conception of history, which is a record of man's development, can overlook the fundamental importance of geography. It was not until the barriers were broken down and until isolation gave way to intercourse with other peoples that civilization made safe and permanent advances.

Political Geography deals merely with the distribution of the human race in different communities, but an intelligent study of the boundaries of states involves an acquaintance with natural geographical conditions and the history of the inhabitants. It has been proposed to divide history into three periods. The first, known as the Fluvial, includes the growth of nations developing in fertile river deltas, with such scanty means of intercourse as the streams afforded. The Mesopotamian nations of Assyria and Babylon, the Egyptians, and the Hindus, are well-known examples. As the sailor became more venturesome, and skirted the shores of large inland seas, the Mediterranean period succeeded the Fluvial. Columbus and Vasco da Gama inaugurated the last, or the Oceanic period. Such a view is at least not inappropriate in tracing the development of commerce.

Commercial Geogrophy is the most practical branch of the subject. It means a knowledge of the distribution of the world's products, of existing demands for these commodities, and satisfactory means of transportation and exchange. The Phœnicians were the first great traders. Their horizon was practically limited by the shores of the Mediterranean, although they sailed beyond its confines, and many of the goods with which their ships were laden were brought to Syria by caravans. The Phœnicians were succeeded by the Carthaginians and the Greeks, but the typical merchants of the Mediterranean class were the Venetians. Their supremacy in the world's commerce was unquestioned until, at the close of the 15th century, the Atlantic succeeded the Mediterranean as the highway of trade. The centre of the world's commerce then passed in succession from Portugal to Spain, and then on to Holland, the Hanseatic towns and London. To-day commerce is not a monopoly, but is world-wide. In volume of trade the United States is surpassed by no other nation, but competition is keen, and the successful merchant of the future must be well versed in that knowledge of which geography forms the basis.

The growth of commerce has been in direct ratio to the extent and rapidity of geographical discovery. Some of the conditions, which are favorable or unfavorable to trade, are quite obvious. An indented continental outline and navigable rivers reaching the interior are most desirable features. In these respects, Europe and North America are fortunate. Asia also is penetrated by arms of the sea, but her largest rivers, like the northern streams of North America, are practically useless, because they are tributary to an inhospitable frozen sea. Africa has no breaks in its contour, and its rivers reach the sea by dropping from a plateau. Though lying next to Europe, it baffled both the curiosity and the greed of her adventurers until the latter half of the 19th century. South America is not wanting in inlets, and her river systems are remarkable, yet very little is known of the interior. It becomes evident that latitude is an important factor in the case of both Africa and South America. The torrid heat, the burning desert, and the deadly fever were obstacles which the African explorer dreaded. The stagnation of South America is also explained when its tropical position is considered. Aside from topography and climate, the character of the inhabitants has much to do with the success of commercial intercourse.

Commerce has expanded because man has been able to meet and to overcome natural obstacles. He has to a great extent eliminated time and distance, by cutting canals through isthmuses, by connecting the shores of the oceans by continental railroads, by the substitution of steam vessels for those propelled by the wind, and by girdling the globe with the telegraph. He has modified climate both as to rainfall and healthfulness by the planting or removal of trees, and by drainage of the ground. By irrigation, he has made the arid waste productive and fruitful. At the beginning of the 19th century, the merchant was obliged to visit the region in which he desired to purchase his commodities, and to carry with him the money for payment. Now, by the aid of a cosmopolitan system of credit, he may within a few hours buy in one part of the globe and sell in another without leaving his office.

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Geological Society of America, an association of geologists organized in 1888. It was the outgrowth of the geological section of the American Association for the Advancement of Science. The society has a restricted membership of 300. A quarterly bulletin is issued under its auspices.

Geological Survey, United States, a bureau of the Interior Department created for the purpose of preparing a map of the United States, classifying the public lands, examining the geological structure, mineral resources, and the products of the country. To these duties have since been added those of investigating the extent to which the arid lands of the West can be redeemed by irrigation, segregating the irrigable from the non-irrigable lands, and the selection of sites for reservoirs and canals for the purposes of irrigation. The maps made by the Geological Survey are all on a large scale, and have a degree of accuracy and a minuteness in detail incomparably greater than ordinary maps. The smallest scale is 1-250,000, or about 4 miles to the inch, and this scale has been employed for regions of the West which are thinly settled, and where the topography is mountainous. But it has been superseded by scales of 2 miles and 1 mile to the inch, the latter for populous regions with slightly or moderately diversified topography, like Massachusetts and New Jersey. The maps are engraved on sheets which, with the 4-mile scale, embrace 1° of latitude and 1° of longitude. The 2-mile maps embrace tracts of half the above linear or one fourth the areal dimensions; the 1-mile maps embrace one fourth of the above linear and one sixteenth the areal dimensions. The topography is represented by "contours" or "grade curves"; that is, by lines of equal altitude above the sea. The contour intervals are uniform for each sheet, but vary in different sheets according to the character of the country. In some tracts the contour intervals represent a difference of elevation of 200 feet, these being in very mountainous countries, while in flat countries and on large-scale sheets they may be as small as 20 feet. The general construction and methods of all maps are, however, the same.

There are three principal branches of the geological survey: (1) Geology proper; (2) topography; (3) irrigation surveys. The geological branch investigates the stratigraphy, the geological structure and history, the lithology, mineralogy, and palæontology, the ores and mines, and in general the natural economics, resources, and physical geography of the country. The topographic branch prepares the maps; the irrigation branch investigates the possibilities of irrigation and selects the irrigable lands and sites available for reservoirs and canals. The work of the topographic branch is the basis of the work of the other two, and all the results of the latter are projected on the maps. The publications of the survey are: (1) the annual report of the director, which, besides the administrative report, contains memoirs on geologic subjects by members of the survey, and is distributed according to the regulations of the Interior Department; (2) monographs on the leading subjects of special investigation by the geologists; (3) bulletins on more limited special subjects of research; (4) an annual volume of mineral statistics. The last three are distributed gratuitously only to designated libraries and to learned corporate societies, which send their own publications in exchange. Otherwise they are sold by the director and the money deposited in the treasury. See GEOLOGY; IRRIGATION; TOPOGRAPHY.

Geological Survey, Methods and Publications of the. The preceding article states in a general way the functions of this Survey as originally defined by Congress, together with subsequent modifications which included within the scope of its duties the study of the hydrographical conditions relating to water power, and to the irrigation of the arid lands of the western states.

As the geologic and hydrographic work depends upon the topographic work, the preparation of a suitable topographic map received primary consideration, and the general lines of operations extended to secure it were very definitely outlined from the earliest period of the Survey, so that at the present time over 900,000 square miles, or 30 per cent. of the total area of the United States, exclusive of Alaska, has been surveyed and mapped for this purpose.

In the execution of the field work the procedure has conformed to the general methods employed in accurate trigonometrical surveys; but the enormous extent of the territory surveyed; the great diversity and the peculiar arrangement of the natural features of the country, and the necessity for executing the work as expeditiously as possible, and yet consistent with all the requirements of thorough accuracy, have tended to develop methods which are not only specially applicable to the work of the Survey, but also form a group of comparatively new methods available for any other line of topographical work. These methods may be briefly outlined as follows:

The surveying and mapping operations conform to the general plan which divides the whole area of the country into a series of quadrangles each of which is equal to a square degree, that is, each quadrangle is bounded on the east and the west by a degree of longitude, and on the north and the south by a degree of latitude.

The surveying operations consist in the extension of a system of primary and secondary triangles with tertiary triangulation points over the whole country, accompanied by three systems of level lines, supplemented by a system of road and stadia traverse.

The primary triangulation has been planned for the control of the work over the whole country, thus insuring the accurate ultimate meeting of fragmentary surveys which may be initiated a hundred or even a thousand miles apart. In this work, the triangles are expanded from accurately measured base lines, and connect various points of reference the geographical positions of which have been accurately determined by the most approved astronomical methods. The astronomical work consists of: (1) the measurement of the zenith distances of stars by means of delicate zenith telescopes, for the determination of latitude; (2) the exchange of telegraphic time signals between unknown astronomical positions and a known astronomical position, such as a first class observatory, for the determination of the differences of longitude; and (3) the observation of circumpolar stars for the determination of the azimuth of a line, such as a base line, or the side of a primary triangle. The base lines are measured by means of base bars, iced bars, or steel tapes, proper allowances being made for sag, pull, etc., and the measurements repeated several times in order to reduce the probable error to a minimum of less than 1 in 1,000,000. The elevations of the various stations are established by lines of precise levels run from the datum of mean sea level determined by means of accurate tide gauges. The angles of the triangles connecting these stations are measured by means of theodolites equipped with high power terrestrial telescopes. From the data thus obtained, the lengths of the sides of the various triangles are computed and the entire system of triangulation plotted on the topographic map to furnish the primary control for the secondary detail.

The secondary triangulation is usually executed by means of the plane table, and new points located so as to give from one to three good tertiary triangulation points per square mile. The elevations of these points, usually hill summits, are determined by the measurement of vertical angles of elevation and depression, depending upon spirit levelling, while the lower relief of the country is determined by lines of secondary spirit levels run six miles apart with intermediate lines of flying levels run three miles apart with sufficient accuracy to allow them to close on the secondary levels within the limits of one or two feet.

Traverse Lines.—Where the country is covered with dense forests, or where the surface relief is insufficient for triangulation purposes, both the primary and secondary control consists of a system of primary traverses checked by primary triangulation locations, or by astronomically determined positions. These traverses are run by compass and plane table, and a secondary system of traverse line consisting of odometer and stadia measurements of roads is interwoven with the plane table work. The data obtained from the secondary traverses is plotted upon the plane table sheets during the progress of the work, and is subsequently adjusted upon the final map between the check points established by the primary traverse, or by the plane-table triangulation, the distances between which are so short—1 to 4 miles—that errors of location are scarcely perceptible upon map scales of one inch to one or two miles.

The work of primary triangulation and precise levelling is usually executed a season in advance of the topographic sketching, while the secondary triangulation, traverse work, and lines of flying levels are immediately followed by the topographic sketching, both classes of work being done by members of the same party. The data obtained from the secondary triangulation and traverses is then plotted upon a sketch sheet. This data is of such a character that each sheet includes from two to five trigonometric locations; from four to eight inches of road traverse; and one or more instrumental elevations, per square inch. Equipped with a sketch sheet thus prepared, the topographer places himself at a point of known elevation and sketches on the sheet by eye with the aid of a hand level the plan of the contour line which passes through his position. In open country, the contours may be located in this manner quite accurately for a distance of half a mile in either direction from his position, corresponding to a total distance of an inch upon the sketch sheet. In wooded country where the figure of the contour cannot be seen beyond his immediate position, he proceeds by road carefully observing the variations of the slope, and determines the differences of elevation for short distances between check points by means of the aneroid, and sketches in the plan of the contour according to the data thus obtained. In cases where the number of accurately determined elevations are insufficient, more locations are fixed by vertical angulation, or by flying levels as the work of sketching progresses. In this manner a system of contours is built up along the roads and water courses, and if the lines do not practically fill up the entire sheet, the topographer walks into the spaces within the road circuits, and by means of stadia lines for long distances, or by pacing for short distances, determines the positions of the contours required to complete the sheet. The sketches thus obtained are inked in, either in the field or at the office, and are then reduced to the scale of the final map by photography and form the copy for the engravers.

The great topographic map of the United States now being thus prepared by the Survey, is published in atlas sheets of approximately uniform size, 16½ by 20 inches, on which the mapped area occupies a space 17½ inches in height, and 11½ to 16 inches in width according to the latitude. The division of land represented by an atlas sheet is called a "quadrangle," and is always bounded by parallels of altitude and meridians. Although the sizes of the sheets are always the same, three different scales are employed in the mapping of the surveyed areas in order to serve different purposes and to suit various conditions. A scale of 1 : 62500, very nearly one inch to one mile, is used for mapping the thickly settled, or industrially important sections of the country. The sheets on this scale cover an area of 15′ of latitude by 15′ of longitude. A scale of 1 : 125000, very nearly one inch to two miles, is used for mapping the greater part of the country. The sheets on this scale cover an area of 30′ of latitude by 30′ of longitude. A scale of 1 : 250000, very nearly one inch to four miles, is used for mapping the desert regions of the western states, and gives sheets which include an area of 1° of latitude by 1° of longitude.

This map is printed in three colors and shows the following named classes of natural and artificial features: (1) *Water*, including seas, lakes, ponds, rivers, creeks, canals, swamps, etc., are shown in blue. (2) *Relief*, including mountains, hills, valleys, cliffs, etc., are shown in brown contours. (3) *Culture*, or the works of man, such as villages, towns, cities, roads, railroads, boundary lines, etc., are shown in black. The features shown in blue and black are self-explanatory. In the case of the brown contour lines, each contour passes through points which have the same altitude above mean sea level, and a series of such lines arranged one above the other at regular vertical intervals, but appearing on the map at irregular intervals, that is, close together where the slopes are steep, and far apart where the slopes are gentle, accurately delineates the general configuration of the country, and gives the elevations of all points above the level of the sea. The vertical interval adopted varies according to the character of the country mapped. In a flat country it may be as small as 10 feet, while in a mountainous region it may be as large as 200 feet. Usually, every fifth contour is made heavier than the others, and is accompanied by figures giving its elevation above the level of the sea. The heights of many other points, such as the intersections of ordinary roads and highways, railroad crossings, and stations, the summits of uplands, hills, and mountains, and definite bench marks, are also given in figures which are placed close to the points to which they refer, and are correct to the nearest foot. Each sheet is designated by the name of a principal town, or the name of some prominent natural feature within the district represented, and the names of the adjoining published sheets are printed on the margins. Explanations of the various conventional signs used are printed on the back of each sheet, and materially assist in the reading of the map.

This topographic map is the base on which the facts relating to the geology and the mineral resources of a quadrangle are represented, and constitute the sheets of the Geologic Atlas of the United States published by the Survey. The price of the topographic sheets is five cents each when the number purchased is less than 100 copies, and two cents each when they are ordered in lots of 100 or more copies. In the Geologic Atlas the topographic and the geologic sheets of a quadrangle are bound together, and, accompanied with a textual description of the district represented, constitute a folio of the Atlas. These folios are sold for twenty-five cents each, except those that have received special treatment and are unusually comprehensive. The price of such varies according to the character of the information afforded, the number of the maps in the folio, etc. All communications relative to these maps, or any other publication of the Survey should be addressed to The Director, United States Geological Survey, Washington, D. C.

The accompanying map is a small portion of the Housatonic quadrangle which includes portions of Massachusetts, New York, and Connecticut. It affords a general idea of the topographical treatment; but, being printed only in black and white, it fails almost completely to give a true idea of the actual beauty of the original sheet as printed in the three conventional colors already described.

The methods by which these maps are reproduced for publication utilize the most approved processes and refined manipulations of the photographic and lithographic arts as applied to map making. As has been heretofore stated, the plane table sheets are roughly inked in and then turned over to the photographic division of the Survey, where they are reduced to the scale of publication. These reductions are made with the greatest care and are absolutely free from any of the inaccuracies which usually result from the use of poor lenses, poor glass plates, etc., in ordinary photographic manipulations. Each sheet contains all of the features of the quadrangle, that is the water, relief, and culture, in black and white. From a sheet thus prepared, the engravers make an exact tracing on a sheet of transparent gelatine and transfer copies of the same to three stones, one for each color of the final print. In this way, the engraver of a particular class of features has the positions of the other two classes of features on his stone also, and is thereby enabled to arrange the figures, letters, etc., which belong to his class in such positions that they will not conflict with the figures, letters, etc., belonging to either of the other two classes. When the three stones have been engraved, an impression print from each one is taken in a hand press, with lithographic ink, and transferred to three smooth stones from which the final map is printed by three successive color printings in a power driven cylinder press. In this final work, an exact superposing or absolutely perfect register of the three prints is sought for and obtained by the most careful adjustment of the positions of the stones in the press, the use of well seasoned paper, etc., and any sheet which exhibits a discrepancy of register exceeding one two-hundredths of an inch, barely the width of a very fine line, is discarded and destroyed. As examples of the art of modern map making, these sheets are practically unrivalled in their particular class by any other similar maps in the world. The importance of the topographical and geological publications of the survey cannot be overestimated. The maps form the basis of all the state and county maps of the United States published for commercial purpose. Their accuracy is such that they are readily available for use in connection with the preliminary work of railroad, canal, and other surveys, and for purposes of verification in damage suits and other legal proceedings before the various tribunals.

Portion of Housatonic Quadrangle

It is true that the work of the survey costs the Government hundreds of thousand of dollars annually, but the returns through the various industrial channels, and through the development of the natural resources of the country, amounts to hundreds of millions.

This is especially the case relative to the work and publications of the geologic department, without which the high economical development of the mineral resources of the country would be practically impossible.

In the matter of the use of instruments, such as the plane table, stadia, and tape, and in the application of precise but rapid methods in the execution of the particular class of surveying practiced, the various publications of the survey set the standard for this country and are invaluable not only to the student-engineer, but also to the actual worker in the field. These publications may be obtained by application to the Director of the Survey at Washington, D. C.

Geology is the science of the Earth's history. In common with myths of creation that appear in the folk-lore and religions of all peoples, geology recognizes the essential fact of changes which make up a history; but it differs from the myths in being well-ordered knowledge based on observation, in interpreting natural phenomena according to the laws of the material world, and in seeking causes among the forces of the physical universe. Guesses at the beginning or the end are not part of the science, which deals only with those eras that are recorded in the rocks.

Geology is a very comprehensive science, embracing some knowledge from each of the chief natural sciences. The Earth, a planet, may be studied as a member of the solar system and in comparison with stars; and in so far geology joins astronomy. The Earth is composed of elements, associating and combining according to the laws governing physical and chemical activity; thus geology includes physics and chemistry as applied to rocks, seas, and air. The Earth has been and is the home of multitudes of living beings, whose development has been conditioned by her changes and is part of her history; organic evolution, as studied through comparative botany and zoology, is, therefore, part of geology. A great geologist has defined geology as astronomy, physics, chemistry, and biology applied to the Earth.

Aims of Geology.— The aims of geologic research may be classed as three: (1) To discover the principles, the forces, and the processes of the Earth's development; (2) to trace the history of the physical world and of its organic inhabitants; (3) to advance the exploitation of natural resources for the benefit of mankind. Those views which are now current and which represent the present advancement of the science are briefly suggested in the following paragraphs, but for a more complete treatment the reader must be referred to the books and articles mentioned in the bibliography.

A Fundamental Principle.— The causes which are now effective in producing changes in the Earth have been in operation throughout all known eras of her history, and the past is to be interpreted in the light of the present. This general principle applies to all departments of the science, and is the foundation upon which all knowledge of the past is built up. If the substance of the Earth ever formed part of a nebula, it condensed according to causes now operating in nebulæ. If it was once a molten globe, it cooled and solidified as a molten globe now would. Upon the cool Earth, rains have ever fallen, streams have always flowed, seas have been gathered into basins about lands; and the processes now active on the continents, in the oceans, and within the rock mass have been active continuously, but in greater or less degree.

The intensity of geologic processes is unequal at the present time in different parts of the world, and during past eras has varied from age to age for each and every zone. The most familiar process, that of erosion, which comprises all the chemical and physical effects of the atmosphere upon land surfaces, produces very different results in lowlands and in highlands, in humid regions and in deserts, in the tropics and beneath the pole star; and during the past it has varied in the nature and intensity of its activity, as the governing conditions were more or less favorable. In these respects erosion may be considered as an illustration of the variability of other processes, all acting under immutable laws.

Geologic Forces.— The natural forces which are involved in geologic processes are: (1) Radiant energy of the sun, namely, light and external heat; (2) gravitation, both terrestrial and general; (3) chemical energy; and (4) the vital force.

Summary of Effects.— It may promote a clearer understanding of the operation of these forces to give some illustrations of their effects, before making a fuller statement of the processes of geologic change. Sunlight and heat directly act on rocks in deserts, where they are unhindered by vegetation and moisture. The brilliant glowing days and the radiantly clear nights result in changes of temperature which cause rocks to expand and contract and in consequence to crumble. The sands of Sahara are in part grains thus broken from granite. Less direct, but more widely effective, is the action of the sun through the agencies of the atmosphere, the winds, snows, frost, rains, and running streams, all of which are started and kept in motion by the sun. In life also the sun's energy is manifest.

Gravitation, as it is expressed in the force by which all things are attracted toward the Earth's centre, is familiar to us. Winds are influenced by it, rains obey it, and streams flow in accordance with the laws of its attraction. Thus gravitation and sun force cooperate in the movements of the atmosphere. Gravitation holds the oceans in their beds and the firm Earth to its form. It is the cause of pressure within the Earth, and immediately or remotely of the Earth's internal heat. The manifestations of pressure and heat are therefore attributable to it, and these include a great range of phenomena.

Chemical energy, which controls combinations of elements, and of which we avail ourselves in manifold ways, governs the constitution of minerals, the composition of the air, and that of the sea. It is effective when rocks, like an iron bar, rust at the surface of the Earth, as it is also when they change in structure and recrystallize within the Earth. All ores are chemical compounds and owe their concentration in valuable ore bodies to chemical reactions.

The vital force has animated myriads of creatures, which have built their shells or skeletons, each according to his kind, and left them as grains in great rock masses. Strata many hundreds of feet thick and many thousands of square miles in extent are composed of such remains, which thus form stupendous monuments to the activity of the vital force. But this is not all. Living creatures are liable to change according to environment, and obey a great law of adaptation and progress, the law of evolution. They have, therefore, changed as the conditions of life have changed; they have evolved from lowest to higher forms, and are evolving. Finding their remains in strata according to a definite sequence, we are able for that place to trace the progress of evolution; and comparing stages of evolution as discovered in strata in different provinces or continents, we can ascertain in how far the succession of events affecting life was the same or was different, in Europe, for example, and America. Though differences are discovered, likenesses are surprisingly general and close, and it is believed that the parallel developments of life in different continents have occurred nearly simultaneously, age for age. Thus the time scale of geologic history is based on the evolution of living forms through vital force.

Geologic Processes.— The forces which have been described are active, and long have been, in three realms — in the atmosphere, in the seas, and in the solid rocks. They interact in each realm, and in each give rise to a group of characteristic phenomena. Thus there is an interaction or process which goes on in and beneath the atmosphere, where air and moisture affect the surface of the land, and which is called *erosion*. A second process is active in lakes and seas, in and beneath the waters; it is called *sedimentation*. And a third is that which is manifested in the movement and distortion of rock masses, and which is known as *deformation*.

Erosion.— The process of erosion may be briefly described as the process of land sculpture, the effects being observed in the forms of plateaus, mountains, hills, slopes, valleys, and plains. The forces involved have already been stated as sunlight, sunheat, chemical energy, and gravitation. The process involves several distinct sub-processes, which are broadly classified under the four heads of weathering, transportation, corrasion, and aggradation. The active agents by which the forces are applied are, primarily, the air and water in its various forms, and, secondarily, vegetation and other organisms, with their products of decay. The materials affected are rocks, and these, being aggregates of chemical compounds more or less compactly bound together, differ greatly in the degree of resistance which they offer to the same activities. Limestone, for example, being readily soluble in water containing carbonic acid, occasions valleys in a region of vegetation and moist climate, whereas sandstone maintains ridges. In an arid district these relations may be reversed.

Taking up the sub-processes of erosion we may briefly describe them, considering that of weathering first. Changes of temperature, such as ensue when brilliant sunlight is followed by clear nights, occasion sufficient change of volume in rocks to cause them to crack and shatter, as has been stated. The expansion of water in freezing widens crevices. Chemical changes in rocks are brought about at and near the surface of the ground, chiefly through water, the common solvent, which becomes particularly efficient when it contains carbonic acid or other organic acids resulting from decay. With many minerals water forms a chemical combination by which they become hydrated, as it is called, and their volume is thereby increased. Feldspar, a constituent of many crystalline rocks, is especially liable to this change, and the force of expansion due to the chemical combination is sufficient to dislocate and loosen the bonds that hold the grains together. Consequently, such rocks crumble anad form a loosened, porous covering to the sounder rock remaining beneath. This porous material, being hydrated, is more readily attacked by carbonic acid; and soluble carbonates of iron, lime, magnesia, soda, potash, etc., are formed and taken into solution. Certain insoluble constituents (chiefly quartz, silicate of alumina, and oxide of iron), remain mixed in various proportions, and constitute what are commonly known as sand, loam, and clay. The rocks which are not usually recognized as crystalline, such as sandstone, mud rocks or shales, and limestones, are broken down, in part mechanically, through heat and frost, and in part chemically. Limestone, as already stated, is peculiarly liable to solution. Those silicious rocks known as quartz, sandstone, and quartzite are especially resistant, and where they occur in masses always maintain hills, which stand higher than the worn surface of other rocks, or where they have become broken may be carried to great distances and form beds of white and brown pebbles, so commonly found.

The sub-process *transportation* is effective in distributing the products of weathering. Gravitation is the essential force, and the mantle of soil which accumulates through the mechanical and chemical activities that have been enumerated, is moved ever downward in one way or another. On steep slopes and cliffs gravity acts simply upon any loosened block, whose diminishing support finally fails and allows it to fall. Of soil resting even on gentle slopes, a mass softened by water may creep downward, or, loosened, move in such volume and so far that we recognize it as a landslide. These, however, are minor effects. In arid regions wind, the chief carrier, moves the sands of the desert, whose billows have been likened to the sea. Greatly predominant, however, the world over, is the work of running water, which from the tiny rivulet that gathers from the rain falling on a field to the great floods of the Mississippi or Ganges, is always laden with a greater or less burden of earth held in suspension, or with substances taken from the rocks by solution. The effects of this almost universal activity are incredible. It must be credited with having changed the face of the Earth again and again in the long lapse of geologic ages, and with having swept away the greatest mountain ranges and reduced continents to flat plains.

Corrasion, the third sub-process, is the wearing of stream channels. Waters gathering on a soil-covered slope wash with them particles of sand and clay. Where they fall over any inequality, they deepen the hollow beneath it, and undermine their tiny banks. Gathering volume and velocity, they acquire force to work more vigorously, and if not checked develop deep gullies. The stream at any place in its course where it has sufficient velocity, sweeps along whatever sand and clay has been carried thus far, and scours the hard rock bottom. The effect is that of a file, and the channel is deepened. If the resistant rock is a rim underlain by softer beds, the waters dig out the channel below and form a gorge, at whose upper end is a cascade, perhaps a Niagara. They may completely file through or undermine the hard rock, and thus in time lower the level of the channel to a position determined temporarily by some rock rim farther down the stream, and ultimately by the level of the sea. There is no limit to this activity of the stream short of that slope from sea-level on which the waters can no longer keep the channel clear of sediment.

The cut which any stream makes is narrow, and it may become a deep canyon without growing very wide; but the rocks differ very much in their capacity to maintain steep cliffs or slopes; none of them endure forever. Wherever cliff faces stand boldly up, atmospheric activities loosen and undermine each jutting point, and as each falls, exposing another, the cliff recedes. When the retreating cliff becomes a slope, branching gullies develop and grow like twigs at their heads, since not only the main stream is engaged in sinking its channel, but every tributary, including the smallest rivulets, is doing the same according to its power. Growing, branching, multiplying, they become widely effective, and in time attack the entire land surface, however extensive. Throughout the early stages of this process, while channels are narrow, slopes are steep and the surfaces of highlands are broad; the landscape is then said to be young. When the streams have carried on their work so far that valleys are wide, slopes gentle, and the highlands but narrow ridges, it is said that the topography has become mature. And when, the process continuing, the highlands lessen in altitude until they become eminences scarcely rising above the valley plains, the phase is called aged.

Aggradation is a word which may be translated as valley filling. It applies to that sub-process of erosion whose effects are seen in bottom lands and flood plains along rivers. The sand and clay which are transported by rapid streams are dropped where the current slackens, it may be at a distance from the sea and high above it, or along the lower reaches of the river. The one is but an interruption in the journey of the sediment from the heights; the latter is a more prolonged but not necessarily a final stop. The winding course of a mud-loaded stream, like that of the lower Mississippi, is caused by the shoals which form in eddies and, diverting the current, cause it to cut away the opposite bank. Thus shifting, a channel wanders widely and widens the valley. By deposits made during moderately high water a heavily loaded river also builds up its banks till they stand above the adjacent flood plain, and in time of floods it may break through them and spread a fresh deposit over great stretches of fertile plain. Every spring has its story of broken levees along the Mississippi, and that river is not peculiar in this respect. The ultimate character of all valleys, if development goes on unhindered, is that of flood plains as extensive as are the lands, and valleys thus become stored with alluvium, which in course of geologic changes goes to form sedimentary rocks beneath the sea.

A phase of erosion which is not included in the above statement is that carried on by the sea along the shores where it attacks the land. The power of the sea is derived chiefly from the winds, and depends upon their prevailing direction and the distance throughout which they blow across its surface, for the winds raise the waves, which gather force as the effect is continued over wide stretches, and the dash of the waves on the shore is the effective eroding activity. The land resists according to its altitude and the coherence of the rock masses, in some places developing bold headlands, and elsewhere becoming fringed by extensive beaches. The attack of the sea is delivered in a horizontal plane at and just below the water surface, and its effect, when sufficiently continued at one level, is to cut away whatever is higher, and to produce a bench, at the inner margin of which rises a cliff or slope. The material that is worn away is carried by undertow and shore currents and distributed along the coast in favorable locations to form beaches, and beneath the sea as widespread deposits. These phenomena belong to the process next to be described — that of sedimentation. The effects upon the land depend not only upon the resistance offered to the sea, but also upon the continuance of the process. If a shore has been newly established it follows all the sinuosities of the surface contour, retreating far landward in deep valleys, projecting far seaward about headlands and islands. But when the sea has cut and built at the same level during a long time, it may have carved away the headlands and extended beaches across the bays, and thus have straightened the shore line. There are, therefore, youthful shores and aged shores, as there are youthful canyons and aged valleys or plains.

Sedimentation.— Sedimentation may be described as that process which results in layers of sediment spread under water. In a special sense the name is applied to the process as carried on in lakes and seas, and to the strata which are thus produced, but in a more general sense it may include methods of deposition of material borne by streams, by ice, and by winds, and may thus cover a large part of the effects above included in the process of erosion. In this article it is used in the more special sense, sedimentary strata being considered to be lacustrine or marine in origin.

The sub-processes of sedimentation are *sorting*, *distribution*, and *deposition*. They are effected by moving waters, and thus depend upon the winds, tides, and ocean currents. All of these movements are directly or indirectly effects of gravitation, which is, therefore, the force to which sedimentation is ultimately due.

The work of waves in eroding the land was referred to in a previous paragraph. Through their constantly repeated attacks the pebbles and sands of beaches are abraded and reduced in size, and the finer is stirred up and carried away from the coarser. Every wave agitates and washes the material of a beach, and the successions of waves constitute a grinding and sorting mill of great efficiency. That material which may be moved by the onrush of the waves is swept along the beach in the direction of the prevailing winds or heaviest storms. That which is fine enough to be taken up by the undertow is carried down under the sea and distributed to a greater or less distance from the shore over the bottom. This work of the waves is exceptionally well illustrated in the beaches that fringe the Atlantic coast of the United States from Long Island to Florida, and in the mud which is deposited over the sea bottom even to a distance of 100 miles southeast of it; for this is a coast on which the waves break with great power, under the influence of the prevailing southeasterly winds, and which is composed of soft rocks that offer comparatively feeble resistance. It is therefore a coast of aged aspect, characterized by long, slender, wave-built beaches, and it contrasts strongly with the young rock-bound coast of Maine.

Where any great river, such as the Mississippi, brings its burden of sand and clay and delivers it to a sea in which the waves have but moderate power, as in the Gulf of Mexico, the river builds a delta, which interferes with the course of waves and currents, and is attacked by them. The form and extent of the delta are a result of the conflict between the river and the sea. The currents of the latter receive a considerable part of the river's burden directly, they may wear away other portions which the stream deposited when conditions favored, and they carry the material on to some place where it settles. Thus the South Atlantic ocean current circulates into and around the Gulf of Mexico from south to north and east, and receiving much clay and sand from the rivers whose mouths it passes, deposits it in eddies along the coast of Alabama and Florida; another part is swept on through the Straits of Florida, where the constricted Gulf stream flows swiftly, and is carried out to form a great bank where the Atlantic deepens north of the Bahama Islands.

Another kind of sediment, consisting chiefly of carbonate of lime, is derived from marine waters through chemical or organic agencies. Lime is known to be readily soluble when combined as a bicarbonate, and to be relatively insoluble as a monocarbonate. It enters into solution as the former, and is deposited in the form of the latter as a calcareous mud. The chemical and organic conditions which govern this process are not thoroughly understood. It is known that under some circumstances the change from bicarbonate to monocarbonate may occur through chemical agencies alone, and that in other cases it is carried out through the agency of organisms which live in the sea. Whatever the process, the result is the formation of vast accumulations of calcareous mud, which are chiefly of marine origin and distribution. The South Atlantic ocean current again affords an example; it sweeps through the Caribbean, bearing a multitude of marine organisms, many of which secrete calcareous parts from the water, and, dying, leave their shells to sink to the bottom. From lands composed largely of limestone flow hard waters that may throw down a limy mud, as is the case in the Everglades of Florida; and this also becomes sediment, which the current sweeps on with the organic remains and with the delta silts of the great rivers. The result is the deposit now forming in every deep hollow of the Caribbean, of the Gulf, and along the Atlantic slope of North America.

In the aspects of the coast of North and South America, from Newfoundland to Brazil, are comprised illustrations of most of the processes of marine sedimentation. There is the coast of Maine, through whose deep embayments sweep swift tidal currents, and onto whose shores play powerful waves, grinding and distributing chiefly coarse pebbles and sand. There is the coast of Long Island, New Jersey, and the Carolinas, whose beaches of clean, white, sorted sand stretch for miles, shutting in the estuaries into which the small rivers deliver their sediment, and enclosing the land within a wave-built barrier. Outside, beneath the shallow ocean, reaches a broad flat, which extends out to the margin of the continent, and on this is spread a small amount of mud, sorted from the sands brought by the undertow and distributed by tidal currents. In the Gulf of Mexico and the Caribbean are found, on a large scale, the conditions of delta building and of marine distribution of fine mechanical and organic sediments. Chiefly by processes such as these the sedimentary rocks have been formed throughout geologic ages.

Sedimentary deposits in estuaries and lakes are similar in many respects to those of seas, but as waves are less effective in these smaller water bodies, the sorting is less complete; shore currents are also less active, and materials are carried to less distance from their source; and that which is swept out from shore is usually fine silt only. Lake deposits are closely related to river deposits, especially in regions where torrential streams sweep detritus from hills far out onto plains and into the margins of lakes; and there are vast accumulations, as in the western United States, of which it is not yet surely known to what extent they are lacustrine or how much is fluviatile.

Chemical deposits may be formed in seas or lakes whenever peculiar conditions favor the separation of a substance held in solution. The commonly accepted view is that the substance must be present in amount sufficient to form a saturated solution, so that it is thrown down by evaporation. Such is the case with enclosed lakes having no outlet, like Great Salt Lake. But there are other circumstances, as when carbonate of lime is deposited from spring waters or from ocean waters without organic agency, where saturation is not the condition, yet the substance separates. Waters circulating in a nearly enclosed sea, like the Mediterranean, and subject, as it is, to excessive evaporation, may reach a condition of concentration short of saturation, yet adequate to cause precipitation; mechanical agitation, as that of the waves, may suffice to dissociate a loosely united compound like bicarbonate of lime, and thus to precipitate the monocarbonate (the exact chemical conditions are open to discussion and to experiment); but great bodies of chemical sediments exist, and among them carbonate of lime or limestone, sulphate of lime, or gypsum, and rock salt are the chief ones.

Deformation.— In geology the verb to deform is used in its exact sense — to change form — and not with the more commonly recognized meaning — to put out of shape or disfigure. The geologic process of deformation is therefore one of change of form, and may involve altering by pressure the shape of a stone, a bed or body of rock, a mountain mass, a continent, an ocean basin, or of the whole earth. It is a universal process, which has been effective throughout all time, though not always equally so. The earthquake and the volcano are effects of very local deformation, with intense activity and under special conditions; but the process is far more general than are earthquakes or volcanoes.

Terra firma — the firm earth — appears to be a rigid, unyielding sphere only because we are able to observe but small areas, and these for but brief times. The rounded form, flattened at the poles, is determined by the balance of gravitation with the centrifugal force due to rotation on an axis. Were the attraction of gravitation more or less, the form would still be round, but would differ from the present; and so also, if the rate of rotation were to change so that a day were longer or shorter. This is so not because the earth is soft inside, but because it is so large a mass. The effect of mass may be seen in drops of mercury on a glass plate; tiny ones are nearly perfect spheres, larger ones are much flattened. If the earth were a solid sphere of granite, and could be supported at rest on a pedestal, it would flatten down to a thin sheet.

The rounded form of the whole earth being an effect of balancing forces, we may inquire what features of the surface are, similarly, effects of equilibrium. Are the ocean bottoms underlain by heavier material than that of the continents? And is that the reason why they have sunk so low in balance with the high-standing lands? Balance water and oil in a U-shaped glass tube, and this idea of the heavier ocean beds and lighter continents may become clearer. It is that which is now most commonly accepted as the probable explanation of the extensive inequalities of the earth's surface. Yet it has also been made evident that the earth is on the whole a rigid body; one line of reasoning being that if it were not there must be tides in the land as there are in the ocean, yet observations with delicate instruments have failed to detect land tides; another that earthquake shocks travel through the spheroid at a rate at which only a highly rigid substance could transmit them. This rigidity is conceived to be an effect of pressure which is due to weight of all the mass tending toward the centre. We have seen that the ocean basins are believed to crowd heavily downward, and to hold higher the lighter continents, so that the measure of the rigidity (which is called viscosity or resistance to change of form) is less than the weight of masses beneath ocean basins; but it is obvious that the viscosity is sufficient to sustain large high masses, probably those of mountains, not balanced by masses in lower positions. Time is an important element in these problems, the earth yielding to a sufficient pressure, as tar yields, slowly.

This sphere, whose mass is yielding, yet up to certain limits firm, is stored with energy in the form of internal heat, and is subjected to strains due to external attractions, to cooling, and to the gradual effects of erosion and sedimentation, removing mountains and other elevated masses from their positions on the continents to zones of deposit beneath the margins of the seas. The equilibrium is, therefore, liable to disturbance, which is expressed in movements of one sort or another. Whatever the nature of these movements, they all come within the process of deformation. Gravitation is the ultimate cause, but the immediate causes in any particular case may be obscure, and the search for them includes the most difficult problems of modern geology. Deformation is, therefore, better known by its effects, and through those it must be described.

Turning first to those evidences of movement within rock masses, the more obvious ones are found in forms which we know have been broken or stretched. Pebbles which have been cracked and separated while yet firmly embedded in the rock are not of uncommon occurrence, and there are those which have been pressed out, as one might a ball of wax, until they form long, thin, flattened lenses. Fossil shells whose original forms can be accurately determined are found similarly broken apart or stretched while yet embedded in the matrix of limestone or shale.

Again, rocks whose original character may have been massive or bedded are found to have recrystallized and to have assumed a lamellar structure, like that of a pack of cards. This occurs through a movement which is very like that of cards pressed between the palms and slipped one on the other. Such movements occur on a grand scale at depths beneath the surface of two miles or more and throughout masses of rock which are cubic miles in volume.

Again, it is known that many rocks, such as sandstones and limestones, were originally spread in flat sheets of great extent, as compared with their thickness, even though the latter may amount to several thousand feet. These sheets may be found to be flexed in a series of parallel folds, forming alternating troughs and arches, to be crumpled as though pressed from several directions at once, and to be dislocated and thrust over one part upon another. The compression involved in such folding amounts sometimes to a very notable shortening of an arc of the earth's crust. It is estimated, for example, that in eastern North America the space between the Cumberland plateau on the west and the Blue Ridge on the east, corresponding to the great Appalachian valley and the Alleghany ridges, has been shortened by at least 40 per cent, so that what was 100 miles across is now but 60. And, similarly, the zone of the Alps is estimated to have been shortened by compression by an amount of 74 miles.

Less obvious, but not less certainly effective on a grand scale, are the vertical movements by which ocean basins are deepened, while continents are left standing higher, and mountain systems are perhaps actually elevated in continental areas. The history of continents shows that they may not have maintained from time to time the same extent of land above sea-level, but on the contrary have been submerged now here, now there, now more, now less. These changes are attributed to deformation, in consequence of which ocean basins have varied in size, so that they at one time might contain all the waters, but at other times were relatively not so deep below the continents, which were in part overflowed. The general tendency of deformation is to lessen the earth's size, to shorten the radius, and the grand movements are movements of subsidence, but minor ones, such as the growth of mountain ranges, may be in part or whole movements of uplift, that is, lengthening of the radius.

The phenomena of erosion and sedimentation which have been described afford a means of tracing movements of subsidence and of relative uplift, not only in the present age, but through all the ages of which the sedimentary rocks yield records. As is explained more fully in a succeeding paragraph on the relations of geologic processes, erosion, the process of leveling down altitudes, must come to an end unless renewed by relative uplift. The successions of sedimentary rocks which may be observed in many parts of the world show that everywhere erosion has been at times active, and at other times inactive for lack of the essential condition of elevated lands, and therefore that there have been similar alternations of epochs of relative uplift, which set in motion the activities of erosion, and epochs of constant level, which allowed that process to run down.

Thus from many points of view there are geological phenomena which show that the process of deformation has been of world-wide occurrence, and that it has been more or less effective from time to time during all recognized geologic ages.

Relations of the Geologic Processes.— We have enumerated three geologic processes — erosion, sedimentation, and deformation — in the order in which they are most easily recognized. Erosion goes on daily and before our eyes, and the phenomena which result from it are familiar. Sedimentation is so linked with erosion, and so closely related to the nature of our shores, that many of its phenomena are as easily recognized. Deformation alone is somewhat difficult to grasp; yet if we enumerate the processes in the order of their natural sequence, we must begin with deformation, for it is the initial process, from which the others result. Were the earth a perfectly smooth sphere the waters would be spread over it, erosion would fail for lack of land surface, and there would be no sediments available for the process of sedimentation. Only when, through deformation, the ocean basins should originate, could lands emerge. Even then, if those lands retained their smooth, flat form near sea-level, the opportunity of erosion would be very limited, and the amount of sediment supplied very scanty. Not until lands attained notable altitude above sea-level could the processes of weathering and of transportation deeply affect rock masses and convey any considerable volume of sediment to the sea. Only then could sedimentary rocks accumulate in large volume or of great extent.

Again, although there were elevated lands, the process of erosion tended constantly to reduce their altitude, and thus ever to lessen its own opportunity. If the altitude once established by deformation had not been renewed by subsidence and relative uplift, it must constantly decrease until the mountains had become worn to low hills, and in the lapse of ages to plains. This, indeed, has repeatedly occurred: the continents have seen one generation of mountains succeed another and each one waste away to lowlands. Deformation, therefore, is essential to the renewal of erosion.

And still again, if there be a basin occupied by a sea and so situated as to receive sediment from the land, that basin may in time be filled and its area added to the land, unless, through subsidence of the bottom, its depth be constantly increased. There was, for example, at one time, in the eastern United States, the basin of a shallow bay of the great interior sea which covered part of North America in the Devonian Age. In that shallow basin sediment 10,000 feet deep accumulated, and the ripple marks which occur on the surfaces of the rocks from the bottom to the top of that great thickness, show that it was ever near sea-level. That it could so gather, the bottom must have sunk about as fast as rivers from the adjacent land poured in the mud.

The three processes, therefore, are related to one another in a natural sequence, deformation being the initiative process, erosion the destructive process, and sedimentation the reconstructive process.

CLASSES OF ROCKS.

In General.— Although rocks are of many kinds, which may often be distinguished by the aid of special knowledge only, yet there are four great classes of rocks, which are easily recognized as a rule. Each class comprises those kinds which result from a distinct process, the classification being according to conditions of genesis. One class is due to deformation, one to erosion, and one to sedimentation; and the fourth may be the product of deformation alone or of deformation acting after either of the other two processes. The classes are: (1) igneous; (2) surficial; (3) sedimentary; and (4) metamorphic rocks. Rocks which are thus classified include not only the compact firm substances commonly called rocks, but also beds of ash, gravel, sand, or clay, of loose and incoherent texture. A rock, geologically speaking, is any aggregate of one or more mineral substances.

Igneous Rocks.— Igneous rocks are those whose constituent minerals crystallize from a highly heated condition. They were the earliest rocks, and have developed within the earth's mass at all times down to the present. Their initial condition is commonly described as molten, but only because that is the familiar condition of lavas, a well-known class of igneous rocks. When deeply buried within the earth, they are hot, but may be restrained by pressure from melting, water and gases are mingled with the other constituents, and the condition is probably one of potential fusion and solution. When fusion occurs, either through rise of temperature or lessening pressure, the molten mass behaves like a confined liquid, and pressing into any planes of weakness separates adjoining rock masses. Moving in the direction of least resistance, it rises toward the surface, which it may or may not reach. In the former case volcanic phenomena ensue, and the rocks are said to be extrusive. In the latter case the igneous mass cools and remains buried, and in course of time may be exposed through the process of erosion. It then exhibits the characteristic relations which it has assumed through being pressed in among masses of older rocks, and is called intrusive. The chemical and physical conditions of a magma, as the material of an igneous rock before crystallization is called, are not well understood. From one and the same magma different minerals crystallize out at different pressures and temperatures, and as pressure and temperature vary greatly in the ascent of the magma from deep within the earth to the surface, various kinds of igneous rocks may be formed at different stages of the journey. Thus it is possible to have a continuous series ranging from superficial extrusives down to deep-seated intrusives. The lavas and ash rocks may be taken as the types of the former, and granite as the type of the latter. Within the magma, prior to crystallization, chemical changes appear to go on, and it is observed that a sequence of eruptions in one and the same volcanic region, and presumably from the same magma, may consist of successively varying rocks. One of the purposes of the study of igneous rocks through the methods of petrography, is to ascertain the phenomena of chemical and physical change which magmas undergo, and so to approach the problem of the chemistry and physics of the earth's interior.

Surficial Rocks.— Surficial rocks are products of erosion. Their constituents result from the decomposition of igneous or sedimentary rocks, and the surficial rock masses are formed in various ways, according to the agent by which they are transported to a place of deposit — wind, water, or ice. In composition they differ most markedly from the igneous rocks in that the elements which form soluble compounds, such as the alkaline earths, lime, magnesia, and iron, are removed in solution. Surficial rocks, therefore, consist to a large extent of the insoluble constituents, quartz, silicate of alumina, and oxide of iron. These occur in mixtures, which constitute gravel, sands, clays, and loams of various kinds.

Surficial rocks laid down by water are chiefly river deposits, and come under the general name of alluvium. They are familiar to every one in the bottom lands of streams large or small. Surficial rocks which are spread by wind are little known in districts of even moderate rainfall and vegetation, but in arid regions where dust, resulting from the disintegration of rocks through heating and chilling, is unprotected, they become important. They are exemplified by the sands of the desert. Again, upon the seashore, the effect of winds may be observed in sand dunes; and under special conditions (probably when through the action of glaciers great quantities of finely ground rock meal were provided where streams issued from the ice), the wind has spread over vast areas a sheet of fine dust, which forms the fertile soil of areas of the western plains of North America. A similar deposit of wide distribution occurs in the valleys of China. The peculiarly fine and homogeneous clay has been called loess, and there has been much discussion as to the relations which wind and water have borne in transporting it.

Surficial rocks laid down by ice are broadly classified into those which are produced by ice alone, those which are the product of ice and water together, and those which are produced by waters flowing from the ice. In general they are distinguished from sedimentary rocks chiefly by their heterogeneous composition, since through the action of glaciers in plowing and grinding the surfaces over which they move, rock fragments of various kinds and sizes become mixed, whereas the effect of water is to sort rock debris in distributing it.

Sedimentary Rocks.— Sedimentary rocks are those which are deposited beneath bodies of water which are either still or moving with moderate currents, such as affect lakes and seas. They are laid down in characteristically bedded deposits called strata, which may generally be distinguished from all other forms of rock masses, though sometimes the sediments of a lake or estuary so closely resemble those of a river that no distinction is possible. Along this line sedimentary and surficial rocks grade one into the other. The method of formation of sedimentary rocks has already been described in treating of the process of sedimentation, to which the reader is referred.

Metamorphic Rocks.— The word metamorphic means altered, and in its largest sense, when applied to rocks, would cover all those which are not in the original igneous condition. But it has come to have a narrower meaning, and usually designates a class derived from igneous or sedimentary rocks through the action of heat and moisture and pressure, usually at some depth beneath the earth's surface. That igneous masses which have cooled as intrusives beneath the surface should be subjected to such alteration is easily understood. Sedimentary rocks though formed at the surface may, through the processes of deformation and sedimentation, becomes so deeply buried as to be subject to the same influences. In any case, the process is one of recrystallization under special conditions of pressure, and often of slow movement, and the result is that the rock assumes a more or less crystalline texture, and frequently a thinly laminated structure described by the word schist. Metamorphic rocks are of various kinds, according to the material from which they are derived and according to the degree of metamorphism, which may range from a scarcely perceptible alteration of the original rock to such complete recomposition and rearrangement as to totally obscure the original character.

THE CRUST AND THE INTERIOR.

Some Physical Considerations.— The cooling globe, of which the interior is still very hot, was until recently universally considered to consist of a hard crust over a molten liquid interior, and this view still prevails generally among well-informed people. It is not, however, that which is held by students of the physics of the earth.

It is a general law that, within certain limits, a heated substance may be restrained from melting if confined under sufficient pressure. Pressures within the earth are an effect of gravitation, all substances pressing inward toward the centre, according to their weight. The results are given in the following table, and may be seen to be enormous.

VARIATION OF TERRESTRIAL DENSITY, GRAVITY, AND PRESSURE ACCORDING TO THE LAPLACIAN LAW.

[By R. S. Woodward, 1890.]

Depth in miles	Density	Acceleration of gravity	Pressure in atmosphere	Pressure in pounds per square inch
0	2.75	1.0000g	1	15
1	....	....	400	6,000
2	....	....	800	12,000
3	....	....	1,210	18,150
4	....	....	1,620	24,300
5	2.76	1.0006g	2,020	30,300
10	2.78	1.0012g	4,200	63,000
15	2.79	1.0018g	6,390	95,850
20	2.81	1.0024g	8,600	129,000
50	2.89	1.0060g	22,000	330,000
100	3.03	1.0116g	45,300	679,500
500	4.18	1.0379g	236,000	3,540,000
560	4.36	1.0389g	318,000	4,770,000
610	4.50	[a] 1.0392g	354,000	5,310,000
660	4.65	1.0389g	391,000	5,865,000
1,000	5.63	1.0225g	672,000	10,080,000
2,000	8.28	0.8312g	1,700,000	25,500,000
3,000	10.12	0.4567g	2,640,000	39,600,000
3,959	10.74	0.0000g	3,000,000	45,000,000

[a] This is the maximum value, and the corresponding depth, 610 miles, is the depth at which a given mass would have the greatest weight.

From these estimates it is inferred that the pressure within the earth is sufficient to restrain the mass as a whole from melting, and that a fluid globe within an external hard crust is physically impossible, in spite of the high temperature of the interior.

Under pressures which exceed their crushing strength, the condition of rocks must be one of greater density than at the surface. In fact, the earth having been measured and weighed, it is known that the density of the whole is approximately five and a half times that of water, or about twice that of the rocks occurring at the surface. Hence it is evident that the interior is much denser than the exterior, or, in other words, rocks within yield to the compression.

Direct evidence of the rigidity of the earth's mass has been found through studies of the tides and of earthquakes. Were the earth liquid it must be subject to tidal movements, as are the seas, but observations with very delicate instruments have failed to detect any such earth tides. On the other hand, earthquake shocks recorded by appropriate instruments are known to be transmitted directly through the sphere, as well as around it, and at a speed through the mass greater than that with which they pass around. This fact is taken by physicists as sufficient evidence of great elasticity of the earth's mass, which is consistent only with great rigidity. Thus along several lines of reasoning from the laws of physics, there is evidence that the earth is solid, not fluid, within; and this conclusion is sustained by the phenomena of deformation observed through the methods of geology. Movements of the earth's surface recorded in the development of continents, of lands, and of ocean basins have been so gradual that, considering the great mass of the globe, they are possible only on a rigid sphere. These considerations do not disregard the facts of igneous rocks and volcanic activity, which are, however, to be explained as intense and local results of special stresses set up through the process of deformation.

That portion of the earth's mass which is of most interest to man, and with which he is best acquainted, lies within the moderate depth of six miles from the surface. Here occur all the phenomena of mechanical and chemical change which result in mineral deposits of use and value. The relations of pressure to strength of material are of great importance, and through them the superficial crust is divided into three zones.

The uppermost is that in which all rocks are under such moderate pressures that when forced to move, in process of deformation, they break. Consequently in this uppermost zone, which has a depth of perhaps a mile, cracks and crevices are of general occurrence.

Beneath this superficial zone of fracture, but not distinctly divided from it, is another, in which weak rocks, such as the clay rocks, are constrained by pressure to maintain a coherent mass without open cracks, while other rocks of greater rigidity, such as quartzite, may still break apart. This is the zone of flow and fracture. Under such weight, beds of hard rock may be folded, as one may bend layers of wax, and folds may be pressed one over another till strata are overturned and the order of succession becomes inverted.

A third zone is known as the zone of flow. It lies at a depth of four miles and more below the surface, and is that in which no rock is capable of breaking, because the pressures exceed the crushing strength of any rock. When movement occurs, the masses change form as wax would. This zone is one in which and beneath which there can be no spaces not filled by rock materials, and beneath which, therefore, atmospheric waters cannot penetrate.

Beneath the zone of flow the materials are in that condition of heat and pressure which constitutes the state of potential fusion, referred to in describing igneous rocks; but the conditions so far exceed any which can be observed, that our apprehension of them must long remain in the state of hypothesis, rather than in that of knowledge.

The term crust may well be applied to the three zones of fracture, of flow and fracture, and of flow. The lower limit of the latter can not be defined, but within a thin film, at the most a score of miles deep, is the vast unknown interior.

Some Chemical Considerations.— Chemical reactions, involving exchanges of constituents between substances, are accompanied by changes of temperature and of volume. Burning is a reaction which gives off heat. When carbon is the substance burned, the product is carbon dioxide, CO_2; now we may heat CO_2 to a temperature at which it separates, or dissociates, into two gases (CO and O or carbon monoxide and oxygen), and in this change heat is absorbed; that is to say, in the presence of low temperature the reaction and the effects are the reverse of what they are in the presence of high temperature. If we consider the change of volume involved in different chemical reactions, we shall find those in which there is expansion, and others in which there is shrinkage. When lime is slaked, water combines with the lime and the combined volume is greater than that of the two before combination. The same reaction and result occur when moisture affects feldspar in granite, and combines with or hydrates it. The force of expansion is sufficient to burst the bonds which confine the feldspar crystal in the granite. If we heat the hydrated substance, we can drive off the water; and if the heating occurs under pressure the water is driven off at a lower temperature, because dehydration involves shrinkage, and therefore is promoted by pressure. These illustrations may serve to introduce the general law of chemical reactions as affected by heat and pressure, namely, that between two substances that reaction will tend to occur which meets least resistance or is most effectively aided by the environment.

If we consider the earth's crust as a scene of chemical changes we find that both temperature and pressure increase to a notable degree from the surface downward, and applying the above law we may expect that those reactions which involve liberation of heat and expansion of volume will tend to occur near the cool surface, whereas those resulting in absorption and contraction will be favored in the warmer zones below. The chief effects of weathering in the superficial zone of rocks are the substitution of water, oxygen, and carbonic acid for silica in combination with iron, lime, magnesia, and the alkalies. Some insoluble oxides result, but silica and carbonates go into solution and pass downward into underlying permeable rocks, where they are deposited in great quantities. Beneath the zone of weathering there is thus a zone of cementation, in which the cavities in rocks become filled. If reactions take place the resulting minerals are those whose constitution is favored by high temperature and great pressure. Carbonates, which in combining expand and give off heat, are formed at less depths than silicates, which contract and absorb heat as they form. The zone of cementation grades downward into that of recrystallization, where chemical changes are brought about chiefly by movements within rock masses, and are altogether such as involve absorption of heat and produce heavy minerals.

If the physical and chemical conditions which have been separately suggested be associated as they are in the earth, we may state the effects in the following way:

and the frequency of overtakes. It may have been sufficient to result in general melting, but more likely was insufficient to raise the temperature of the mass to a high degree. This suggestion does not disregard the existing internal heat of the earth, but it has been shown by calculation that that temperature is adequately accounted for by gravitative concentration of the spheroid without external collision.

The earth, according to these considerations, entered upon its present phase of a solid globe with watery and airy envelopes, possibly from a previous condition characterized by somewhat higher temperature, possibly by aggregation of cold matter. When, if ever, a hot earth and a steaming atmosphere gave place to a cold earth with waters gathered in oceans (or when the growing planet had reached approximately its present mass), then began that chapter of history which may be recorded in existing rocks and which it is the object of geology to elucidate.

Zone	Depth	Physical conditions	Chemical conditions
Of fracture and weathering.	0 to 1 mile.	Many open spaces and relatively large crevices; comparatively free circulation of water.	Active oxidation, hydration, carbonation, and desilicification.
Of flow and fracture and cementation.	From near the surface to 4 miles.	Open spaces relatively small and growing smaller with greater depth, till only capillary openings remain.	Cementation by deposition of oxides, carbonates, sulphides, and silica.
Of flow and recrystallization.	3 to 6 miles.	Only capillary and subcapillary openings.	Alteration of rocks with development of heavy silicates.

GEOLOGIC HISTORY.

General Statement.— The astronomer, the geographer, and the biologist consider the earth's history from distinct points of view, the first regarding it as that of a planet, the second as that of oceans and continents, the third as that of organisms. The geologist's account comprises the later phases of astronomical history, includes all geographical changes, and furnishes the fundamental data for the understanding of organic evolution.

The astronomical history of the planet has since Kant and Laplace been based on the nebular hypothesis, according to which the solar system has resulted from the segregation of a homogeneous nebula, and the material of each planet has condensed from a gaseous condition to that which it now has. Intense heat must result from such condensation, and therefore the earth is thought to have cooled from a molten state. Mathematical tests recently appear to show that a homogeneous nebula could not condense to form a system in which the planetary masses should be distributed as they are in the solar system, and also that at the high temperature and great speed of rotation which are necessary to the hypothesis, the earth could not have held so light an element as hydrogen, which is an abundant constituent of terrestrial substances. An alternative hypothesis formulated by Chamberlain, suggests that small cold bodies, designated planetessimals, moving in a common orbit, have coalesced by overtake, rather than by opposed collision. The heat resulting from such a mode of aggregation may have been more or less, according to the size of the bodies

Permanency of Continents and Oceans.—The student of ancient terrestrial geography approaches his subject with a theory of permanent ocean basins and continents; the Indian, Atlantic, and Pacific, Eurasia, Africa, and the Americas are regarded as primeval features of the earth's surface. Yet it is known that every continental area has been submerged beneath marine waters more or less, again and again. The apparent contradiction of theory and knowledge lies in the fact that the words continent and ocean basin have a popular meaning and a technical one, which are not quite the same. In a popular sense the shore line divides the one from the other; in a technical sense a continent may (and now generally does) extend out under the shallow sea to a terraced slope that descends into the depths of the ocean basin proper. In other words, the ocean basins are too small at present to hold all the waters, which therefore overflow upon the margins of the continents. The basins, having been more or less capacious from age to age in the past, have now held, and again not held, all the waters, which accordingly have withdrawn from the lands, or have submerged them. But these changes have not affected the existence of the basins and continents as a whole.

Geologic Time.— The age of the Earth is inconceivable. This seems to be equally true whether we consider the eons which have elapsed since the planet became an individual in the solar system, or only the eras that have passed since it assumed its present physical characters as recorded in the rocks. That eminent physicist, Lord Kelvin, proceeding on the assumption that the earth has cooled from a gaseous condition, has calculated that not more than 40,000,000 years, nor less than 20,000,000 years, have passed since condensation began. But we have already seen that the assumption is not surely correct, and geologists have uniformly contended that far more time was necessary for the events of which they observe the evidence. The estimates based on geological phenomena and comprising only the time covered by them, have rarely been less than 100,000,000 years, and larger ones are probably reasonable.

Before proceeding to state the divisions of time which geologists recognize, it is desirable to suggest the evidence upon which they base their distinctions. It is a simple principle that where sediments have been deposited, layer upon layer, the bottom strata are the oldest. And this principle underlies all determinations of relative geological age. It may be applied to any succession of rocks, however thick, which may be observed in a continuous exposure. In regions where the strata lie horizontally, such observations are limited to a few hundred feet, or at most to a few thousand. But strata are often observed to be tilted so that their edges are exposed in a horizontal surface, and there is then the possibility of examining the relations of strata many thousand feet thick.

A second principle rests upon the evidence of interruptions in the accumulation of sediments such as occur when the sea bottom is for a time elevated above the water and is exposed to the process of erosion. Features of a landscape are then cut upon the strata, and a record is made of the topographic aspects of the land. If the surface is again submerged, and stratified rocks are again laid down upon it, the evidence of interruption remains, and the two series of sedimentary rocks are said to be unconformable. It not infrequently happens that during the interval the underlying set has been deformed, has undergone more or less profound changes of character, and is evidently very much older than the overlying sequence. A great interval of time is then represented at the unconformity between the two rock masses, but the record of it can be compared only to torn or missing pages of an ancient manuscript.

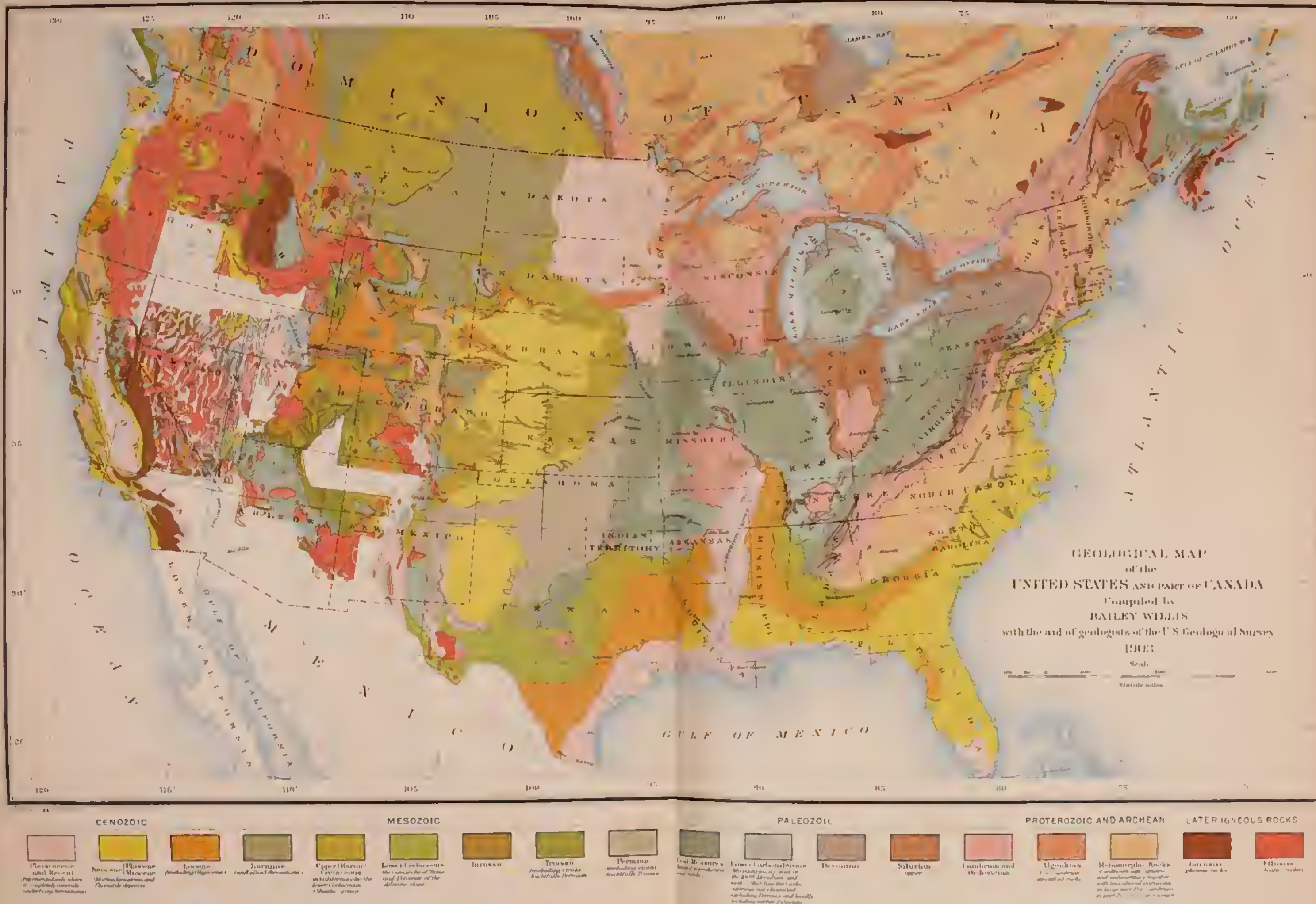
Evidences of sedimentation or of erosion enable us to ascertain the succession of events in any one province, that is so far as we can trace and identify the same strata and the same unconformities, but this possibility is limited by many conditions. On comparing the sequences of strata, even of adjacent provinces, marked differences are found and the simply physical phenomena fail as a basis of correlation of events of history which occurred in separated regions.

A third principle rests upon the evolution of organisms. Late in the 18th century an English engineer, William Smith, who was in charge of a canal dug across tilted strata in southern England, observed that many of the beds contained marine shells; that certain kinds of shells occurred particularly in the lower and older beds, and other kinds in the younger and upper beds; and that these differences as to the kinds of shells were definite and constant. Hence he concluded that wherever he might find shells characteristic of a certain stratum he had a representative of that particular bed, even though he could not trace its continuity from place to place. Thus William Smith laid the foundations for one of the great generalizations of geology, which is that in sediments of each epoch of the earth's history since life began were buried the remains of creatures characteristic of that general time; and these remains becoming fossilized serve to identify the strata in which they may be found with the epoch during which the organisms lived. Hence it follows that fossils are used to compare and correlate the events of geologic history in one province with those in another province within any one continent, and also from continent to continent. But correlation even by faunas is not an accurate matching. Faunas of different provinces are rarely closely alike, their migration has been influenced by physical changes, their evolution depends upon the environment which was undergoing change and was shifting. Correlation by faunas, therefore, involves comparisons of developing migrating associations whose likenesses are derived from a more or less nearly related common stock or stocks. Like methods of correlation by physical evidence it is of highest value only within short range; but of all methods, it is that which at present must be relied on for the greatest ranges.

Great sequences of strata, each of which is characterized by peculiar associations of fossils, have been found throughout Europe, and parallel sequences have been identified throughout North America. In other continents also closely related systems of strata are known. Each great sequence thus marked by peculiar remains of life is named and is thought to correspond to a particular geologic period, although the limits of time divisions are indefinite to the extent that correlation is approximate. The errors, however, are small in comparison with the vast lapses of time represented, so that we may say with Huxley that geologic systems were relatively contemporaneous, though not absolutely so.

The recognized systems are enumerated below in the order in which they would be found in a column were they all to occur in any one province, the oldest at the bottom, the youngest at the top. Their names are taken in most instances from districts in which the strata occur typically, or from characteristics of the rocks themselves. The time division corresponding to a system is here called a period. Periods are grouped to constitute eras, and these are named according to the condition of development of the living forms, except the first, the lifeless era. Thus we have the Azoic, lifeless era, the Eozoic, dawn life era (or the Proterozoic, fore life era, or Agnotozoic, unknown life era), the Paleozoic, ancient life era, the Mesozoic, middle life era, and the Cenozoic, modern life era.

Each system is divided into series, some of which have received names that are used alike in Europe, America, and elsewhere wherever the fossils characteristic of the series are found, while others are identified by name in a particular province only. The Quaternary is divided into Pleistocene and Recent, the former term designating collectively the Glacial epochs. The Tertiary of Europe and North America includes the Eocene, Oligocene, Miocene, and Pliocene series, enumerating from earlier to later. These cover the most familiar cases of



GEOLOGICAL MAP
of the
UNITED STATES AND PART OF CANADA
Compiled by
BAILEY WILLIS
with the aid of geologists of the U.S. Geological Survey
1903
Scale
DOMINION OF CANADA
PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO
MEXICO
LOWER CALIFORNIA
GULF OF CALIFORNIA
LAKE SUPERIOR
LAKE MICHIGAN
LAKE ERIE
LAKE ONTARIO
JAMES BAY
N. DAKOTA
S. DAKOTA
WYOMING
NEBRASKA
COLORADO
KANSAS
OKLAHOMA
INDIAN TERRITORY
ARKANSAS
MISSOURI
IOWA
WISCONSIN
ILLINOIS
OHIO
PENNSYLVANIA
NEW YORK
WEST VIRGINIA
VIRGINIA
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
FLORIDA
TEXAS
NEW MEXICO
MISSISSIPPI
CENOZOIC
MESOZOIC
PALEOZOIC
PROTEROZOIC AND ARCHEAN
LATER IGNEOUS ROCKS
Pleistocene and Recent
Neocene (Pliocene, Miocene)
Eocene
Laramie
Upper Cretaceous
Lower Cretaceous
Jurassic
Triassic
Permian
Coal Measures
Lower Carboniferous
Devonian
Silurian
Cambrian and Ordovician
Algonkian
Metamorphic Rocks
Intrusive
Effusive

names of series in world-wide use; those names which have only provincial use are very many and their definition and correlation belong to manuals and special articles.

Eras.	World-wide systems of strata corresponding to periods of the same names, U. S. Geological Survey usage 1903.	Periods, Geikie's text-book, 1885.
Cenozoic.	Quaternary	Recent, Pleistocene
	Tertiary	Pliocene, Miocene, Oligocene, Eocene
Mesozoic.	Cretaceous	Cretaceous
	Jurassic	Jurassic
	Triassic	Triassic
Paleozoic.	Carboniferous	Permian, Carboniferous
	Devonian	Devonian
	Silurian	Silurian
	Ordovician	
	Cambrian	Cambrian
Proterozoic.	Algonkian	Archean
Azoic.	Archean	

Within each series there are many minor subdivisions which represent conditions in local districts of each province, and for these again distinctly local names must be chosen. The common practice is to give to each such minor division of a rock sequence the geographic name of a place at or near which the particular formation is to be seen in typical character, and this name is applied to that formation as far as the latter can be traced continuously. There was formerly an attempt to recognize the details of geologic systems throughout wide areas, even throughout continents. The geology of North America having been studied first in a thorough manner in New York State, names which were selected from New York localities were applied to formations in distant territories. The "Potsdam sandstone" and the "Trenton limestone" are much-abused examples of this practice. But it has been found necessary to recognize the great complexity of the geologic record by giving distinctive names, and the labor of reducing the multitudinous details to that orderly historic record which they no doubt express must proceed slowly with the development of more complete knowledge of the physical and biological conditions of the past.

Aspects of Physical History.— No attempt can be made to condense an account of geologic history into these few paragraphs, but a general view of the subject may be given. We have seen, in considering geologic processes, that deformation is the initiative process, and that all other phenomena are more or less remote effects of the gravitation of the earth's mass toward its centre. Therefore the first question we may put to the historic record is: What have been the chaanges in the internal energy of the earth during recorded geologic time? The commonly accepted view that the earth has cooled from an excessively heated condition, since the formation of the oldest known rocks, is not sustained by geological evidence. It is true that the oldest rocks — those of the Archean — are predominantly igneous rocks, that is to say, they have crystallized from a molten state. There is, however, abundant evidence that the areas in which they are now observed have been very deeply denuded in process of erosion, and therefore that these ancient rocks have come to the surface from great depths, at which at the present time similar rocks are presumably quite as hot as they were. The igneous character of these ancient rocks is, therefore, entirely consistent with the hypothesis of a cool surface at the time of their crystallization. Moreover, there occur with them small but significant amounts of sedimentary rocks, which in chemical and mechanical characters resemble those of later, even of the latest, epochs, and which therefore indicate that the conditions of temperature were not markedly different from those which now exist. We may consider it improbable that the internal energy of the earth has since the beginning of the Algonkian undergone such great changes as are commonly conceived.

Again, it is frequently supposed that the earth's energy as expressed in the development of mountain ranges, was far more intense and effective in earlier geologic periods than now. But each epoch of mountain growth, and there have been many, is recorded in the sediments which resulted from erosion of the uplifted land masses, and from the volume and character of the sediments we may infer the magnitude of the uplift. Studied from this point of view, the sedimentary strata give no reason to suppose that mountains greater than those which now exist have ever diversified the surface. On the contrary, it appears that there have in the past been long ages during which no mountains developed, and that these ages alternated with epochs of shorter duration, during which mountain growth was an active phenomenon. The Algonkian period, whose duration was probably equal to that of all time since its close, may have included several such alternations of quiescence and activity. It certainly was in some districts, as in that of Lake Superior, characterized not only by vigorous but even by volcanic mountain growth. The Cambrian and Ordovician periods, on the other hand, were not thus marked, and sediments, changing as they do from the mechanical products of erosion to those of a marine origin laid down in widespread seas, indicate that the land stood long at a constant level with reference to sea, and that the elevations of an early date were later reduced to wide plains, which were submerged as they subsided. During the Silurian and Devonian there were cycles of erosion resulting from local uplifts, in alternation with epochs during which the processes were relatively at rest; but these appear to have been of shorter duration. The greater part of the Carboniferous, from its earliest epoch on toward the close, was, like the Cambrian, a time of constant level, followed by subsidence of lands and expansion of seas. The closing epoch of the Carboniferous period and of the Paleozoic era initiated an activity which continued into the Triassic and resulted in extensive lands diversified by mountain chains.

During the Jurassic and Cretaceous these were eroded to low plains, and the surfaces of the lands were widely submerged beneath the broad Cretaceous seas. The Tertiary, like the Upper Silurian and Devonian, had its minor cycles, culminating in a broader extension of the lands; and at the present time we live in an epoch of vigorous mountain growth, when the aspects of the earth are most varied and the conditions of environment and climate are most favorable to a great variety of plants and animals.

Much stress has been laid upon sedimentary rocks in the preceding brief statement, because it is through the orderly relations of stratified beds, and through the fossils which they contain, that we are able to make out something of the geologic record. In order that the reader may gain a clearer idea of the manner of distribution of sediments following upon the great fluctuations in the distribution of lands and seas, the following maps of North America showing the geographical conditions of widely separated epochs, are herewith introduced.

Paleography is that branch of geology which deals with the geography of past times. The appended paleographic maps of North America are based on physical and faunal evidence, which is acceptable as showing the general geographic condition during a geologic age; they are not refined enough to give the geography of a particular epoch. The limits of seas and lands, even where most accurately mapped, were changing, and in no case can one of these maps represent the geography of the continent at a definite date.

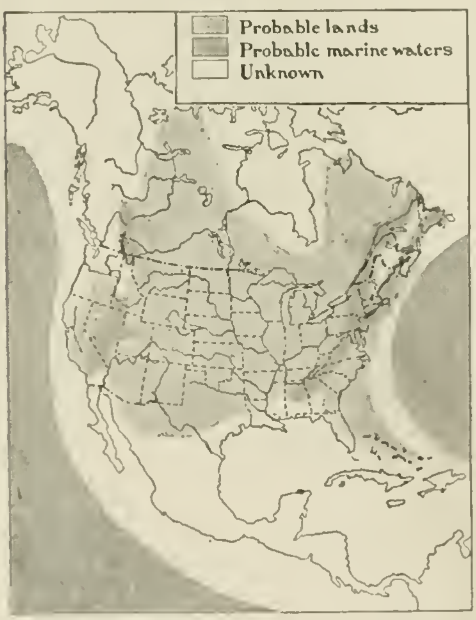


Fig. 1.— Geography of North America during the early Cambrian. Preceding this stage land areas had long been extensive; following this stage they became less by general planation and submergence.

Aspects of Climatic History.— Climatic conditions of the past are known to have been variable. There are evidences of extremely luxuriant plant growth, indicative of warm and moist climates, and in alternation with these occurred ages during which chemical sediments, such as salt and gypsum, were laid down in quantities consistent only with great aridity.

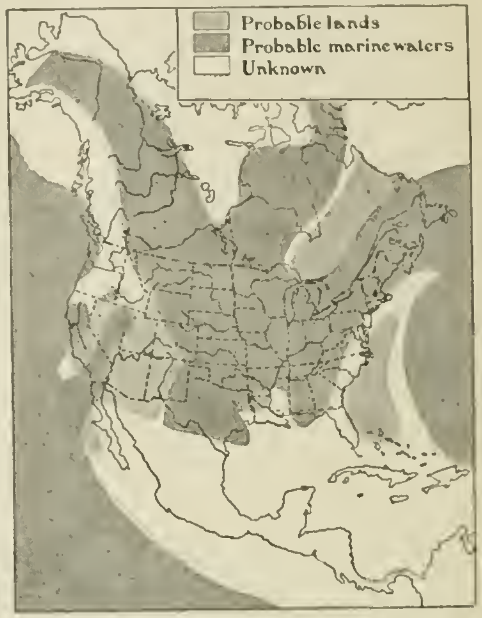


Fig. 2.— Geography of North America late in the Ordovician. About this time the continent was probably more extensively submerged than at any later epoch; extensive emergence followed.

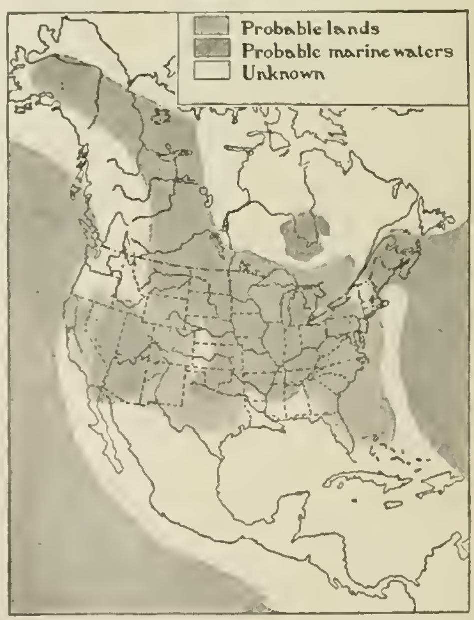


Fig. 3.— Geography of North America late in the Devonian. Preceding this stage land areas had been more extensive, particularly in the eastern United States; following this stage the seas expanded to the condition shown in the next map.

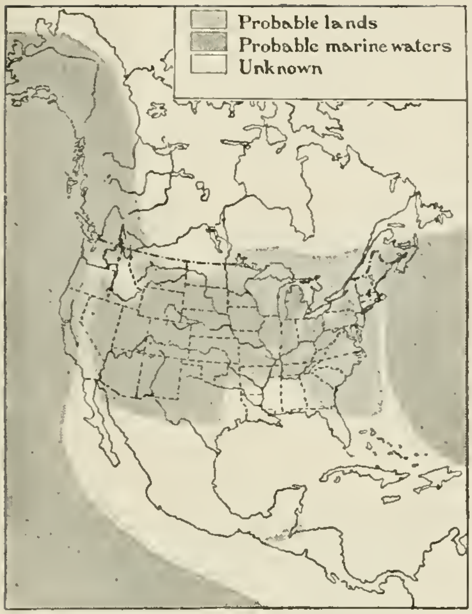


FIG. 4.— Geography of North America during the Mississippian age. At this stage the late Paleozoic seas probably had greatest extent.

FIG. 6.— Geography of North America during the Permian and Triassic ages. This map represents the passage of the continent from Paleozoic to Mesozoic aspects. From Mississippian to Triassic time the net effect of conflicting movements was the general withdrawal of marine waters from the continent, and the later stages of that phase are here represented. Marine deposits also occur in fresh water areas.

Again, there are records of tropical vegetation within the present Arctic Circle, and also of a general ice mantle extending in Europe and America as far south as the fortieth parallel of latitude. Extensive glaciers occurred in Aus-

FIG. 5.— Geography of North America during the Pennsylvanian (Coal Measure) age. Preceded by more extensive seas, this stage was characterized by emerging lands. Marsh, river, and marine deposits alternate in areas shown as fresh water.

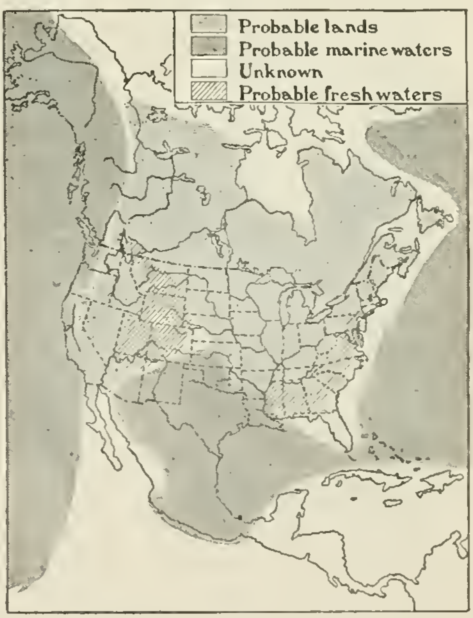


FIG. 7.— Geography of North America during the Lower Cretaceous. Preceding this stage, namely, during the early Mesozoic, land areas had been more extensive than at any time since Algonkian. This map represents the first stage of the Cretaceous submergence which increased to its maximum, see next map.

FIG. 8.— Geography of North America during the Upper Cretaceous. This map represents the culmination of the submergence which occurred during Cretaceous time.

FIG. 9.— Geography of North America during the Tertiary. Accompanying the withdrawal of marine waters from the areas over which they had spread in Cretaceous time, there were effective mountain growths which continued intermittently through the Tertiary and into the Pleistocene, and which resulted in the present distribution of ranges. In the provinces of the Rocky Mountains and Great Plains river and lake deposits of unusual extent accumulated. The map is a composite picture, not one of any definite stage.

tralia and South Africa late in Carboniferous time, where but a short time previously tropical conditions had prevailed, as they do now. Various hypotheses have been framed to account for these special conditions, some of them depending upon changes of astronomical relations of the earth to the sun, others upon altitude of lands above sea, and one upon the constitution of the atmosphere. The last named appears at present to afford the most reasonable basis of explanation, though the hypothesis is by no means established as true in all its phases. It rests upon the physical and chemical properties of carbonic acid (CO_2), and upon the fact that this substance is present in our atmosphere in very small quantities. Physical researches have shown that even the small amount present has a potent influence in absorbing the heat of the sun and raising the temperature of the atmosphere. That is to say, it thickens the atmospheric blanket about the earth. A slight in-

FIG. 10.— Geography of the Pleistocene ice sheets in North America. During the Pleistocene ice sheets developed about three centres in northern Canada and with fluctuations sufficient to characterize several glacial epochs extended at their maximum to the limits shown on this map.

crease in the minute percentage present would suffice greatly to extend the climatic conditions of the temperate and tropical zones toward the north and south poles, whereas a diminution to one half of the present quantity would bring on the conditions of the glacial epoch. Carbonic acid is the most active reagent of the atmosphere entering into decomposing rock masses, and must be taken into combination in relatively great quantities during periods of active erosion. When so combined it occurs in solution in waters in the form of bicarbonates, and in large part passes to the sea. As periods of erosion are not indefinitely continued, but in course of time cease through the activity of the very agencies of erosion, that process runs down, and in time the absorption of carbonic acid becomes relatively insignificant. The amount of carbonates conveyed to the sea may, however, by that time have been sufficient greatly to promote the activity of organic and chemical agents, through which monocarbonates are deposited, especially as limestone, and the second molecule of carbonic acid is set free. The latter is then returned to the atmosphere, which may thus become re-enriched. This idea is the central one of the carbonic acid hypothesis of climatic variation; but with it are combined many auxiliary facts and conditions which greatly strengthen it and serve to explain many of the minor cycles of variation whose record is noted in the rocks and in the life forms which they contain. The whole hypothesis rests upon the periodic activity of the earth's internal forces, already described in speaking of the growth of continents and mountain ranges; and thus climatic change is traced to deformation, the initiative process of all physical conditions of the earth.

It is estimated somewhat indefinitely that 40,000 years have passed since the climate was such that the southern part of the latest great ice sheet occupied Lake Erie and, retreating, permitted the cataract of Niagara to begin its existence at Lewiston. From that place the river has since cut back its gorge to the present site. That time, 40,000 years ago, may be regarded as the close of winter in one of the great cycles of climatic change. It would be interesting to know how long the seasons of that cycle are. Are forty thousand years a month, a springtime, or more? Do we live in the early vernal season of a great era and is the climate to grow warmer during many tens of thousands of years to come? Or is the summer of this cycle well advanced and will a glacial winter again sheathe the north temperate zone in ice?

Aspects of Organic Environment.— The evolution of organic life is properly a subject for distinct treatment, and not to be considered in this connection, except to point out the influence which changes of environment may have had. As far back as early in the Algonkian period, that is to say near the beginning of well-recognized geologic history, there were deposits of carbonates and of carbonaceous material which seemed to indicate the existence of organisms, and trails made by some low forms crawling upon soft mud are abundant in later Algonkian strata. The beginning of the Cambrian period is, however, the first time at which fossils were preserved in large numbers and of varied species. Six of the nine classes of creatures now recognized are represented in strata of that period, and the vertebrates appeared in the next. The other two classes are not of such organisms as would leave remains likely to be preserved. The variety and exuberance of life shows that evolution had been going on during long ages prior to the Cambrian, and that conditions had long been favorable for organic activity. In this connection it should be noted that during the Algonkian, so far as the record goes, land areas had been extensive and sea basins had probably been correspondingly deep and limited. During the Cambrian and succeeding Ordovician periods, occurred one of the greatest submergences not only of North America but also of Europe, and the expanses of shallow seas afforded great realms in which the conditions were favorable to life. These two periods are also characterized the world over by a predominance of deposits of limestone, which according to the atmospheric hypothesis above suggested should have resulted in warm climates appropriate to exuberant life development.

If we were to trace the great changes in living forms which occurred in passing from the Ordovician to the Devonian, from the Carboniferous to the Triassic, from the Cretaceous to the Tertiary, we should find that each accompanied and probably resulted from the great variations of habitat and of climate. Epochs during which seas were wide and temperatures high promoted development and resulted in great diversity of genera and species. Epochs during which seas were limited to deep basins afforded very narrow areas in which competition was fierce and opportunity limited, and the low temperatures resulting from erosion of extended land areas were unfavorable. It is along these lines of suggestion that the geologist is now seeking for the explanation of the stages of organic evolution and of the unequal progress which has been made from one age to another.

APPLIED GEOLOGY.

Scope of the Subject.— The scientific principles of geology relate to rocks and minerals which are useful to man and afford a means of determining their origin, their forms of occurrence and extent, and the peculiar relations of rock masses or structure which have led to concentration, notably of metallic ores. All classes of mineral products fall within the scope of applied geology. Gravels, sands, and clays of surficial deposits, massive rocks quarried for building and ornamental purposes, coals, and other bedded strata, and the ores of iron and of the precious metals, all these are products of genetic conditions which when understood afford clues that promote discovery and direct exploitation. Inasmuch as only exceptional occurrences are valuable, whereas it is generally supposed that mineral wealth is common, the service of applied geology is as frequently to prevent unprofitable operations as to aid those which may yield results. The essential knowledge belongs in part to each of the sciences of geology, mechanics, physics, and chemistry, and to be reliable should be aided by wide experience in observations underground, as well as of geological phenomena in general. The application of principles must rest upon an intelligent understanding of the conditions of formation of a rock mass or deposit, and accordingly economic minerals are classified by the conditions of genesis.

Classification of Economic Minerals.— Classifications of economic minerals, and especially of ore deposits, have been much discussed, and are still debated. One which is adequate for all general purposes follows the classification of rocks already given, and comprises three classes of economic rocks and minerals: Those of igneous origin, those of sedimentary origin, and those of chemical origin by the agency of underground waters.

Igneous rocks have value as useful and ornamental stones, such as granite, serpentine or verde antique, trap rocks for road metal, etc., and occur in large masses, which as a rule are quarried by the simplest processes. Metalliferous ores, which are directly of igneous origin, though commonly supposed to be most abundant, are in fact of limited occurrence. Titaniferous iron ores such as are found in the Champlain district of New York, are igneous rocks peculiarly rich in iron. Ore bodies of other metallic compounds in some instances occur in such relations to igneous masses as apparently to have been formed from gases or waters accompanying the eruptions; but the chief part which igneous rocks play in relation to ores lies in the fact that they contain the metals in appreciable though minute quantities, and yield them to underground waters by which the metalliferous minerals are concentrated in ore bodies.

The class of sedimentary deposits of value includes many clays, sands, building stones, etc.; some iron ores; and coals. The class is characterized by the stratified structure of all materials contained in it. The strata are usually of great extent and moderate thickness, and their dimensions may be observed by tracing and measuring them throughout their appearance at the surface, or outcrop. From these observations the distribution of the strata where they extend beneath the surface, even to considerable depth, may be inferred. It may easily be understood how this method of looking underground is applied to any one tilted stratum, such as a coal bed; and though the operation becomes more complex, the principle remains the same when many beds of known succession are considered. The same method of observing the normal succession and thickness of strata and of drawing inferences as to the extent of formations underground is applied in districts where the layers have been bent into forms of troughs and arches, which are usually long, narrow, and parallel. Any stratum occurring at the surface bears known relations to all those below it, and thus the depth to any other stratum beneath any particular one seen may be estimated. Through many such estimates the form of the trough corresponding to any one stratum may be worked out and delineated by maps, drawings, or models. These principles, based on the regularity of stratification and of sequence of strata, are of most service in regard to coal beds and artesian waters, serving in the former case to afford a basis on which the amount of coal and the methods of mining may be determined in advance; and in the latter case to determine the depth at which an artesian flow of water may be reached. Good topographic and geologic maps are essential preliminaries to such economic investigations if the latter are to be reliable and of value.

Ore Deposits through Underground Waters. — Underground waters circulate deeply downward, laterally and upward in the earth's crust. They dissolve constituents of nearly all minerals, including gold, some of them readily, at surface pressures and temperatures, others in notable quantities only at pressures and temperatures of deeper zones. In circulating they bring together solutions which may differ in composition and may cause chemical reactions; or they may bring solutions into contact with wall rocks that exert similar chemical influences. The results are precipitation of metalliferous minerals in cavities, or the replacement of the wall rock itself by the ore. To these activities most ore deposits are due.

The metallic elements are contained in igneous rocks which are the original sources, but usually in minute quantities and disseminated through large masses and in compounds not available as ores. The universal combinations of iron and other bases with silica are obvious examples, as is also the frequent occurrence of pyrites or "fool's gold." Processes of chemical alteration, solution, and deposition are necessary steps toward concentration, and they may be more or less complex or often repeated. The reagent which accomplishes these chemical reactions is primarily that rain water which percolates beneath the surface and becomes ground water. Charged with oxygen and carbonic acid, it enters the superficial part of the zone of fracture, and is there active in producing oxides and carbonates and displacing silica, as already described. The important reaction upon metalliferous ores is the oxidization and carbonation of sulphides. Descending through the zone of cementation, where it may deposit much or all of the substances taken into solution, the water is warmed or heated, and is under constantly increasing pressure as it sinks deeper. It thus becomes a more active solvent for metalliferous minerals, and in the deep zone of recrystallization, where the movement is through capillary and subcapillary spaces, and is very slow, it may become even more potent. Its course in circulating, however deep and roundabout, is toward an outlet at the surface, and is ultimately upward. Among the ascending waters there may well be those which have escaped from the magmas of the interior and with substances in solution have joined the meteoric waters. The circulating underground solutions are directed in movement by the spaces in and between rock masses, spaces which are very minute in the deeper part of the zone of flow and fracture, and which are larger in the stronger rocks and nearer the surface. The larger ones, which are called trunk channels, are those in or near which ore bodies may form. The courses of descending and ascending waters are also controlled by relatively impervious beds, such as strata of clay, or shale, or schist, which may be too weak to maintain openings and too dense to absorb solutions. The spaces between rock masses are usually effects of deformation, fissures, faults, and folds, which are detected and traced through the fact that along them the rocks have departed from the relative positions or succession which they originally had, or have been brought into contact by intrusion, in the case of eruptive rocks. To understand the character of the structure, whatever it may be, involves primarily an understanding of the nature and original relations of the rock masses.

Large ore bodies if developed in open spaces can only occur in the zone of fracture and in the upper part of the zone of flow and fracture. If they are formed by replacement of the country rock by metalliferous minerals, their limits are determined by the mechanical, physical, and chemical conditions that in the individual case favored replacement. The relative parts played by descending, ascending, and laterally flowing solutions are unlike in the different cases, but are of practical significance in estimating the position and extent of ore bodies. The chemical reactions which may result in formation of ore minerals from gases, from solution, or by replacement, are controlled by pressure, temperature, and environment, in ways that are not fully understood and that are being actively investigated. It is, however, clear that the exceptional concentrates are to be sought in general in regions of disturbance, and, so far as the precious metals are concerned, especially in districts affected by intrusive igneous rocks; further that ore bodies are usually related to water channels which may best be followed through an understanding of the structure by which they were determined; and that within ore deposits processes of oxidation, carbonation, solution, and reprecipitation are in progress and produce the richest accumulations of ores.

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General Bibliographies.— The literature of the several branches of geological science is voluminous, but there are many articles published in serials which are of interest to the general reader. Reference to all the literature may be had through the following bibliographies: Darton, 'Catalogue and Index of Contributions to North American Geology 1732-1891' (Bull. U. S. Geol. Survey No. 127); Warman, 'Catalogue and Index of the Publications of the United States Geological Survey 1880-1901' (Bull. U. S. Geol. Survey No. 177); Weeks, 'Bibliography of North American Geology, Paleontology, Petrology, and Mineralogy for the years 1892-1900, Inclusive' (Bull. U. S. Geol. Survey No. 188).

The official bulletins, annual reports, and professional papers of the United States Geological Survey contain many special articles, and may be had on application to the director, Washington, D. C.

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Geomancy, jē'ō-măn-sĭ (Greek, *gē*, the earth, and *manteia, divination*), a kind of divination formerly practised. Sparry, in his translation of Cattan's 'Geomancie' (written about the middle of the 16th century, and translated in 1591), says: "Geomancie is a science and art which consisteth of points, prickes, and lines made instead of the foure elements, and of the starres and planets of heaven. . . And this arte may be made on the earth or on white paper, or uppon any other thing whereon it may commodiously be done, so that the prickes and lines may be knowen." See DIVINATION; FUNG-SHUI.

Geomet'rical Mean of two numbers is that number the square of which is equal to the product of the two numbers; thus, the geometrical mean of 9 and 16 is 12, for $9 \times 16 = 144 = 12^2$. Hence the geometrical mean of two numbers is found by multiplying the two numbers together and extracting the square root of the product.

Geometrical Optics. See MIRROR; LENS; OPTICS.

Geometrical Progression. A series of quantities is said to be in geometrical progression when the ratio of each term to the preceding is the same for all the terms, that is when any term is equal to the product of the preceding term and a factor which is the same throughout the series. This constant ratio or factor is termed the *common ratio.* See PROGRESSION.

Geometridæ, jē-ō-mĕt'rĭ-dē, a family of moths whose larvæ walk by arching the body and so bringing the hinder feet (prolegs) close up to the forward (thoracic) feet, and again reaching forward. Hence they are called "loopers," "inch-worms," etc. See MEASURING-WORMS.

Geometry. The characteristic aspiration of scientific man is to conceive the universe as a genuine cosmos. Of scientific generalizations, one of the most obvious and important, and one which is at the same time historically among the first, has reference to *order*, namely, that the universe presents or at least suggests two grand order-types: order of coexistence or of side-by-side, that is, order-in-Space; and order of succession or of before-and-after, that is, order-in-Time. These seem to be logically independent. Which one, if either, is the more fundamental remains undetermined. The two combine to give the category of motion, and accordingly the world presents alike to the sense and to thought two complemental aspects, the static and the dynamic. To these and their combination correspond the fundamental sciences. The mentioned order-types taken in the abstract are the subject-matter of mathematics: the former yielding pure geometry, the latter pure analysis; the two together, analytico-geometry and geometrico-analysis.

By perusal of the articles that immediately follow, the reader may gain some notion of the wondrously diverse and manifold significance assumed by the term geometry in modern times. The view thus gained may be further matured and enriched by reference to such other articles of this work as: CURVES, HIGHER PLANE; CURVES OF DOUBLE CURVATURE, THEORY OF; SURFACES, THEORY OF; MENSURATION; HYPERSPACES; ANALYSIS SITUS; QUATERNIONS; CALCULUS OF VARIATIONS, THE; CALCULUS, THE INFINITESIMAL; HARMONIC ANALYSIS; EQUATIONS, DIFFERENTIAL; INVARIANTS AND COVARIANTS. Some of these latter are indeed primarily analytic. They nevertheless serve to illustrate, not only the unity of mathematics in general, not merely the complemental relationship in which the two grand divisions, geometry and analysis, stand to each other, but in particular the universal pervasiveness of geometric concepts and methods.

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Geometry, History of the Elements of. The history of the science of geometry begins in Greece. It is true that mensuration was developed to a considerable extent at an early period in Egypt, Babylonia, and India, and that this work involved the measurement of angles in the astronomical observations of the people of these countries, but the abstract science of form never attained any prominence before the Greek period. In Egypt, for example, the harpedonaptæ (rope stretchers) knew the right-angled triangle whose sides are 3, 4, 5, and stretched their ropes to lay out a right angle in much the same way that a modern surveyor erects a perpendicular by the help of his chain; but there is no evidence that the Egyptians thought of proving the Pythagorean theorem. Herodotus testifies to the fact that the Egyptians divided the land that was subject to the overflow of the Nile, into quadrilaterals, and therefore they must have had some knowledge of elementary surveying. Indeed, long before this time Ahmes (see ALGEBRA, HISTORY OF THE ELEMENTS OF) gave certain rules, partly incorrect, for measuring areas and volumes, in particular an interesting one for the area of the circle, $a = (d - \frac{d}{9})^2$. All of this work was, however, very elementary, and the rules were merely the result of unscientific observation.

In Greece the science of geometry may be said to have begun with Thales (q.v.), who was born at Miletus, c. 640 B.C., and who died at Athens in 548. Brought up in contact with the learning that drifted from the East to the shores of the Mediterranean, in his younger days devoted to those commercial pursuits that made Miletus a centre of wealth, he traveled extensively, and devoted his later years to philosophy. From Egypt he seems to have taken back to Ionia whatever of primitive geometry was known, and his school at Miletus was devoted to the study of philosophy, astronomy, and the science of form. Thales is supposed to have proved the propositions concerning the equality of vertical angles, the sides opposite the equal angles of a triangle, the determination of a triangle by one side and two angles, the bisection of a circle by a diameter, and the nature of an angle inscribed in a semicircle. His most famous pupil was Pythagoras (q.v.), who was born at Samos in 580 and died in southern Italy in 501. A man of great personal magnetism, a mystic, and versed in the lore of the Orient, Pythagoras made his school at Crotona, the mathematical centre of his time. Although none of his works are extant, if, indeed, he wrote any, it is known that he proved the famous theorem which bears his name (Euclid I., 47), a proposition known empirically to the Egyptians, at least for special cases. Pythagoras also gave much attention to the study of proportions and irrational quantities, always from the standpoint of geometry. He also knew the size of the angle of a regular n-gon, and the stellar pentagon was made the badge of his order.

The century following Pythagoras was one of discovery. Among the most noted geometers was Hippocrates of Chios, c. 440 B.C., who must not be confounded with the great physician who wrote on the mystic number 7. Hippocrates, who had come in contact with the Pythagoreans, wrote the first Greek text-book on mathematics, and designated the geometric figures by letters placed at the angles. To him is due the first example of the quadrature of a curvilinear figure, a proposition known as the lunes of Hippocrates. The theorem asserts that if semicircles be described on the three sides of a right-angled triangle in such way as to form lunes on the two shorter sides, the area of the lunes equals that of the triangle. In his attempt to duplicate the cube he showed that the problem can be solved if two mean proportionals can be found between c and $2c$, where c is the edge. This problem was one of the three famous ones of antiquity, the others being to square the circle and to trisect any given angle. It is now known that these problems, easily solved if the necessary instruments are allowed, cannot be solved merely by the use of an unmarked ruler and a pair of compasses. Contemporary with Hippocrates lived Hippias of Elis, to whom is probably due the quadratrix which Dinostratus afterward studied and named. About the same time Antiphon and Bryson sought the quadrature of the circle by means of inscribed and circumscribed polygons, the number of sides being successively doubled, and with them begins the theories of limits and of exhaustions.

The influence of Plato (429–348 B.C.) on elementary geometry was greater than is usually supposed. He found the science in a disordered state, a mass of unrelated propositions, very likely covering much of plane geometry as found in Euclid. His philosophic mind led him to the attempt to put the science on a more satisfactory foundation by insisting upon accuracy of definition, upon a limited number of postulates (including axioms), and upon definite bounds to plane geometry. As a result, only those figures capable of construction by the help of an unmarked ruler and the compasses are recognized as belonging to the field of elementary geometry. To the school of Plato is also due the analytic method of attack in geometry, including the *reductio ad absurdum*. Although not himself a great discoverer in mathematics, two of Plato's pupils reached high eminence in geometry. Of these the first was Eudoxus, who extended the theory of proportion, founded the doctrine of similar figures, gave much attention to the problem of the golden section, applied the method of exhaustions to the mensuration of solids, and wrote the first text-book upon stereometry. The second was Menæchmus, who, in his attempts to solve the duplication (or Delian) problem, discovered the conic sections. The study of the five regular polyhedra also occupied the attention of Plato's pupils, so much so that they received the name of Platonic bodies.

The influence of Aristotle was directed to the encouragement of the study of the history of geometry and the applications of mathematics. As a result, his followers began to collate the work of the earlier Greeks and to consider its relation to physical problems. Elementary geometry now enters the text-book period, and several attempts at works of this character appear in the fourth century, B.C. This movement culminated in the works of Euclid (q.v.), a man of whose personal life we know practically nothing save that he taught and wrote in Alexandria c. 300 B.C. Probably of little originality in the way of mathematical discovery, Euclid had a genius for compilation, and this showed itself in the Στοιχεία (connected series), or *Elements,* as it was called in later times. This famous work is devoted principally to plane geometry, and it has formed the basis of practically all elementary treatises up to the present time. The natural effect of Euclid's work was to give the impression that the field of elementary plane geometry was exhausted. Mathematicians therefore directed their energies to the applications of geometry, to stereometry, and to conics. Archimedes (q.v.), writing at Syracuse c. 240 B.C., opened the great field of mathematical physics and carried the study of elementary geometric solids to its greatest height among the Greeks. To him is also due the limits $3\frac{1}{7}$ and $3\frac{10}{71}$ for π, the study of the spiral that bears his name, and the quadrature of the parabola. Apollonius of Perga (q.v.), "the great geometer," wrote eight books on conics c. 225 B.C., and set a standard which still influences the text-books in analytic geometry. Of the minor geometers who followed Apollonius, two may be mentioned. Nicomedes (c. 180 B.C.), who invented the conchoid, a curve which easily solves the trisection problem, and his contemporary, Diocles, whose cissoid furnishes an easy means for duplicating the cube. Of the later Greek geometers the most noteworthy is Hero of Alexandria (see HERO OF ALEXANDRIA), whose personal history, like that of Euclid, is practically unknown, and to whom it is difficult to assign a date even within a century. His most interesting contribution to elementary geometry is the formula for the area of a triangle in terms of the sides,

$$\Delta = \sqrt{s(s-a)(s-b)(s-c)}.$$

Possibly contemporary with Hero lived Menelaus, whose theorem, known in the Middle Ages as the *Regula sex quantitatum,* has made his name well known. His most important discovery, however, was the projective property of the anharmonic ratio. By this time the age of discovery in geometry had passed in Greece, and the efforts of the Neopythagoreans at Alexandria were productive of little that is remembered. Pappus (c. 300 A.D.), an Alexandrian mathematician and geographer, may be called the last of the Greek geometricians who showed any originality. He suggested the theory of involution of points, restated the projective property discovered by Menelaus, and discovered the theorem (which also bears the name of Guldin) concerning the volume generated by a plane figure revolving about an axis.

The Orientals contributed but little to elementary geometry, their interests being rather directed to algebra (q.v.) and trigonometry (q.v.), with astronomy as the leading application for their advanced mathematics. Brahmagupta, a Hindu, born in 598, generalized the Hero formula, showing that the area of an inscribed quadrilateral is expressed by

$$A = \sqrt{(s-a)(s-b)(s-c)(s-d)},$$

but aside from problems in mensuration, geometry played but little part in India. The Bagdad school of c. 800 was chiefly interested in geometry only as it concerned trigonometry, and its greatest contribution to the science consisted in the preservation of the works of the Greeks. Euclid, for example, was first made known to Christian Europe in the Middle Ages through a translation from the Arabic by Adelhard of Bath, c. 1120.

Among the first books on mathematics to be printed was Euclid's 'Elements' (1482), a fact which made this famous work again a standard. The appearance of this classic had the same effect as in the later centuries of Greek culture, to encourage commentators rather than investigators. In the way of original work, only such minor efforts as the study of stellar polygons and the geometry of a single opening of the compasses characterized the closing decades of the Middle Ages and the opening years of the Renaissance. Not until Kepler (q.v.) suggested the principle of continuity (1604), and Cavalieri set forth the method of indivisibles (1629; published in 1635), and Desargues began the theory of modern geometry (1639), was there any material advance in the subject. When, however, this advance was undertaken it was so vigorous as to lead from elementary geometry to higher fields. In the latter part of the 19th century there was a renaissance of investigation in the elementary domain, leading to an interesting but not very productive study of the geometry of the circle and the triangle, notably in the work of Lemoine and Brocard. The 19th century also saw an exhaustive study of non-Euclidean geometries (q.v.), those based on other postulates than those of Euclid. This study began with the works of Lobachevsky and Bolyai (qq.v.), and has led to very interesting results, hardly to be ranked, however, in the domain of elementary geometry.

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Geometry, Cartesian.—Between number and the properties of number, on the one hand, and space and the properties of space, on the other, there is, strictly speaking, no *resemblance*; and the science of number, *i.e.*, algebra or analysis, and the science of space, *i.e.*, geometry, are essentially, psychologically, and logically independent doctrines. But despite their fundamental unlikeness and independence, there is between the two, broadly speaking, a fact-to-fact *correspondence*. For example, there subsists, or may be established, a unique and reciprocal, or one-to-one, correspondence between the real numbers and the points of a straight line or other curve; between the real numbers and the lines of a flat pencil (see PROJECTIVE GEOMETRY) or the tangents to a curve; between the pairs of real numbers and the points or the lines of a plane; between the triplets of real numbers and the circles of a plane or the points or planes of space; between the quartets (permutations four at a time) of the real numbers and the lines or the spheres of space (see LINE GEOMETRY AND ALLIED THEORIES). The theory of the correspondence thus simply exemplified, the logically organic body of propositions setting it forth, is the *science* called analytic or algebraic geometry. It is often called coördinate geometry from the fact that the set of numbers determining or corresponding to a geometric element are called the coördinates of the element. By virtue of the correlation between analytic facts and geometric facts, it is frequently possible, when facts of the one type are known, to infer the corresponding facts of the other, and so to investigate space analytically (algebraically, arithmetically) and to investigate number geometrically. Under either of these aspects, analytical geometry appears as a *method*: analytic investigation of geometry, geometric investigation of analysis. Usually it is the former aspect under which the doctrine is regarded, geometry being the subject-matter, and analysis the means or instrument of research.

The science presents numerous branches or varieties. These differ among themselves in various ways. Two varieties may differ in respect to what is often called their 'spaces,' *i.e.*, in respect to the domains, fields, regions, or extents (as curve, surface, space) containing the configurations with which they deal. Thus arise such distinctive designations as geometry of (on, in) a plane, or plane geometry, geometry on a surface or a curve, geometry of space. Again, a given 'space' or domain may be conceived in countless ways. It may be conceived as the assemblage of its points or of its lines or of its circles, and so on. Accordingly two geometries relating to a same 'space' or domain may yet differ in respect to their *primary* elements, in respect, *i.e.*, to the elements of which the configurations investigated are regarded as composed. So arise, for example, such distinct theories as the point, line, circle, . . . , geometries of the plane, and the point, line, plane, circle, sphere, . . . , geometries of space. Once more, as will appear in this and related articles herein cited, a chosen element in any given domain may be referred to different kinds of configurations of reference; it may, in other words, be determined by, made to correspond to, or be associated with, different kinds of *coordinate systems.* Upon the choice of coordinate system depends, *ceteris paribus*, the analytic form of a given geometric theory. Accordingly, two geometries that are identical in content may differ in form, in algebraic guise or garb.

The primitive, by far the oldest, variety of analytic geometry, the parent of all other varieties, is the Cartesian, so called from its founder, René Descartes (1596–1650). Though originally a plane geometry, its procedure is equally adapted, and has been extended, to spaces of every dimensionality in points (see HYPERSPACES). It is characterized partly by its primary element, the point, and partly by its coordinate system, which will be explained below. Descartes' geometry, contained in his *Discours de la méthode pour bien conduire sa raison et chercher la vérité, dans les sciences*, published in 1637, is to be regarded, on account of its influence on mathematics and upon knowledge in general, as one of the very greatest contributions ever made to science. Descartes was not indeed the first to apply algebra to geometry. That had been done by «the great geometer,» Apollonius of Perga (about 260–200 B. C.), who had referred the conic sections to their tangents and diameters, expressing the relations by linear equations between areas. In the 14th century Oresme and others had applied numbers («latitudo» and «longitudo,» precursors of the modern ordinate and abscissa) to refer a point to two chosen rectangular lines or axes. The point was confined, however, to the first quadrant. In this way the straight line, the circle and the parabola were studied. Other predecessors of Descartes were Vieta (1540–1603), Cavalieri (1598–1647), Roberval (1602–1675), and the brilliant Fermat (1601–1665), who more nearly than any other approaches Descartes in his understanding of the analytic method. Even Fermat, however, had apparently not seen, what Descartes saw, the possibility of referring at once to a single coördinate configuration different curves of different orders.

The following paragraphs give a very brief account of the elements of Cartesian, or ordinary analytical, geometry with special reference to the straight line and the conic section and the simplest configurations of space.

THE PLANE.

Cartesian Coordinates.—Any two straight lines, as XX' and YY', are assumed as lines of reference, or *coordinate axes*. The former is X-axis or axis of *abscissæ*, the latter is Y-axis or axis of *ordinates*. The point O is the *origin* of *distances;* the (half) line OX, the *origin* of *angles*. Distances on or parallel to the X-axis are regarded *positive* (+) if measured *rightward*, *negative* (−) if *leftward*. Distances on or parallel to the Y-axis are regarded *positive* if measured *upward*, *negative* if *downward*. Angles are regarded *positive* or *negative* according as they are conceived to be generated by *counter-clockwise* or by *clockwise* rotation. (See TRIGONOMETRY.) Conceive drawn all lines parallel to the X-axis and all parallel to the Y-axis. Any pair of these lines, one of the former set and one of the latter, determine (intersect in) a point, and all points of the plane are thus determined. Conversely, any point determines (is the common point of) a pair of the lines, and all the pairs of the parallels are

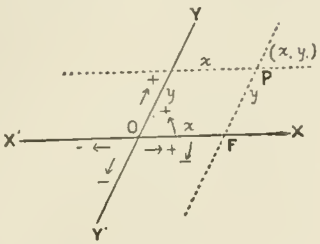

FIG. 1.

thus determined. Obviously any line-pair or its *point* determines two real numbers: the distances OF and FP in terms of any convenient unit. These, denoted respectively by x and y, are named respectively the *abscissa* and the *ordinate*, together the *coordinates*, of the point. Conversely, any *pair* of real numbers determine a point. It is thus seen that, by means of a pair (system) of axes, a one-to-one correspondence is established between the *points* of the plane and the assemblage of real number *pairs*. Any such point and its pair of coordinates are said to *correspond*; the point is said to depict or represent its pair of numbers geometrically, and the number pair is said to represent the point arithmetically or algebraically or analytically.

Transformation of Cartesian Coordinates.—It is plain that (the unit being the same) the coordinates of a point referred to one pair of axes will not coincide with its coordinates referred to a different pair. Formulæ for expressing the old in terms of the new coordinates are exceedingly useful. To find such formulæ, consider first the case where the old and new origins coincide. Denote by α and β the angles made with OX by OX' and OY' respectively. Let x and y be the old, and x' and y' the new, coordinates of any point P, and denote the

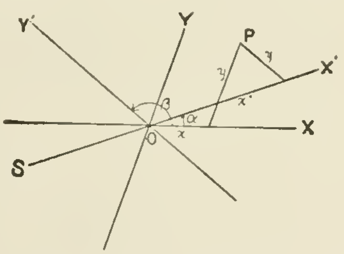

FIG. 2.

angle XOY by ω. The formulæ in question are readily seen to be: $x \sin \omega = x' \sin (\omega - \alpha) + y' \sin (\omega - \beta)$, $y \sin \omega = x' \sin \alpha + y' \sin \beta$. If the origins do not coincide and if h and k be the coordinates of the new origin O' with reference to the old axes, the formulæ of transformation are found by adding $h \sin \omega$ and $k \sin \omega$ respectively to the right-hand members of the foregoing equations. Most commonly the axes are assumed to be *rectangular*. In that case, $\omega = 90°$, $\sin \omega = 1$, $\beta = (90° + \alpha)$, and the equations of transformation become: $x = x' \cos \alpha - y' \sin \alpha + h$, $y = x' \sin \alpha + \cos \alpha + k$. The equations for effecting the *inverse* transformation are found by solving for x' and y' the equations of the *direct* transformation.

Polar Coordinates.—Though it is never necessary, it is often convenient, to employ other than Cartesian coordinates to determine the position of a point. Of such other coordinate systems, the most familiar is the *polar*. About any point O (as center), called the *pole*, suppose drawn all possible concentric circles; also suppose drawn out from the pole all possible *rays* (half-lines). Any circle and any ray determine (intersect in) a point, and all points of the plane are thus determined; conversely, any point determines (is common to) a circle

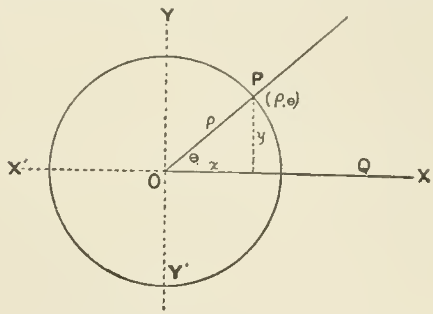

FIG. 3.

and a ray, and all pairs of such lines (circle and ray) are thus determined. A circle is given by its radius ρ, and a ray by its angle θ made with a fixed ray, as OQ, called the *initial line* or *polar axis*. All the circles are obtained by letting ρ vary from 0 to ∞, and all rays by allowing θ to vary from 0 to 2π or 360°. Obviously, to any pair of values (within the ranges of variation mentioned) of ρ and θ there corresponds one point, and conversely. The pair of numbers (ρ, θ) determining or determined by a point P are called the *polar coordinates* of P. In particular, ρ is called the *radius vector*, and θ the *vectorial angle*, of P.

Transformations from Cartesian to Polar Coordinates.—We present here only the simplest and most important case, *viz.*, that wherein the Cartesian axes are rectangular, the origin coinciding with the pole, and the positive half of the X-axis with the polar axis. Let P be any point. It is clear, Fig. 3, that the equations of direct transformation are: $x = \rho \cos \theta$; $y = \rho \sin \theta$. Solving these for ρ and θ, the equa-

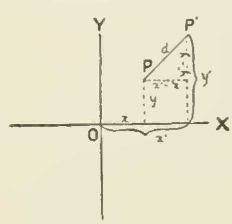

FIG. 4.

tions of the inverse transformation are found to be: $\rho = \sqrt{x^2 + y^2}$; $\theta = \tan^{-1}\dfrac{y}{x}$.

Distance between Points.—Henceforth the axes will be assumed to be rectangular. Let P and P' be any two points, of coordinates

(x, y) and (x', y') respectively. From Fig. 4, by the Pythagorean theorem, $d^2=(x-x')^2+(y-y')^2$, whence the distance between any two points (x, y) and (x', y') is found to be $d=\sqrt{(x-x')^2+(y-y')^2}$. Transforming to polar coordinates (ρ, θ) and (ρ', θ'), and reducing, there results $d=\sqrt{\rho^2+\rho'^2-2\rho\rho'\cos(\theta-\theta')}$, in agreement with the Law of Cosines. (See TRIGONOMETRY.)

Division of Line-segment in Given Ratio.—Suppose P divides the segment P_1P_2 in the

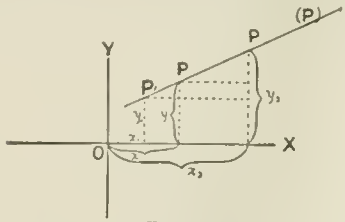

FIG. 5.

ratio, $m_1:m_2$. By hypothesis, $P_1P:PP_2=m_1:m_2$; hence, from similar triangles,

$$m_1:m_2=(x-x_1):(x_2-x)=(y-y_1):(y_2-y);$$

these equations, solved for x and y, yield

$$x=(m_1x_2+m_2x_1):(m_1+m_2)$$

and $$y=(m_1y_2+m_2y_1):(m_1+m_2).$$

If the division be *exterior*, *i.e.*, if P be *outside* the segment, as at (P), one term of the ratio is negative, and the formulæ are

$$x=(m_1x_2-m_2x_1):(m_1-m_2),$$

$$y=(m_1y_2-m_2y_1):(m_1-m_2).$$

If P be the interior mid-point, $m_1=m_2$, and $x=(x_1+x_2):2$, $y=(y_1+y_2):2$. If $m_1=-m_2$, P is the exterior mid-point and its coordinates are both infinite unless the segment is parallel to an axis, in which case but one of the coordinates is infinite.

Locus of Equation.—An equation, $f(x, y)=0$, between the variables x and y, *defines* a system or aggregate or assemblage of *pairs* of numbers, *viz.*, the assemblage of pairs of values of x and y that satisfy the equation. To each of such pairs of (real) values, a system of axes and a unit of distance being chosen, there corresponds a point. The assemblage of all the points so determined constitute the (real) *locus* of the equation. In general, as x or y varies continuously, y or x will vary continuously, and accordingly the corresponding point will trace a continuous path, some *curve*, the locus in question. Conversely, if a point move subject to some geometric condition, its path will be a curve such that the coordinates of its points and of no other satisfy some equation. An equation and its locus or curve are each said to represent the other, and, from the properties of either, corresponding properties of the other can be inferred. An equation defines its locus, a locus defines its equation. Any equation, $f(x, y)=0$, is, of course, satisfied by countless pairs of values of which either (or both) is imaginary or complex. To such a pair no real or «visible» point of the plane corresponds. Nevertheless, in order that the geometric and analytic languages shall be coextensive, it is customary to say that any pair of numbers of which at least one is complex represents an «imaginary point» of the plane. Accordingly the locus (in generalized sense) of an equation is composed of a real part and an imaginary part, the latter consisting of all imaginary points whose coordinates satisfy the equation. The intersection of two loci or curves consists of the points (real and imaginary) whose coordinates satisfy the equations of both curves. The foregoing remarks respecting equations in Cartesian coordinates apply equally to equations in polar coordinates.

The Straight Line and the Linear Equation.—Let (1) be any line through the origin, and denote by θ its angle with OX, and let $m=\tan\theta$. Obviously the x and y of any (every) point of (1) and of no other point are connected by the equation $y=mx$, which therefore defines, and is called the equation of, line (1). To each line through O there corresponds one value of the *slope* m, and conversely. Any line not through O is parallel to a line through O. Hence (2), parallel to (1), represents any line not through O. Clearly by adding b to any y of (1) the corresponding y of (2) is found, while corresponding x's are the same. Hence the equation of (2) is $y=mx+b$. The quantity b is called the *Y-intercept* of the line; if b is zero, (2) goes through O, and conversely. The equation represents a line for every pair of real values of m and b; conversely,

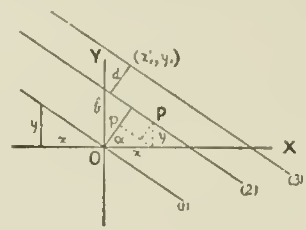

FIG. 6.

every line has a slope and a Y-intercept (positive or negative). Hence every equation of 1st degree in x and y represents a straight line, and conversely. Solving the equation $y=0$ of the X-axis and the equation of (2) as simultaneous, the intersection is found to be $\left(-\frac{b}{m}, 0\right)$, or $(a, 0)$, whence the equation of (2) may be written $\frac{x}{a}+\frac{y}{b}=1$, called the *intercept* or *symmetric form*, a being the X-intercept. The equation $y=mx+b$ is called the *slope form*. Other forms are readily obtainable, of which one of the most important is the so-called *standard* or *normal* form, $x\cos\alpha+y\sin\alpha-p=0$, readily deducible from the figure, where p is the length of the perpendicular (normal) from O to (2), α is the angle indicated, and P is any point of (2). The *general* equation

$$Ax+By+C=0$$

can be reduced to any of the foregoing forms. To reduce it to the normal form, it suffices to multiply by the *normalizing factor*, $1:\sqrt{A^2+B^2}$, yielding

$$\frac{Ax}{\sqrt{A^2+B^2}}+\frac{By}{\sqrt{}}+\frac{C}{\sqrt{}}=0.$$

where $\cos\alpha = A:\sqrt{}$, $\sin\alpha = B:\sqrt{}$, $p = -C:\sqrt{}$, that sign before the radical being chosen which renders the constant (or absolute) term negative. A line is determined by yet other pairs of data, as by its slope m and a given point (x_1, y_1) or by two points (x_1, y_1), (x_2, y_2), and its equation assumes corresponding forms, which may be called respectively the *point-slope* form and the *two-point* form. The former plainly is $y - y_1 = m(x - x_1)$. The necessary and sufficient *condition* that this line shall pass through (x_2, y_2) is $y_2 - y_1 = m(x_2 - x_1)$. Combining the two equations by division, there results the two-point form, $(y - y_1):(y_2 - y_1) = (x - x_1):(x_2 - x_1)$, equation of the line fixed by the points (x_1, y_1), (x_2, y_2).

Distance from Point to Line.—The equation of any line (3), parallel to (2), Fig. 6, is $x\cos\alpha + y\sin\alpha - p' = 0$, where $p' = p + d$. The condition that (x', y') be on (3) is $x'\cos\alpha + y'\sin\alpha = p'$. Subtracting p from both members, we find $d = x'\cos\alpha + y'\sin\alpha - p$, distance from (x', y') to $x\cos\alpha + y\sin\alpha - p = 0$.

Angle between Lines.—Let ϕ be the angle between two lines whose slopes are m_1 and m_2. Then $\tan\phi = \pm(m_1 - m_2):(1 + m_1m_2)$. If $\phi = 0$, then $\tan\phi = 0$, and $m_1 = m_2$, condition of parallelism. If $\phi = 90°$, then $\tan\phi = \infty$, and $1 + m_1m_2 = 0$, whence $m_1m_2 = -1$, condition of perpendicularity.

The Circle and Its Equation.—About any point (a, b) as center describe a circle of any radius r. Let $P(x, y)$ be any point of the circle. A glance at the figure shows that x and y are connected by the relation

$$(x-a)^2 + (y-b)^2 - r^2 = 0,$$

equation of the circle. By comparison with the equation $x^2 + y^2 + 2Ax + 2By + C = 0$, the

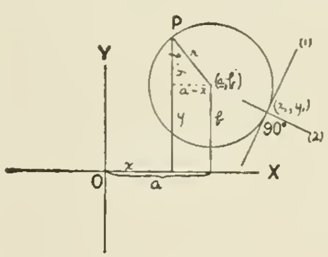

FIG. 7.

latter is found to represent a circle of center $(-A, -B)$, and radius $\sqrt{A^2 + B^2 - C}$. If the radicand be negative, the radius and hence the circle is imaginary. The tangent (1) to the circle at the point (x_1, y_1) is

$$(x_1 - a)(x - a) + (y_1 - b)(y - b) - r^2 = 0;$$

the normal (2) is

$$(y_1 - b)(x - x_1) - (x_1 - a)(y - y_1) = 0.$$

If the center be at the origin, the circle is $x^2 + y^2 = r^2$, the tangent at (x_1, y_1) is $x_1x + y_1y - r^2 = 0$, and the normal is $y_1x - x_1y = 0$. The line $y = mx + c$ is tangent to $x^2 + y^2 - r^2 = 0$ when and only when the distance from O to the line is r, *i.e.*, when $c = \pm r\sqrt{1 + m^2}$; hence $y = mx \pm r\sqrt{1 + m^2}$ is tangent to the circle and as m varies completely envelops the circle. Similarly it may be found that for every value of m the line $y - b = m(x - a) \pm r\sqrt{1 + m^2}$ is tangent to the circle of center (a, b) and radius r. This equation (in slope form) of the tangent is sometimes called the *magic* equation of the tangent. By transformation of coordinates or otherwise the polar equation of the circle of center (ρ', θ') and radius r may be found to be $\rho^2 - 2\rho'\rho\cos(\theta - \theta') + \rho'^2 - r^2 = 0$.

The Conic Sections: Ellipse, Parabola, Hyperbola.—The equation of the path, locus, or curve generated by a point (x, y) which so moves that the ratio of its distance from a fixed point (called the *focus*) to its distance from a fixed straight line (called the *directrix*) is a constant e (called the *eccentricity*) is of the form $Ax^2 + By^2 + Cxy + Dx + Ey + F = 0$; conversely, the locus of every equation of second degree is a curve of the kind in question. All such curves are called *conics* or *conic sections*, because any one of them is the intersection of a plane and a cone, where by cone is meant the surface that may be generated by a straight line revolving about a fixed point (vertex) and making a constant angle with a fixed line (axis) through the point; conversely, every such intersection is a conic, curve of second degree. The conics, of the very greatest importance alike in pure and in applied mathematics (cf. ASTRONOMY), were studied by the ancients (cf. APOLLONIUS), who conceived them as intersections of plane and cone. There are three species of conics, a conic being named *ellipse* (E), *parabola* (P), or *hyperbola* (H), according as the eccentricity $e <, =,$ or > 1. The foregoing equation represents an E, a P, or an H, according as $4AB - C^2$ is *positive*, *zero*, or *negative*. Among the conics of any species are *degenerate* or *degraded* or so-called *improper* conics of that species. The degraded form of E is any pair of imaginary straight lines intersecting in a real point (center of the conic, vertex of the cone); any pair of parallel real straight lines is a degraded P; and any pair of non-parallel real lines is a degenerate H. By suitable transformations of coordinates the equation of any conic may be made to assume a simplest, named *standard*, form. The standard forms of the species are presented below.

Ellipse.—The standard form of the E is $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, in which a is the half *major*, and b the half *minor*, *axis* of the E. The focus

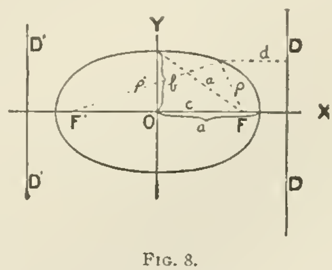

FIG. 8.

and directrix are respectively F and DD or F' and $D'D'$. The equations of the directrices are $x = \pm a:e$; $e = c:a$. The sum of the focal radii of any point of E is $\rho + \rho' = 2a$, a property often taken as definition of the E, instead of the relation $\rho = ed$. If $b = a$, the E is a circle;

hence the circle is an E of coincident foci and eccentricity zero. The area of E is πab.

Hyperbola. — The standard equation is $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$, where a is half of the *transverse*, and b is half of the *conjugate, axis*. The equation represents the curve composed of the two branches (1) and (2). For any point,

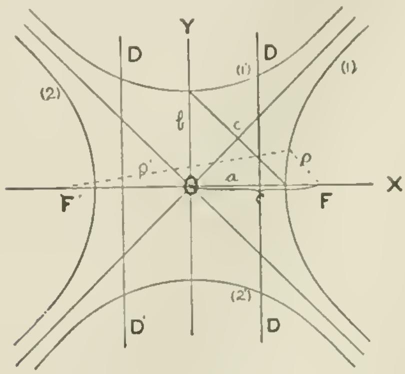

Fig. 9.

$\rho'-\rho=2a$, a defining property of the H. The H composed of (1') and (2') is called *conjugate* to the other one and has $\frac{x^2}{a^2}-\frac{y^2}{b^2}=-1$ for its equation. The two oblique lines through O *tangent* to both H's at ∞ are named *asymptotes* of the curves. The equations of the asymptotes are $y=\pm\frac{b}{a}x$. The corresponding lines of the E are imaginary, $y=\pm i\frac{b}{a}x$. If $a=b$, the H, $x^2-y^2=a^2$, is called equiaxial or equilateral or *rectangular*, its asymptotes being at right angles. It is related to the general H as the circle to the general E.

Parabola. —The standard equation is $y^2=4px$. The equation of the directrix is $x=-p$; the coordinates of the focus are $(p, 0)$; for any

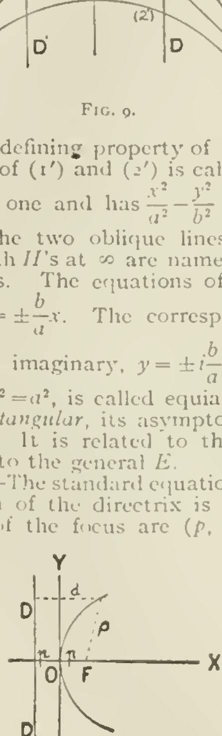

Fig. 10.

point $\rho=d$. The second focus and the center lie at ∞ on the axis of the curve.

For some account of plane curves of higher order or degree, see the article Higher Plane Curves, and for elaborate and detailed treatment of the analytical geometry of the plane, including exhaustive discussion of the conics, see works cited in bibliography below. We add here a note introducing the Cartesian geometry of

Space.

Coordinate Configurations. — Space is tridimensional in points, three independent data being necessary and sufficient to determine the position of a point. Of such data the simplest are the distances, Cartesian rectangular *coordinates*, x, y, z, of a point P from three fixed planes XOY, YOZ, ZOX, each perpendicular to the other two. These *coordinate planes* determine three lines, called *coordinate*

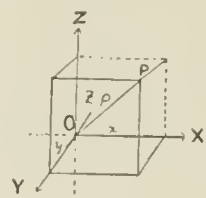

Fig. 11.

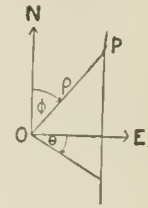

Fig. 12.

axes, having a common point O, the *origin*. Positive directions are indicated by the arrow heads. The polar coordinates of a point P, Fig. 12, are the radius vector ρ, and the vectorial angles θ and ϕ, reckoned respectively from the pole O and the *polar axes* OE and ON. If the pole coincide with the origin, and the polar axes with OX and OZ, then $x=\rho\cos\theta\sin\phi$, $y=\rho\sin\theta\sin\phi$, $z=\rho\cos\theta$, $\rho=\sqrt{x^2+y^2+z^2}$, $\tan\theta=y:x$, $\cos\phi=z:\rho$, formulæ of transformation from either system to the other. If α, β, γ are the direction angles (made respectively with OX, OY, OZ) of the radius vector ρ of any point P, Fig. 11, then $x=\rho\cos\alpha$, $y=\rho\cos\beta$, $z=\rho\cos\gamma$, and $1=\cos^2\alpha+\cos^2\beta+\cos^2\gamma$, sum of squares of *direction-cosines* of ρ. Any linear equation $Ax+By+Cz+D=0$ represents a plane. The symmetric equation of a plane is $\frac{x}{a}+\frac{y}{b}+\frac{c}{z}=1$, a, b, c being the axial intercepts extending from O to the plane. In normal form the equation of the plane is $x\cos\alpha+y\cos\beta+z\cos\gamma=p$, where p is the length, and $\cos\alpha$, $\cos\beta$, $\cos\gamma$ are the direction-cosines, of the perpendicular from O to the plane. To convert $Ax+By+Cz+D=0$ to the normal form it suffices to multiply it by the normalizing factor, $1:\sqrt{A^2+B^2+C^2}$, the new coefficients $A:\sqrt{\quad}$, $B:\sqrt{\quad}$, $C:\sqrt{\quad}$, being $\cos\alpha$, $\cos\beta$, $\cos\gamma$, and $D:\sqrt{\quad}$ being $-p$. The angle θ between two planes $Ax+By+Cz+D=0$ and $A'x+B'y+C'z+D'=0$ is determined by the relation

$$\cos\theta=(AA'+BB'+CC'):\sqrt{(A^2+B^2+C^2)(A'^2+B'^2+C'^2)},$$

whence the planes are parallel when and only when $A:A'=B:B'=C:C'$, and are perpendicular when and only when $AA'+BB'+CC'=0$. The equations of any two of the planes containing a line, *together* represent the line. Accordingly in space the line has *two* equations. Its simplest equations are those of any two of the three planes containing the line and being perpendicular respectively to the coordinate planes as $x=mz+p$, $y=nz+q$. Such a pair are unsymmetric. Symmetric equations of the line directed by α, β, γ, and going through the point (x_1, y_1, z_1) are

$$(x-x_1):\cos\alpha=(y-y_1):\cos\beta=(z-z_1):\cos\gamma,$$

in number three of which but (any) two are independent. The angle θ between two lines whose direction-cosines are proportional to

L, M, N and L', M', N', respectively, is determined by the relation

$$\cos\theta = (LL' + MM' + NN') : \sqrt{(L^2+M^2+N^2)(L'^2+M'^2+N'^2)},$$

whence the lines are parallel if and only if $L:L' = M:M' = N:N'$, and are perpendicular if and only if $LL' + MM' + NN' = 0$. The angle θ between a line of direction-cosines proportional to L, M, N and a plane

$$Ax + By + Cz + D = 0$$

is given by the relation

$$\sin\theta = (AL + BM + CN) : \sqrt{(A^2+B^2+C^2)(L^2+M^2+N^2)},$$

whence the line and plane are parallel if and only if $AL + BM + CN = 0$ and are perpendicular if and only if $A:L = B:M = C:N$. The necessary and sufficient condition that the line $x = m_1z + p_1$, $y = n_1z + q_1$, shall intersect the line $x = m_2z + p_2$, $y = n_2z + q_2$, is that $(m_1 - m_2):(n_1 - n_2) = (p_1 - p_2):(q_1 - q_2)$.

The literature of the analytical geometry of space, herewith barely introduced, is extensive. For some account of further developments of the subject, see the articles SURFACES, THEORY OF, and CURVES OF DOUBLE CURVATURE, THEORY OF, in this Encyclopedia. In the doctrine above introduced the point is employed as element. Some account of the theories that arise on choosing for element some other geometric entity, as the plane, the line, the sphere, etc., may be found in the articles, GEOMETRY, MODERN ANALYTICAL, and GEOMETRY, LINE, AND ALLIED THEORIES, in this work.

Bibliography.—College text-books of analytical geometry abound. One of the scientifically best American texts is W. B. Smith's 'Coordinate Geometry.' The most comprehensive English works are Salmon's 'Conic Sections' and 'Geometry of Three Dimensions' (both of which have been translated into French by O. Chemin, and supplemented and translated into German by Wilhelm Fiedler), and Frost's 'Solid Geometry.'

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Geometry, Elementary. Geometry is the science of space. Its object is the study of the properties of forms (configurations, figures) of every conceivable kind. The subject is thus endless in two ways: in the first place, the number of configurations is infinite—this is so even if we restrict ourselves to curves and surfaces; in the second place, any one type of figure has an inexhaustible variety of properties.

Elementary geometry may be roughly described as the study of the simpler or more evident properties of the simpler configurations. Specifically, the title refers to the body of geometric truths incorporated by Euclid in his famous 'Elements.' The text-books on elementary geometry used throughout the civilized world for the last twenty centuries are in fact merely revisions of the 'Elements'; so that the subject itself is often referred to, especially in England, as the study of Euclid. The majority of the theorems refer to points, straight lines, and planes, with their combinations. Of curves, only the circle is considered, and of surfaces, those related to the circle (spherical, cylindrical, conical).

It is not the object of this article to give a résumé of the standard theorems of elementary geometry, but rather to indicate some of the more significant general features, especially in the light of the more recent developments.

LOGICAL FOUNDATIONS.

The most prominent aspect of elementary geometry is the logical aspect: a great number of propositions, termed theorems, are deduced from a comparatively few propositions assumed at the outset and termed axioms or postulates. In the ideal treatment of the subject, all the assumptions should be enumerated explicitly, so that, if the question is asked, «Are the theorems of geometry true,» the mathematician can answer correctly, «Yes, if my postulates are true.» As to whether the postulates are true, that is not a matter for the mathematician as such to consider, but rather comes within the province of the physicist, psychologist, or philosopher.

The ordinary course in geometry, modeled after Euclid, does not carry out this ideal. Assumptions are continually being made as they may be needed for the purpose of proof, in addition to those explicitly enunciated as axioms and postulates. For example, in the first proposition of Euclid, dealing with the construction of an equilateral triangle on a given segment AB, circles are drawn with centres A and B and common radius AB, and it is then assumed that these circles intersect. The only justification given is the diagram or the appeal to spatial intuition. Again, in dealing with the congruence of triangles, it is assumed that a triangle may be moved about without altering its sides or angles, though the stated axioms do not even mention displacement. In spite of himself, Euclid's treatment is (partly) physical or intuitional, instead of purely mathematical, that is, purely logical.

It is only within the last few years that the ideal has been (practically) attained; that is, a set of explicit assumptions (termed axioms or postulates indifferently) drawn up, from which the propositions of ordinary geometry follow by purely logical processes. Geometry becomes then a branch of pure mathematics. As Poincaré expresses it, in this ideal treatment «We might put the axioms into a reasoning apparatus like the logical machine of Stanley Jevons, and see all geometry come out of it.»

Many contributors have aided in this development, among whom may be mentioned Gauss, Lobachevsky, Pasch, Veronese, and especially Peano and his co-workers in symbolic logic, Pieri and Peano. The most elaborately worked out system is that of Hilbert (1900). We give a brief account of his axioms.

Geometry deals with three systems of objects or elements termed *points*, *lines* (used here in sense of straight lines), and *planes*, connected by certain relations expressed by the words *lying in*, *between*, etc. It is not necessary for the development of the subject that these words should suggest visual images: in fact the concrete nature of the elements and relations is to be eliminated from the discussion. To emphasize this abstract aspect, it is convenient to use symbols, say capital letters for points, italics for lines, and Greek letters for planes. The axioms are arranged in five groups as follows:

I. *Axioms of Association or Connection.*— 1. Any two different points A, B determine a line a. (Such points are then said to lie on the line.)

2. Any two different points on a line determine that line.

3. In any line there are at least two points, and in a plane there are at least three points not on a line.

4. Any three non-collinear points A, B, C determine a plane α.

5. Three non-collinear points of a plane determine that plane.

6. If two points A, B of a line a are in a plane α, then every point of a is in α. (The line is then said to lie in the plane.)

7 Two planes α, β which have a point A in common have at least a second point B in common.

8. There exist at least four points not in one plane.

II. *Axioms of Order.*—These deal with the relation expressed by the term *between*.

1. If A, B, C are points of a line and B is between A and C, then B is between C and A.

2. If A and C are points of a line a, then there exists on a at least one point B between A and C, and at least one point D such that C is between A and D.

3. Of any three collinear points, one and only one is between the other two.

These three axioms deal with the line, while the fourth deals with the plane.

4. If A, B, C are any three non-collinear points, and a is a line in their plane passing through a point of the segment AB, but not through A or B or C, then a contains a point of either the segment AC or the segment BC.

III *Axioms of Congruence.*—The first five axioms of this group relate to congruent segments and congruent angles. For example, a segment AB is congruent to itself and to the reversed segment BA; and segments congruent to the same segments are congruent to each other. Finally, the sixth is a metrical axiom concerning triangles: if two sides and the included angle of one triangle are congruent respectively to two sides and the included angle of another triangle, then the remaining angles are also congruent.

The fact that the remaining sides are congruent is not included as a part of the axiom because it may be proved. The other cases of congruent triangles are theorems. In Euclid the above statement is a theorem, but this is possible, as already observed merely on account of unstated assumptions relating to displacement. Euclid's axiom that all right angles are congruent, in Hilbert's system becomes a theorem.

IV. *The Axiom of Parallels.*—This contains only the so-called *Euclidean axiom*, in the form: Given a line a and a point A not on a, then in the plane α determined by a and α there is only one line through A which does not intersect a.

V. *Axioms of Continuity.*—The continuity notion is analyzed into two parts of which the first (1) is stated in the axiom of *Archimedes:* 1. On a straight line consider any two points A, B and a point A_1 between them; construct the points A_2, A_3, . . . , in order, so that A_1 is between A and A_2, A_2 between A_1 and A_3, etc., and so that the segments AA_1, A_1A_2, A_2A_3, . . . , are congruent; then among the points so constructed there exists a point A_n such that B is between A and A_n. That is, by repeatedly laying off a given segment however small any assigned point of the line will be passed after a finite number of steps.

This axiom is sufficient for the development of the usual theorems of geometry. However the space to which the theorems apply would not be continuous in ordinary sense. It would in fact contain only those points of the space considered in analytical geometry whose coordinates are rational or expressible by radicals of the second order. To identify with continuous space it is necessary to add a final axiom (2) relating to convergent point sets, or else the so-called axiom of completeness which states that the system of elements (points, lines, planes) cannot be enlarged by adjoining other elements in such a way that all the previous axioms are preserved.

The fact that this set of axioms is sufficient is shown by actually deducing the usual body of theorems. This is done in Hilbert's 'Grundlagen.' Diagrams are here used, it is true, but only for convenience; the proofs can be given without any reference to the diagrams. Often the deduction of those results which are evident to the intuition is long and complicated. This is the case, for example, in showing that a triangle (or any simple polygon) has the properties expressed by the terms inside and outside. It must be shown from the axioms that the given triangle brings about a division of the points in its plane into three classes, namely, points P, points I, and points O, such that any two I points or any two O points may be connected by a broken line not containing any P point, while any broken line from an I point to an O point necessarily contains P points. To the intuition, of course, the P points are the points on the perimeter of the triangle, the I points are those inside, and the P points are those outside.

In the development it is important to observe that some theorems depend upon only part of the axioms. Thus from group I alone it follows that two planes having a point in common necessarily have a line in common, and that a line and a point determine a plane. The property of triangles and polygons stated above follows from group I and II. The theory of proportion may be established without employing group V. The theorem that if two triangles in one plane have their sides respectively parallel, the lines joining corresponding vertices are either parallel or concurrent (a special case of *Desargues'* theorem), can be proved without using axiom III 6 if and only if the spatial axioms in addition to the plane axioms are employed.

An important result which has been obtained recently is that while the areas of plane polygons may be treated without appealing to the continuity axioms, this is not possible with the volumes of polyhedrons. The difference is observed in Euclid's proofs: the proposition that triangles having the same base and altitude are equal in area is demonstrated by adding or taking away congruent parts from congruent figures, while the corresponding proposition concerning triangular pyramids is proved by the method of limits, or the equivalent method of exhaustion. That this difference in treatment is not avoidable was established by Dehn (1901), who showed that there exist polyhedrons of equal volumes which cannot be formed by the addition or subtraction of respectively congruent polyhedrons. In plane geometry this formation applies to any two polygons with the same area.

The most fundamental question concerning the set of axioms is that of *consistency.* In the development of geometry no contradiction has thus far presented itself; but will this always be the caes? Can it be shown that no inconsistency can ever arise? The only known method of answering this question depends upon establishing a correspondence between the geometrical elements and certain numerical entities, and showing that any inherent contradiction in geometry would involve contradictory relations among these entities. The question is thus transferred to the field of Arithmetic. Are the axioms of number (commutative, associative, distributive, etc.) inconsistent? No direct proof has yet been devised.

Another question to be considered is the independence of the axioms. If any one axiom can be deduced from the others, it may be omitted from the list and introduced as a theorem. It is therefore desirable that the axioms should express mutually independent statements. The standard method employed in proving the independence of an axiom or group of axioms consists in devising a set of objects of any kind which, when considered as elements, fulfill the relations expressed in remaining axioms, but for which the axiom or group in question is not satisfied. Thus the fact that the axiom of parallels (IV) cannot be deduced from the other axioms is shown by the non-Euclidean geometry of Lobachevsky. Similarly, the independence of axiom VI is proved by means of the non-Archimedean geometries of Veronese and Hilbert. Various apparently artificial systems have been devised in this connection, which, while not amenable to the intuition, are conceivable and mathematically true because based on assumptions which may be shown to be free from inconsistency.

The set of axioms presented above is of course not the only one which may serve as foundation for ordinary geometry. Thus the axiom of parallels may be replaced by the statement that the sum of the angles of a triangle is two right angles. In general the propositions of a given collection may be derived from various sets selected from the total collection. In the present case the possibilities are endless.

Geometry may also be founded on other primitive (undefined) concepts than those introduced above. Thus in the discussions inaugurated by Helmholtz and continued by Lie and Poincaré, the principal concept is that of transformation (displacement, rigid motion) and the axioms include the group property (the resultant of two displacements is itself a displacement). The straight line is then no longer, as in Hilbert's system, a primitive concept, but receives definition: if in a displacement two points are fixed, there are an infinite number of fixed points forming, by definition, a straight line (the axis of rotation).

In the usual intuitional treatment the concept of general surface is assumed as a starting-point and the plane is then defined as a surface such that if any two of its points are joined by a straight line, the latter lies entirely in the surface. This obviously states more than is required for the determination of the surface. To meet this objection the plane is sometimes defined as generated by drawing straight lines from a fixed point A to all the points of a straight line a. To obtain the entire plane it is necessary to add the line through A parallel to a. This definition is therefore unsatisfactory, because parallel lines require in their definition the previous definition of the plane. Peano has met the difficulty by this definition: Consider three fixed points A, B, C not in a straight line; take a fixed point D within the segment BC, and on the segment AD take a fixed point E; a plane is then generated by the lines (rays) from E to every point of the perimeter ABC. It may then be proved that a straight line connecting any two points of such a surface lies on the surface.

Problems and Constructions.

The only instruments whose use is implied in the postulates of elementary geometry are the ruler (straight-edge), for drawing straight lines, and the compass, for drawing circles. Only those problems are considered as coming within the domain of elementary geometry which can be solved by a finite number of operations with these instruments. Such constructions are termed *Euclidean*, or sometimes simply *geometric.* An example is the construction for bisecting an angle. With the vertex V as centre and any radius describe a circle cutting the sides of the angle in points A and B; with these points as centres and any (sufficiently large) radius describe circles intersecting in points C and D; the line joining C and D necessarily passes through V and bisects the given angle.

However, many problems arise which cannot be solved in this way. A well-known example is the problem of trisecting an angle. For centuries the Greek geometers and their followers sought for a solution; only within the present century has it been shown that such attempts must necessarily fail. The statement that the problem is impossible does not deny that lines trisecting the given angle exist, but means simply that such lines cannot be obtained by a construction employing a finite number of straight lines and circles.

No one has yet succeeded in demonstrating this impossibility by purely geometric means. The question arises naturally in elementary geometry, but apparently cannot be answered by elementary methods. We give now an outline of the algebraic method for deciding whether a given problem comes within the class of possible or the class of impossible problems.

Any line segment may be represented by a segment, namely, the ratio of the given segment to an assumed unit segment. Conversely, any number then represents a segment. Consider now the elementary operations of arithmetic or algebra in relation to geometric constructions.

If a and b denote given segments, or the corresponding numbers, the sum $a+b$ is constructed by transferring the segment b, by means of the compass, so that it is collinear and adjacent to a. The difference $a-b$ is also readily constructible.

The product $x=ab$ may be defined by the proportion $1:a=b:x$. The proper construction is then suggested by the theorem that a line parallel to the base of a triangle divides the sides proportionally. Draw any triangle with 1 and a as two of the sides; along the first side prolonged if necessary lay off segment b; from the terminal point draw a line parallel to the base of the triangle; this cuts off on the second side a segment equal to the required x. The quotient $y=a/b$ is obtained similarly from the proportion $b:1=a:y$. Hence all rational expressions, that is, expressions formed by a finite number of additions, subtractions, multiplications, and divisions are constructible.

Furthermore, extraction of square roots is possible. For $z=\sqrt{a}$ may be defined by $1:z=z:a$. Hence if on $1+a$ as diameter a semicircle is described, the perpendicular at the end of the unit segment is the required z. Therefore,

Theorem I.—Any expression involving only rational operations and the extraction of square roots can be constructed with ruler and compass.

Expressions which cannot be reduced to this form cannot be constructed. This we now prove in the form of the converse:

Theorem II.—Any segment which can be constructed with ruler and compass is expressible algebraically by rational operations and the extraction of square roots.

For any such construction consists in drawing a finite number of straight lines and circles and finding their intersections. Employing Cartesian coordinates (see GEOMETRY, CARTESIAN), the equation of a straight line is of the form $ax+by+c=0$, and that of a circle is of the form $x^2+y^2+ax+by+c=0$. The intersection of two straight lines leads to the solution of two equations of the first degree, which requires only rational operations. The intersections of a straight line and circle, or of two circles, depends on the solution of quadratic equations and leads to radicals of the second degree.

We proceed to apply these theorems to several examples.

Consider first the problem of bisecting an angle. The given angle θ and the required angle $\frac{\theta}{2}$ may be determined by their cosines. Let $a=\cos\theta$ and $x=\cos\frac{\theta}{2}$ From trigonometry $\cos\theta=2\cos^2\frac{\theta}{2}-1$, that is, $2x^2-1=a$. Hence $x=\sqrt{\frac{1+a}{2}}$. Therefore, by Theorem I, the problem is elementary. The formula also indicates a definite method of construction.

In the *trisection* of a given angle we require the formula $\cos\theta=4\cos^3\frac{\theta}{3}-3\cos\frac{\theta}{3}$. Here $\cos\theta=a$ is known, and $\cos\frac{\theta}{3}=x$ is required. The equation of the problem is

$$4x^3-3x-a=0.$$

When solved by Cardan's formula this leads to cube roots. But before Theorem II can be applied it must be shown that no expression involving only square roots can satisfy the equation. This is true in the present case by the following general theorem taken from the theory of equations:

Theorem III.—An irreducible equation whose degree is not a power of two cannot have a root expressible by radicals of the second degree. (The term irreducible equation is here employed to describe an equation $f(x)=0$ with rational coefficients whose left member cannot be factored rationally.)

In general the algebraic questions which arise in this connection require for their complete discussion the powerful Galois Theory of Equations. See EQUATIONS, GALOIS' THEORY OF.

A second of the so-called famous problems of elementary geometry is the *Delian problem*, or the duplication of the cube. Given a cube with side a, to construct a cube with side x having double the volume. The equation of the problem is $x^3=2a^3$. Theorem III and then Theorem II apply. The corresponding problem concerning the square, leading to the equation $x^2=2a^2$, is easily solved: the side of the required square is simply the diagonal of the given square.

Regular Polygons.—The construction of a regular polygon of n sides is equivalent to the division of a given circumference into n equal arcs. The only cases treated by Greek geometers and the ordinary text-books are, for prime numbers, $n=3$ and $n=5$; from these constructions of the regular triangle and pentagon, combined with the construction for bisecting an angle, the constructions for the cases 2^κ, $3\cdot 2^\kappa$, $5\cdot 2^\kappa$, $3\cdot 5\cdot 2^\kappa$, where κ is any integer, are easily found.

No advance was made, that is, no new constructible polygons were discovered, until Gauss, about a century ago, applied the algebraic method. The equation of the problem may be put into the form

$$x^{n-1}+x^{n-2}+\ldots+x+1=0,$$

which is then termed the *cyclotomic equation.* When n is a prime number the equation is irreducible. Hence by Theorem III the construction is possible only when $n-1$ is a power of 2. That is, n must be of the form $2^\mu+1$. Prime numbers of this type are necessarily of the form $2^{2^\nu}+1$, and are known as *Fermat primes.* The values $\nu=0$ and $\nu=1$ give the familiar cases $n=3$ and $n=5$; the first new case, arising from $\nu=2$, is $n=17$. The construction for the regular polygon of 17 sides is complicated, but the steps are indicated definitely by the algebraic solution of the cyclotomic equation, which is in fact solvable by square roots.

The general result on regular polygons is as follows: The regular polygon of n sides can be constructed with ruler and compass if, and only if, the prime factors of n are 2 repeated any number of times and distinct Fermat primes. The first impossible cases are $n=7$ and $n=9$.

Quadrature of the Circle.—This most famous problem of geometry requires the construction of a square having the same area as a given circle. That this is impossible (that is, that the construction cannot be effected with the ruler and compass) was not definitely shown until 1882, although the failure of innumerable attempts had led many to suspect the true result. The *rectification* of the circle, that is, the construction of a straight line having the same length as a given circumference, is an equivalent problem, and hence also impossible. This is so on account of the theorem that the area of a circle equals one half the product and the radius into the circumference.

The ratio of the circumference to the diameter is the same for all circles: the constant thus arising has been generally denoted by the symbol π since the time of Euler. It was proved, quite simply, by Legendre that π is not rational (i.e., cannot be represented exactly by the ratio of any two integers, and hence, in particular, cannot be represented by a terminating decimal). The difficulty consists in showing that π is *transcendental*, that is, is not the root of any algebraic equation

$$a_0x^n + a_1x^{n-1} + \ldots + a_n = 0,$$

where n is a positive integer, and the coefficients are any integers. This was finally proved by Lindemann in 1882, after Hermite in 1873 had shown that e, the base of the Napierian system of logarithms, is transcendental. The two numbers are connected by the remarkable relation $e^{i\pi} = -1$, where i is the imaginary unit number $\sqrt{-1}$. Since π cannot satisfy any algebraic equation, it certainly cannot be expressed by square roots. Hence Theorem II proves the impossibility.

Approximate Constructions.—The problems considered cannot be solved exactly by ruler and compass, but they can be solved to any required degree of approximation. Thus a simple approximate solution of the rectification problem is the following: Let O be the centre and AB any diameter of the given circle. At the middle point E of AO construct a perpendicular cutting the circumference in C and D. On AB prolonged lay off $EF=CD$. Draw FD, and on this line lay off $FH=AB$. Then the segment HD is approximately one fourth the circumference. The error is less than one part in 5000.

Other Instruments.—The problems considered may be solved exactly if other instruments in addition to ruler and compass are allowed. Thus the trisection and duplication problems (like all problems depending on cubic and biquadratic equations) can be solved by the instruments for drawing parabolas or other conics, or by appropriate linkages. The quadrature of the circle, being a transcendental problem, cannot be effected by any instrument which draws algebraic curves. It can be solved by various transcendental curves (quadratrix, sinusoid, cycloid); or by the integraph (an instrument which draws the curve $y=\int f(x)dx$, where $y=f(x)$ is a given curve).

We consider now various restrictions which may be imposed on Euclidean constructions.

(1) *Ruler Constructions.*—Here only the straight-edge is allowed. For the possibility of such a construction it is necessary but not sufficient that the corresponding algebraic expression should be rational. If two parallel lines are given, then through a given point a line may be drawn parallel to given lines by a ruler construction. But this is not the case when a line is to be drawn through a given point parallel to a given line. The impossibility proof, based upon projection, may be carried out by pure geometry.

(2) *Mascheroni Constructions.*—Here only the compass is allowed. A straight line is considered as known when two of its points are determined. Mascheroni, in 1797, showed that all problems which can be solved by the ruler and compass can be solved by the compass alone.

(3) Poncelet and Steiner have shown that, if a single fixed circle with its centre is given, all elementary constructions may be carried out by means of the straight-edge. Again, if a ruler with parallel edges may be employed (it is then, for instance, possible to place the instrument so that each edge goes through an assigned point), all elementary problems may be solved without the compass.

(4) Hilbert considers constructions with the straight-edge and *sect-carrier.* The latter denotes a compass used not to draw circles, but merely to lay off a given segment on a given line. All such constructions can be carried out by the straight-edge and a movable unit sect. The test for deciding the possibility or impossibility of a problem in this sense is exceedingly complicated, depending on the higher theory of algebraic numbers.

Geometrography.—A problem of elementary geometry can usually be solved in a variety of ways by the ruler and compass. Thus for the Apollonian problem (to construct a circle touching three given circles) over one hundred distinct solutions have been worked out (Apollonius, Poncelet, Steiner, Lemoine, Study, etc.). How can we compare these as regards simplicity? It is necessary to adopt some standard or measure of simplicity. One method, for instance, would be to take the number of lines and circles as the measure of simplicity.

A more complete (but still somewhat artificial) discussion has been elaborated by E. Lemoine in his 'Geometrography.' Constructions are analyzed into the following elementary operations: Operation C_1 consists in placing one point of the compass on a given point in the plane of construction; including a given length between the points of the compass is then denoted by $2C_1$; placing a point of the compass on an undetermined point of a line is operation C_2; drawing a circle is C_3; making the edge of the ruler pass through an assigned point is operation R_1, and through two assigned points is $2R_1$; finally, drawing a straight line is operation R_2. Any construction may then be represented by a symbol $l_1R_1 + l_2R_2 + m_1C_1 + m_2C_2 + m_3C_3$, where the coefficients represent the numbers of elementary operations involved. The *simplicity* is measured by $l_1 + l_2 + m_1 + m_2 + m_3$, and the *exactness* by $l_1 + m_1 + m_2$ (the preparatory operations). The number of lines employed is given by l_2 and of circles by m_3.

In the case of the construction for the bisection of an angle explained above the symbol is $3C_1+3C_3+2R_1+R_2$. The construction which leads to the smallest possible value for the *simplicity* is termed the geometrographic solution. There may be more than one solution of this kind.

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Geometry, Line-, and Allied Theories.—For geometric purposes space may be conceived in an endless variety of ways (see CARTESIAN GEOMETRY), *i.e.*, as the manifold of all the geometric entities of *any* given kind contained in it. In particular, it may be viewed as the assemblage (manifold, aggregate, plenum) of its points or of its planes or of its lines. According as one or another of these views be adopted as fundamental, any configuration, as a curve or a surface, will present as fundamental the corresponding aspect, *i.e.*, it will appear as the *locus* (assemblage) of its points or as the *envelope* (assemblage) of its tangent planes or as the *envelope* (assemblage) of its tangent lines. These various views or aspects are not independent. Each involves the others, but they are not coordinate: one of them being assumed as fundamental or *primary*, the others appear as derived or *secondary*. Space accordingly admits of various geometric theories distinguished by and taking their names from their primary elements. Line-geometry contemplates space as primarily composed of lines, employs the line as fundamental element, and has for its subject-matter the relations and properties of line configurations. Thus the rôle of the right line in this doctrine is quite analogous to that of the point or the plane in the older geometries. The plane, too, has a line-geometry (see GEOMETRY, MODERN ANALYTICAL), but the line and the point theories of the plane, being analytically identical, are best treated simultaneously as dual aspects of a single doctrine.

The honor of having been the first to make formal and systematic use of the right line as primary element in the geometry of space belongs to Julius Plücker (1801–1868), whose 'Neue Geometrie des Raumes gegründet auf die Betrachtung der geraden Linie als Raumelement,' 1868–69, is the first great contribution to the subject. The idea of employing the line as space element had indeed occurred to him at a much earlier date. (Cf. his 'System der Geometrie des Raumes,' 1846.) His first memoir on the subject, entitled 'On a New Geometry of Space,' was published in English in 1865 and may be found in vol. 14 of 'The Proceedings of the Royal Society of London and elsewhere. Certain important line systems, as congruences and complexes (names given by Plucker), had indeed been previously studied to some extent by others. The notion of congruences of lines naturally first presented itself in geometric researches in optics, and in fact the first appearance of the concept of the line complex seems to be that found in the 'Traité d'Optique' of the physicist, Étienne Louis Malus (1775–1812). The point-plane and line-line correlations or null-systems established by the linear complex were considered in 1827 by the Italian geometrician Giorgini (('Memorie dei XL.,' vol. 20), and in 1833 by Moebius in a memoir entitled 'Über eine besondere Art dualer Verhältnisse zwischen Figuren im Raume' ('Crelle's Journal,' vol. 9–10). Nevertheless the invention of the line geometry of space is, as said, to be properly ascribed to Plucker. His work in this field is the beginning of a great epoch in the science of analytical geometry. The undying influence of that work is due neither to its content nor, strictly speaking, to its method, important as these are. It is rather due to its spirit, which is the spirit of freedom, emancipating alike from traditional concepts and traditional modes of procedure. Since Plücker's time the science begun by him has been greatly refined and vastly extended, and out of it have come great and growing kindred doctrines, as the sphere and the circle geometries of space, and allied theories in spaces of higher dimensionality. The following paragraphs present a brief account of the elements of some of these theories, especially of line geometry, together with some indications of further developments and references to the corresponding literature.

Line Coordinates.—In Cartesian coordinates (see GEOMETRY, CARTESIAN) the line is determined by any pair of its projecting planes, *e.g.*, by the pair $x=rz+\rho$, $y=sz+\sigma$; conversely, any such pair determines a line. Accordingly the position of the line depends upon four independent quantities or *coordinates*, r, s, σ, ρ; the line has four degrees of freedom, space contains a fourfold infinity, ∞^4, of lines; in lines it is 4-dimensional: a being who thought in lines as «naturally» as man thinks in points would regard (our) space as having four instead of three dimensions. Linear transformation of Cartesian coordinates converts the line coordinates r, s, σ, ρ into the coordinates r', s', σ', ρ' (of the same line) where these are fractions whose terms are linear functions of r, s, σ, ρ, and $r\sigma-s\rho$; and, accordingly, an equation of degree n in r, s, σ, ρ is converted into one of degree $2n$ in those quantities. In order that the new and the old equations should be of the same degree in the old coordinates, Plücker introduced a fifth coordinate η, where $\eta=r\sigma-s\rho$. There are numerous other systems of line coordinates, and in his above-cited first paper Plücker himself presents no less than eight distinct systems. Of all the systems those that are *homogeneous* are at once the most artistic and convenient. These naturally present themselves as follows: If x_i and ξ_i ($i=1$, 2, 3, 4) denote respectively the homogeneous coordinates (see GEOMETRY, MODERN ANALYTICAL) of a point and a plane referred to a fundamental tetraedron, then the equation $\xi_1x_1+\xi_2x_2+\xi_3x_3+\xi_4x_4=0$, or $\Sigma\xi_ix_i=0$, will serve to represent the plane ξ_i (as locus of points) or the point x_i (as envelope of planes). It is at the same time the condition that the point x_i and the plane ξ_i shall be united in position, each containing the other. The line determined by two planes ξ_i and η_i is represented by the pair of equations $\Sigma\xi_i x_i=0$, $\Sigma\eta_i x_i=0$. It is equally determined by any two planes of the axal pencil $\Sigma(\xi_i+\lambda\eta_i)x_i=0$. Of these the simplest are the four of which each contains a vertex of the tetraedron of reference. Their equations are

$$\begin{array}{l} * \ +q_{12}x_2+q_{13}x_3+q_{14}x_4=0, \\ q_{21}x_1+\ *\ +q_{23}x_3+q_{24}x_4=0, \\ q_{31}x_1+q_{32}x_2+\ *\ +q_{34}x_4=0, \\ q_{41}x_1+q_{42}x_2+q_{43}x_3+\ *\ =0, \end{array}$$

where $\rho q_{jk}=\xi_j\eta_k-\xi_k\eta_j$, ρ being a proportionality factor; *e.g.*, $\rho q_{12}=\xi_1\eta_2-\xi_2\eta_1$. As $q_{jk}=-q_{jk}$, there are but six numerically distinct coefficients q. These are connected by the quadratic identity $q_{12}q_{34}+q_{13}q_{42}+q_{14}q_{23}=0$; as, moreover, only their ratios are essential, the six q's are equivalent to but four independents. Accordingly the q's may be, and for the sake of symmetry are, adopted as *six homogeneous coordinates of the line regarded as the axis* (*envelope*) *of a pencil of planes*.

The line has another aspect; it may be viewed as locus of its points, determined by any pair of them as x_i and y_i. So viewed, it is represented by the pair of point equations $\Sigma x_i\xi_i=0$, $\Sigma y_i\xi_i=0$. The line is equally determined by any two points of the range $\Sigma(x_i+\lambda y_i)\xi_i=0$ and in particular by any two of the four points in which the line pierces the faces (planes) of the fundamental tetraedron. Of these points the equations are

$$\begin{array}{l} * \ +p_{12}\xi_2+p_{13}\xi_3+p_{14}\xi_4=0, \\ p_{21}\xi_1+\ *\ +p_{23}\xi_3+p_{24}\xi_4=0, \\ p_{31}\xi_1+p_{32}\xi_2+\ *\ +p_{34}\xi_4=0, \\ p_{41}\xi_1+p_{42}\xi_2+p_{43}\xi_3+\ *\ =0, \end{array}$$

where $\sigma p_{kj}=x_jy_k-x_ky_j$. The six p's satisfy an identity like that of the q's, the ratios of the p's are alone important, and, again with a view to symmetry, the p's are chosen as the *six homogeneous coordinates of the line conceived as a locus* (*range*) *of points*.

It is readily found that the line p_{jk} and the line q_{jk} are one and the same when and only when $p_{12}:q_{34}=p_{13}:q_{42}=p_{14}:q_{23}=p_{34}:q_{12}=p_{42}:q_{13}=p_{23}:q_{14}$. Accordingly, disregarding both the locus and envelope aspects of the line, we may employ for its coordinates any six quantities r_{jk} which, ρ and σ being proportionality factors, satisfy the relations: $r_{12}=\rho q_{12}=\sigma p_{34}$, $r_{13}=\rho q_{13}=\sigma p_{42}$, $r_{14}=\rho q_{14}=\sigma p_{23}$, $r_{34}=\rho q_{34}=\sigma p_{12}$, $r_{42}=\rho q_{42}=\sigma p_{13}$, $r_{23}=\rho q_{23}=\sigma p_{14}$. The identity connecting the r's may be written (after Koenigs) $\omega(r)=2(r_{12}r_{34}+r_{13}r_{42}+r_{14}r_{23})=0$.

Passing from homogeneous to Cartesian point coordinates, *i.e.*, from a finite tetraedron to an infinite one having three of its faces mutually perpendicular and for the fourth the plane at ∞, there result the six homogeneous line coordinates employed by Plücker. The transition is effected by substituting x', y', z', 1 respectively for x_1, x_2, x_3, x_4, and x'', y'', z'', 1 for y_1, y_2, y_3, y_4; the Plücker coordinates accordingly are:

$$p_{12}=x'y''-x''y',\ p_{13}=x'z''-x''z',\ p_{23}=y'z''-y''z',$$
$$p_{14}=x'-x'',\quad p_{42}=y''-y',\quad p_{34}=z'-z''.$$

If we replace x'', ... by $x'+dx'$, ..., *i.e.*, if we regard the line as determined by consecutive (neighboring, infinitely near) points, the Plücker coordinates assume the form adopted by Sophus Lie. The primes being omitted, the Lie line coordinates are: $p_{12}=xdy-ydx$, $p_{13}=xdz-zdx$, $p_{23}=ydz-zdy$, $p_{14}=-dx$, $p_{42}=dy$, $p_{34}=-dz$.

The general coordinates r_{jk} admit of further generalization. They may be replaced by linear functions of them; *i.e.*, if $r_{jk}=C_{jk\cdot 1}v_1+C_{jk\cdot 2}v_2+\ldots+C_{jk\cdot 6}v_6$, where the determinant of the C's does not vanish, the six variables v_i may be employed as line coordinates. The v's satisfy a quadratic identity $\xi(v)=0$, into which $\omega(r)=0$ is converted by the foregoing transformation. A simple special case of this transformation yields an elegant system of line coordinates introduced by Felix Klein. Replacing the v's by x's, the special transformation is: $x_1=r_{12}+r_{34}$, $ix_2=r_{12}-r_{34}$; $x_3=r_{13}+r_{42}$, $ix_4=r_{13}-r_{42}$; $x_5=r_{14}+r_{23}$, $ix_6=r_{14}-r_{23}$; where $i=\sqrt{-1}$. The Kleinian line coordinates are $x_j\ (j=1,\ldots,6)$. The identity connecting them is $\Sigma x_j^2=0$.

Condition of Intersection of Lines.—The two lines may be conceived as loci, or as axes, or one as a locus and the other as an axis. In the first case, suppose the lines are determined respectively by the point pairs (x_i, y_i), (x'_i, y'_i). The lines p and p' will intersect when and only when the four points lie in a plane, for which the necessary and sufficient condition is

$$\begin{vmatrix} x_1 & x_2 & x_3 & x_4 \\ y_1 & y_2 & y_3 & y_4 \\ x_1' & x_2' & x_3' & x_4' \\ y_1' & y_2' & y_3' & y_4' \end{vmatrix}=0,$$

which on expansion yields $p_{12}p'_{34}+p_{13}p'_{42}+p_{14}p'_{23}+p_{34}p'_{12}+p_{42}p'_{13}+p_{23}p'_{14}=0$. Of this condition the first member is

$$\frac{1}{2}\left[\frac{\partial\omega(p)}{\partial p_{12}}p'_{12}+\ldots+\frac{\partial\omega(p)}{\partial p_{42}}p'_{42}\right]$$
$$=\frac{1}{2}\left[\frac{\partial\omega(p')}{\partial p'_{12}}p_{12}+\ldots+\frac{\partial\omega(p')}{\partial p'_{42}}p_{42}\right].$$

Denoting this *polar* form by $\omega(p, p')$, the condition that the two lines (loci, point ranges) p and p' shall have a common point is $\omega(p,p')=0$. In like manner, the condition that the lines (envelopes, axal pencils of planes) q and q' shall have a common plane is $\omega(q,q')=0$. If one of the lines be regarded as a locus, the other as an envelope, the condition of intersection is $\Sigma p_{jk}q'_{jk}=0$ or $\Sigma q_{jk}p'_{jk}=0$. Disregarding the aspects of the lines r and r', the condition is $\omega(r,r')=0$. The preceding transformation from r's to v's converts $\omega(r, r')$ into $\xi(v, v')$, where $2\xi(v, v')=\frac{\partial\xi}{\partial v_1}v_1'+\ldots+\frac{\partial\xi}{\partial v_6}v_6'$. Hence the condition that the lines v, v' shall intersect is $\xi(v, v')=0$. In Klein coordinates, the condition for the intersection of the lines x and x' is $\Sigma x_jx_j'=0\ (j=1,\ldots 6)$.

Pencils and Hyperpencils.—Let v_i' and v_i'' be any two intersecting lines. These determine a flat pencil, *viz.*, that whose vertex is the common point of v' and v'' and whose lines lie in the plane of v' and v''. All and only the coordinates of the lines of the pencil are given by the formula $v_i = \lambda v_i' + \mu v_i''$. For, first, $\xi(v) = \xi(v')\lambda^2 + 2\xi(v', v'')\lambda\mu + \xi(v'')\mu^2$, and, by hypothesis, $\xi(v') = 0$, $\xi(v'') = 0$, $\xi(v', v'') = 0$; hence $\xi(v) = 0$, and v_i represents a line for all values of the parameters λ and μ. Secondly, if v_i''' be *any* line cutting v' and v'', $\xi(v', v''') = 0$, $\xi(v'', v''') = 0$; hence $\xi(v, v''') = 0$, for $\xi(v, v''') = \lambda\xi(v', v''') + \mu\xi(v'', v''')$; therefore the lines v_i belong to the pencil. Thirdly, these are *all* of the lines of the pencil, for it is easily proved that the ratio, $\lambda : \mu$, can be determined so that the corresponding v_i shall cut *any* given line not contained in the plane of the pencil.

Koenigs has suggested the name hyperpencil (*hyperfaisceau*) to denote alike the totality of lines of a plane and the totality (sheaf, bundle) of lines through a point. A hyperpencil is determined by any three lines (not in a same pencil) of which each intersects the other two. If three such lines be v_i', v_i'', v_i''', then all and only the coordinates of the hyperpencil are given by the formula $v_i = \lambda v_i' + \mu v_i'' + \nu v_i'''$, λ, μ, ν being parameters. The hyperpencil will be a sheaf or a plane of lines according as the given lines determine but one point or three points.

Line Systems in General.—Just as, for example, in ordinary analytical geometry, we study systems (loci) of points represented by equations in point coordinates, so in the present subject we are concerned with line systems represented by equations in line coordinates. The line, we have seen, depends on four independent variables, coordinates, or *parameters*. The totality of lines in space may be called the 4-parameter system; it contains ∞^4 lines, a line in it has four degrees of freedom, one degree for each of the free (unconditioned) parameters or coordinates. One condition on the four parameters renders them equivalent to but three independent ones; hence the lines represented by one equation constitute a 3-parameter system, called by Plücker a line *complex*. A complex contains ∞^3 lines, a line in a complex has but three degrees of freedom. A 2-parameter system or *congruence* (Plücker), containing ∞^2 lines, allowing the line two degrees of freedom, is defined by a pair of equations. A triplet of equations represents a 1-parameter system, a ruled surface, or, better, a *line series* (*Série réglée*, Koenigs); it contains ∞^1 lines; in such a system the line has but one degree of freedom. Finally, a 0-parameter system, defined by four simultaneous equations, contains but a *finite* number of lines. In order, then, that five or more equations should represent a common system of lines, it is necessary that their coefficients satisfy some condition or conditions.

The Linear Complex.—The complex defined by an equation of degree n is said to be of nth degree. If $n = 1$, the complex is called *linear*. The general equation of the linear complex is $c_1v_1 + c_2v_2 + \ldots + c_6v_6 = 0$, or, briefly, $\Sigma c_jv_j = 0$, where $\xi(v) = 0$. How are the lines distributed? Let $v_i = \lambda v_i' + \mu v_i'' + \nu v_i'''$ be an arbitrary hyperpencil. In order that a line of the hyperpencil shall belong to the complex, it is necessary and sufficient that $\Sigma(\lambda v_i' + \mu v_i'' + \nu v_i''') = 0$, a single linear condition on the (two independent) ratios $\lambda : \mu : \nu$. Hence a single infinity of the lines of the hyperpencil belong to the complex. For if $u_i' = \lambda_1 v_i' + \mu_1 v_i'' + \nu_1 v_i'''$ and $u_i'' = \lambda_2 v_i' + \mu_2 v_i'' + \nu_2 v_i'''$ be any two of them, then plainly all lines of the pencil (u', u'') belong to the complex. On the other hand, no other line u''' does so belong, for, if it did, then every pencil determined by u''' and the lines of (u', u''), *i.e.*, all lines of the hyperpencil, would belong to the complex. Hence the proposition: *The lines of a linear complex are so distributed that every hyperpencil in space contains a pencil of lines (and no other line) belonging to the complex.* These pencils are called the pencils of the complex. The proposition admits of various equivalent statements of which one of the most illuminating is: *Given a linear complex, each point of space is the vertex of a pencil of lines of the complex and contains no other line of it; in each plane there is a pencil of lines (but no other line) of the complex.* In the former case the plane containing the pencil of the point is called the *polar* (plane) of the point; in the latter, the vertex of the pencil in the plane is called the *pole* (point) of the plane. Thus a linear complex serves to pair the points and planes of space as poles and polars, any pole and its polar being united in position. If a point P and a plane π be united in position, the pole P' of π and the polar π' of P are also united. Not only, however, are points and planes paired, but lines are paired with lines. The line common to two poles corresponds to the line common to their polars. Two such corresponding lines are called *conjugates* with respect to the complex. To a range of points (poles) corresponds an axal pencil of planes (polars), the base of the range and the axis of the pencil being conjugate lines. A line cutting two conjugates belongs to the complex, and all lines of the complex that cut a given line cut its conjugate also. If two lines intersect, so do their conjugates. Every line of the complex is its own conjugate, self conjugate, and conversely. If a point moves along a line of the complex, the polar plane turns about the same line. This is a special case of the proposition that if a point glides along any line, the polar plane rotates about the conjugate line. Hence if P_1, P_2, P_3, P_4 be any four positions of the moving point and if π_1, π_2, π_3, π_4 are the corresponding planes, then the anharmonic ratios are equal, *i.e.*, $(P_1P_2P_3P_4) = (\pi_1\pi_2\pi_3\pi_4)$. In general: if C denote any configuration of points, lines, and planes, the polars, conjugates, and poles (with respect to a given complex) constitute a configuration C'. C and C' are called *reciprocal* configurations. The points, lines, and planes of either correspond uniquely and respectively to the planes, lines, and points of the other. In particular, if C is a polyedron, so is C'. The edges of either are conjugates of the edges of the other; the vertices and faces of either are respectively the poles and polars of the faces and vertices of the other. The vertices of either lie in the (polar) faces of the other.

Invariant of Complex, Special Complex, Directrix.—The condition,

$$2\xi(v, v') \equiv \frac{\partial\xi}{\partial v_1'}v_1 + \ldots + \frac{\partial\xi}{\partial v_6'}v_6 = 0,$$

that the line v shall intersect the line v', represents a *special* complex, viz., that of which all the lines cut a given line v', called the *directrix* of the complex. The complex $\Sigma c_j v_j = 0$ is, then, special when and only when $\frac{\partial\xi}{\partial v_1'} : \frac{\partial\xi}{\partial v_2'} : \ldots : \frac{\partial\xi}{\partial v_6'} = c_1 : c_2 : \ldots : c_6$. These equations yield the values of (the ratios of) the v_j' in terms of the c_j. Substituting those values in $\xi(v')$, there results a homogeneous quadratic $\Omega(c)$, so that $\xi(v') = \Omega(c)$. Hence $\Omega(c) = 0$ when and only when $\xi(v') = 0$; hence the necessary and sufficient condition that $\Sigma c_j v_j = 0$ shall represent a special complex is that $\Omega(c) = 0$. In such case the coordinates of the directrix are the coefficients c_j. The expression $\Omega(c)$ has been named by Klein the *invariant of the complex* $\Sigma c_j v_j = 0$. The complex is, therefore, special or non-special according as its invariant vanishes or does not. If $\xi(v)$ be reduced to the Plucker type $\omega(v) = 2(v_1v_4 + v_2v_5 + v_3v_6)$, the invariant assumes the form $\Omega(c) = 2(c_1c_4 + c_2c_5 + c_3c_6)$. In case the above-mentioned Klein coordinates are employed, the form of the invariant is $-\Omega(c) = \Sigma c^2_j$ $(j = 1, \ldots, 6)$.

Pencil of Complexes, and Line Congruence.—The system of lines *common* to two complexes is named line *congruence*. It is plain that the lines of the congruence determined by two complexes $\Sigma c_j v_j = 0$ and $\Sigma c_j' v_j = 0$ are common to the complexes of the pencil $\lambda\Sigma c_j v_j + \mu\Sigma c_j' v_j = \Sigma(\lambda c_j + \mu c_j')v_j = 0$ of complexes and that the congruence is equally determined by any two complexes of the pencil. Does the pencil include special complexes? If so, how many? The condition, $\Omega(\lambda c + \mu c') = 0$, for special complexes, is quadratic in the ratio $\lambda : \mu$ of the parameters, and hence yields two values for that ratio, which may be real and distinct, real and equal, or imaginary. Accordingly, every pencil of complexes contains two and but two special complexes, real and distinct, coincident, or imaginary. The directrices of the special complexes are cut by all and only the lines of the congruence and are called the *directrices of the congruence*. Conversely, the assemblage of lines that intersect two given lines is a congruence. Hence a congruence is often defined to be the totality of lines intersecting two fixed lines. The directrices of a congruence are conjugate lines with respect to every complex of the corresponding pencil of complexes. In case the discriminant of the foregoing quadratic is zero, the directrices coincide. The (double) directrix is a line of the congruence. That discriminant is called the *invariant of the congruence*. The vanishing of the invariant signifies coincidence of the two special complexes and of their directrices. It may happen that the quadratic is identically zero. Then all complexes of the pencil are special, and the directrices constitute a pencil of lines.

Angle of Complexes; Involution.—Let a, b, c, d be any four values of the parameter $\lambda : \mu$ of the above pencil of complexes. The anharmonic ratio $(abcd)$ may be called the anharmonic ratio of the four corresponding complexes. If l be a line of the congruence, π a plane of l, and P_1, P_2, P_3, P_4 be the poles of π as to the complexes a, b, c, d respectively, then the anharmonic ratio $(P_1P_2P_3P_4) = (abcd)$. Also, if π_1, π_2, π_3, π_4 are the polar planes of a point P of l with respect to the four complexes, then $(\pi_1\pi_2\pi_3\pi_4) = (abcd)$. Hence $(\pi_1\pi_2\pi_3\pi_4) = (P_1P_2P_3P_4)$, and these equal ratios remain *constant* as π rotates about (P glides along) l and also as l varies its position in the congruence. We may suppose that b and d correspond to the *special* complexes of the pencil, and denote by F and F' the points common to l and the directrices, and by ϕ and ϕ' the planes determined by l and the directrices. Then $(P_1FP_2F') = (abcd) = (\pi_1\phi\pi_2\phi')$. Denote this anharmonic ratio by r. The corresponding angle, $A = (\log r) : 2\sqrt{-1}$, has been named by Klein the *angle of the complexes* a and c. If a and b be so taken (and that is possible) that $A = 90°$, whence $r = -1$, then the two corresponding complexes are said to be *orthogonal* or *in involution*. The geometric significance of this relationship is that, when and only when it subsists between two complexes, each contains the conjugates of its lines with respect to the other. This subject of involution is intimately connected with the general doctrine of linear systems of linear complexes, but it cannot be further pursued here.

Hyperpencil of Complexes.—Such we may call the system $\Sigma(\lambda c_j + \mu c_j' + \nu c_j'')v_j = 0$ determined by three independent complexes. $\Sigma c_j v_j = 0$, $\Sigma c_j' v_j = 0$, $\Sigma c_j'' v_j = 0$. The name, system of three terms, is often employed instead of hyperpencil. The ∞^1 lines common to the three fundamental complexes are obviously common to all complexes of the hyperpencil. They constitute a ruled surface of second order. That the surface is of second order appears from the fact that the number of points in which it is pierced by a line u_j, *i.e.*, the number of solutions of the equations $\Sigma c_j v_j = \Sigma c_j' v_j = \Sigma c_j'' v_j = \xi(v) = \xi(v, u)$, is two. The surface is in general an *hyperboloid of one sheet:* in special case, a *hyperbolic paraboloid*. The lines constitute, however, but one system of generators. What of the other system? To answer, observe that the condition, $\Omega(\lambda c + \mu c' + \nu c'') = 0$, that the hyperpencil shall contain special complexes, yields ∞^1 pairs of values of the (two independent) ratios $\lambda : \mu : \nu$. Hence the hyperpencil includes ∞^1 special complexes. The directrices of these constitute the second system of generators. These last are not lines common to the hyperpencil, on which account it seems better (after Koenigs) to call the lines common to the hyperpencil not a ruled surface, but a demi-quadric or series of lines.)

Complex of Higher Degree.—An equation $f_n(v) = 0$ of degree n in line coordinates v_j defines a complex of degree n. Any line-pencil of space contains n lines of such a complex, so that the degree of a complex may be geometrically defined to be the number of lines common to the complex and an arbitrary pencil. The lines common to a complex of nth degree and a hyperpencil constitute a *cone* of *order* n if the hyperpencil is a *sheaf*, and envelope a plane *curve* of *class* n if the hyperpencil is a plane of lines. The cone is called *cone of the complex;* and the curve, *curve of the complex*. Every point of space is the vertex of such a cone, and every plane contains such a curve. As above seen, if $n = 1$, the cone degenerates into a plane (pencil of lines) and the curve degrades into a point (pencil of lines enveloping it). The 'Neue Geometrie' of Plucker is chiefly devoted to the *quadratic* complex, $n=2$, and many of its cardinal properties are there discovered. For the literature of the subject, including the general doctrine of complexes, the reader is referred to the works above cited and to the bibliography below. We give next a very brief account of certain closely

Allied Theories

the study of whose connections and general comparative anatomy is one of the most instructive and fascinating chapters in the development of modern geometry.

Plane Geometry of the Point in Four-space.—Space that is 4-dimensional in points is also 4-dimensional in *lineoids* (ordinary 3-dimensional spaces). It is 6-dimensional in lines and also in planes. Hence in 4-space the *point* and the *lineoid* are *dual* (reciprocal) elements, and so are the *plane* and the *line*. The lineoid contains ∞^4 lines; the point, ∞^4 planes. The lineoid contains ∞^3 points and as many planes; the point contains ∞^3 lineoids and as many lines. Hence in 4-space, the point, plane, and line geometries of the lineoid are respectively dual to the lineoid, line, and plane theories of the point. Between any two of these pairs of reciprocal geometries there is a fact-to-fact correspondence, and the algebras of any such pair are identical. The emphasis here falls upon the fact that the line geometry of the lineoid (*i.e.*, ordinary line geometry) is precisely the same analytically as the geometry of the 4-space point regarded as the assemblage of its (generating) planes. For an introductory detailed account of the elements of the latter theory, and of the mentioned parallelism, see 'The Plane Geometry of the Point in Point-space of Four Dimensions' ('American Jour. of Math.,' vol. 25).

Geometry of (Ordinary) Space in Pentaspherical Coordinates.—The square of the tangent-distance from a point to a sphere is named the *power of the point with respect to the sphere.* Denote by x_k $(k=1, \ldots, 5)$ the powers of a point with respect to five fixed mutually orthogonal spheres. The x_k satisfy the identity $\Sigma x_k^2=0$. To any set of values of their ratios there corresponds a definite point and conversely. The quantities λx_k are called *pentaspherical point coordinates.* Their discovery and introduction into geometry are mainly ascribable to Gaston Darboux (cf. his memoir 'Sur une class remarquable de courbes et de surfaces algébriques,' 1873), but in part also to Felix Klein and Sophus Lie (cf. 'Mathematische Annalen,' vol. 5). In these coordinates the equation of a sphere is linear, *viz.*, $\Sigma m_k x_k=0$ $(k=1, \ldots, 5)$; conversely, every such equation represents a sphere. The radius is $\rho=(\sqrt{\Sigma m_k^2}):\Sigma(m_k \div R_k)$, where the R_k are the radii of the fundamental spheres. Certain analytic correspondences between line geometry (in Klein coordinates) and point geometry in pentaspherical point coordinates are immediately obvious. For example: in the former $\Sigma x_j^2=0$ $(j=1, \ldots, 6)$ is the identity satisfied by the line coordinates x_j; in the latter, $\Sigma x_k^2=0$ $(k=1, \ldots, 5)$ is the identity connecting the pentaspherical point coordinates; in the former, $\Sigma m_j x_j=0$ represents a linear complex; in the latter, $\Sigma m_k x_k=0$ represents a sphere; in the former, $\Sigma m_j^2=0$ means that the complex is special; in the latter, $\Sigma m_k^2=0$ signifies that the sphere is a point; and so on and on.

Sphere Geometry of Space.—In this doctrine, due to Sophus Lie, the sphere is taken as primary element. To pick out a sphere from among all the spheres of space, it is necessary and sufficient to know four independent things about it, as the (three) coordinates of its center and the length of its radius. Hence the sphere, like the line, has four independent coordinates, it has four degrees of freedom, and sphere geometry, like line geometry, is 4-dimensional. We have seen that every equation $\Sigma m_k x_k=0$ in pentaspherical point coordinates x_k represents a sphere, and conversely; hence the five coefficients m_k may be taken as *homogeneous sphere coordinates,* their ratios being equivalent to four *independents.* The system may be rendered homologous to that of the six line coordinates by introducing a sixth sphere coordinate m_6 by the definition, $im_6=\sqrt{\Sigma m_k^2}$, where $i=\sqrt{-1}$ and $(k=1, \ldots, 5)$. The *six* homogeneous, sphere coordinates m_j $(j=1, \ldots, 6)$ satisfy the quadratic identity $\Sigma m_j^2=0$, identical in form with that connecting the Klein line coordinates. The condition that the *spheres m* and *m'* shall be *tangent* is $\Sigma m_j m_j'=0$, which is precisely like the condition, $\Sigma x_j x_j'=0$, that the *lines x* and *x'* shall *intersect*, a most interesting and fruitful principle of correspondence discovered by Lie in his brilliant memoir, 'Über Complexe, in besondere Linien- und Kugel-Complexe, mit Anwendung auf die Theorie partieller Differentialgleichungen' ('Mathematische Annalen,' vol. 5, 1871).

Circle Geometry of Space.—In this beautiful and growing theory, principally due to the French mathematicians E. Cosserat, C. Stéphanos, and G. Koenigs, the circle is employed as primary or generating element of space. In this element, space is 6-dimensional, like point 4-space in lines or planes. A circle is determined as the intersection of two spheres, as $\Sigma m_j x_j=0$. $\Sigma m_j' x_j=0$ $(j=1, \ldots, 5)$. It is equally determined by any two spheres of the pencil or range, $\Sigma(m_j+\lambda m_j')x_j=0$, of spheres containing it, and, in particular, by any two of the included five of which each is orthogonal to one of the fundamental spheres. The equations of those special spheres correspond to the five λ-values that render the coefficients $m_j+\lambda m_j'=0$ in succession. For the sake of symmetry, the *ten* coefficients $p_{ik}=(m_i m_k'-m_k m_i')$ are taken as homogeneous coordinates of the circle. That the ten are equivalent to the necessary and sufficient number *six* of independents is seen in the facts that only their ratios are essential and that they satisfy five (equivalent to three independent) quadratic identities of the form $\omega_a(p)=2(p_{\beta\gamma}p_{\delta\epsilon}+p_{\beta\delta}p_{\epsilon\gamma}+p_{\beta\epsilon}p_{\gamma\delta})=0$. The circle geometry of space is not parallel to the line geometry of ordinary space, but it is parallel, in a fact-to-fact fashion, to the line and the plane geometries of point 4-space.

Theory of Circles Orthogonal to Sphere.—Two spheres m_k and m_k' $(k=1, \ldots, 5)$ are *orthogonal* when and only when $\Sigma m_k m_k'=0$; hence there are ∞^3 spheres orthogonal to a given sphere. A *circle* is *orthogonal* to a *sphere* when and only when any two (and hence all) of its generating spheres are orthogonal to the sphere. There are, accordingly, ∞^4 circles orthogonal to a given sphere. A one-to-one correlation subsists between such circles and the lines of space. If, in the assemblage of spheres orthogonal to a given sphere, four mutually orthogonal spheres be taken as fundamental or coordinate spheres, any equation $\Sigma m_k x_k = 0$ $(k = 1, \ldots, 4)$ will represent a sphere of the assemblage, and conversely. Hence a pair of such equations will define a circle orthogonal to the fixed sphere, and conversely. It is immediately plain that the coordinates of the circle regarded as element of the assemblage of circles orthogonal to a given sphere are analytically precisely the same as the line coordinates of space. Hence the geometry of such a circle assemblage is analytically identical with line geometry. The first chapters of such a circle geometry are found in the doctor's dissertation (at Columbia University, 1904), 'The Geometry of Circles Orthogonal to a Given Sphere,' by Mr. C. S. Forbes.

Bibliography.—The literature of line geometry and allied theories is extensive and is rapidly increasing. In addition to the foregoing citations, may be mentioned the following works, which together with further citations contained in them constitute a complete bibliography of the subject: Cayley, 'On the Six Coordinates of a Line' (Collected Papers, vol. 7); Klein, 'Einleitung in die höhere Geometrie' and various memoirs by him in vol. 5 and subsequent volumes of *Mathematische Annalen;* Koenigs, 'La géométrie réglée et ses applications' (*Annales de la Faculté des Sciences de Toulouse*, vols. 3 *et seq.*); Cosserat, 'Sur le cercle considéré comme élément générateur de l'espace' (see preceding reference); Loria, 'Il passato ed il presente delle principali teorie geometriche'; E. Pascal, 'Repertorio die mathematiche superiori'; Sturm, 'Die Gebilde ersten und zweiten Grades der Liniengeometrie,' a synthetic treatise; Pasch, 'Zur Theorie der linearen Complexe' (Crelle's Journal, vol. 75); Study, 'Geometrie der Dynamen'; Jessop, 'Treatise on the Line Complex'; 'Encyklopädie der Mathematischen Wissenschaften,' vol. 3.

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Geometry, Modern Analytical. No preliminary statement of the significance of this title could be quite satisfactory to any, much less to all. An adequate sense of its meaning can be gained only by study of the subject itself; and in this case, as in that of most other doctrines, it is better for the reader to end, than for the writer to begin, by an attempt at definition. Logically and historically modern analytical geometry is the outgrowth of Cartesian geometry (q.v.). The former, while in a sense it includes the latter as a special case, avails itself of many principles, processes, and points of view unknown to the older doctrine. It is the aim of this article to give a brief account of some of the modern notions and methods, with particular reference to the geometry of the plane. For further information the reader may consult the articles: GEOMETRY, CARTESIAN; CURVES, HIGHER PLANE; LINE GEOMETRY AND ALLIED THEORIES; CURVES OF DOUBLE CURVATURE, THEORY OF; SURFACES, THEORY OF; HYPERSPACES. As to related matter of pure geometry, see the articles: GEOMETRY, ELEMENTARY PURE; GEOMETRY, PURE PROJECTIVE; and GEOMETRY, NON-EUCLIDEAN. In the following, acquaintance with the elements of ordinary (Cartesian) geometry will be presupposed.

One-dimensional Spaces: Range and Pencil; Elements at Infinity.—Any geometric entity in a given space may be taken as generating element of the space, which is then regarded as the assemblage of all the elements of the chosen kind. A space being assumed, its dimensionality depends upon the choice of generating element and is the number of independent parameters, or coordinates, necessary for the determination of the element. This is what is meant, to take the most familiar examples, by saying that any surface, say a plane, is two-dimensional, and that ordinary space is three-dimensional, in points. Any space being assumed, it is always possible to select as element an infinity of different kinds of entities for any one (kind) of which the space shall have a prescribed dimensionality k. Thus the plane is two-dimensional in lines (see below), its dimensionality is 3 in circles, 4 in parabolas, 5 in conics, . . . , while the dimensionality of ordinary space is 3 in planes, 4 in lines or in spheres (see LINE GEOMETRY), 6 in circles, etc. A plane curve may in general be conceived either as a *locus*, assemblage of its *points*, or as an *envelope*, assemblage of its (tangent) *lines*. In either view the curve appears as a *one*-dimensional space, of points in the former view, of lines in the latter. Of such one-fold spaces, the simplest, and hence in a sense the most important, varieties are the *range* and the *pencil*, the former being the straight line regarded as the locus or assemblage of its points, and the latter being the point regarded as the envelope or assemblage of its lines (the lines through it). Commonly the line is called the *base* of its range, and the point is called the *vertex* of its pencil. In passing it may be pointed out that if a *pair* or *triplet*, . . . of points (lines) be taken as element of the line (point), the line (point) appears as a space of 2, or 3, . . . dimensions in such pairs, triplets, . . .

Let V and b respectively be any pencil and range. The plane being supposed Euclidean in respect to parallels (see NON-EUCLIDEAN GEOMETRY), V contains a single line parallel

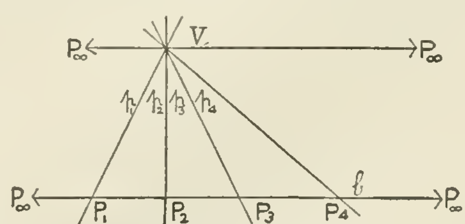

FIG. 1.

to b. Plainly, through any (finite) point of b there passes one and but one line of V; and, conversely, every line of V, except the mentioned parallel, passes through a (finite) point of b. In order to avoid the exception and render the one-to-one correspondence complete, a convention is made, namely, that every range shall be regarded as having one and but one *infinitely distant* point P_∞, called the *infinite point* of the range, and that the infinite point of any range is identical with that of any parallel range. Accordingly any infinite point of the plane is the vertex of a pencil of parallel lines, and the system of lines parallel to a given one constitute a pencil vertexed at ∞. The notion of parallel lines meeting at ∞ had occurred to Kepler, but the systematic introduction of the convention was made by Gerard Desargues (1593–1662), chief among the founders of modern *pure* geometry. From that convention it readily follows, by the theory of similar triangles, that the (infinite) distances from any two finite points of a range to its infinite point are *equal*. The locus of the infinite points of the plane is a straight line, called *the infinite line* of the plane. As for space, the locus of its infinite points is a plane. In general the locus of the infinite points in a point-space of n dimensions is a point-space of $n-1$ dimensions. If a range rotate (in a plane) about one of its finite points, every other point of the range will generate a circle; the path of the infinite point being a straight line, the latter appears as a circle of infinite radius; a perfectly natural phenomenon, for the curvature, $1:r$, of a circle of radius r, vanishes for $r=\infty$.

Non-homogeneous and Homogeneous Coordinates of Point and Line of Range and Pencil.—In a range choose a point O for *origin* of distances. Denote by d the distance from O of an arbitrary point P of the range. Let $x=\rho d$, where the factor ρ may have any chosen value whatever. To any value of x there corresponds a position of P, and conversely. Hence x may serve as coordinate of the elements of the range. If a pencil be paired with a range as above, x will equally serve for coordinate of the lines of the pencil; or, in the latter case, d may be taken to represent the tangent of the angle made by a varying line of the pencil with a fixed line o, called *origin* of angles. Any point (line) of a range (pencil) will be represented by a linear equation $ax+b=0$, the coordinate of the element being $-b:a$. Conversely any element is defined by such an equation. In general n elements will give rise to an equation of nth degree in x, and any such equation will represent n elements. These (points or lines) will be real or *imaginary* elements of the range or pencil according to the corresponding character of the roots of the equation. All the equations can be rendered *homogeneous* by replacing x by the ratio $x_1:x_2$ and clearing of fractions. The quantities σx_1 and σx_2, σ being any chosen finite quantity called proportionality factor, are described as *homogeneous coordinates* of the point (line) of the range (pencil). The position of the element depends on the ratio of the quantities, which is the same as the ratio of the x's, and the element is accordingly spoken of as the point or line (x_1, x_2). One obvious advantage of the homogeneity thus introduced lies in the artistic quality, notably the symmetry, which it lends to the analysis; for example, the equation of a point assumes the form $a_1x_1+a_2x_2=0$; in particular, the equations of the origin and P_∞ are respectively $x_1=0$ and $x_2=0$. Obvious analogous interpretations hold for the pencil. Indeed it is at once evident that the geometry of the range and that of the pencil are *analytically one*. The algebra remaining the same, either geometry passes over into the other on a mere exchange of notions: point (line) for line (point), pencil (range) for range (pencil).

Geometric Interpretation of Homogeneous Coordinates.—In case of the range assume two origins O_1 and O_2 instead of one and let them be δ apart. These divide the range into two parts, the short segment *between* and the long one (including P_∞) *not* between O_1 and O_2. Strictly, any point of the range other than O_1 or O_2 is between these points, for the range is a *closed* figure, but the meaning of the preceding sentence is sufficiently clear. Let it be agreed that a point in the shorter segment is on the positive side of both O's, whence, naturally, a point in the longer segment will be on the positive side of the remoter, and on the negative side of the nearer, O. Denote by x_1 and x_2 respectively the distances of any point P from O_1 and O_2. For any P, $x_1+x_2=\delta$. To any pair of x's satisfying that relation there corresponds a point, and conversely. Hence the homogeneous coordinates σx_1, σx_2 of a point of a range are the distances (multiplied by any finite constant) of the point from two chosen fixed points. Analogously for the pencil, where, however, distances are replaced not by the angles but by the sines of the angles made by the variable line p with two fixed lines o_1 and o_2 and where it is understood that an angle and its vertical angle are one and the same angle.

Anharmonic Ratio.—The ruling notion in the doctrine of the range (pencil) is the *anharmonic* (double or cross) *ratio* of four elements. If x_1, x_2, x_3, x_4 be any four numbers (say any four values of a continuous variable x), the expression $(\overline{x_1-x_2}\cdot\overline{x_3-x_4}):(\overline{x_2-x_3}\cdot\overline{x_4-x_1})$ is called the anharmonic ratio of the four values taken in the order x_1, x_2, x_3, x_4, and is conveniently denoted by the symbol $(x_1x_2x_3x_4)$. If a one-to-one correspondence be established between the continuum of x-values and the elements of a geometric continuum, the notion of the anharmonic ratio of any four x-values may be and is associated with the corresponding four geometric elements, as the points of a range, the lines of a pencil, the planes of an *axal pencil* (assemblage of all planes containing a same line), and so on. The *order* of the elements is essential. The 24 possible permutations of 4 elements yield six (in general distinct) values of their anharmonic ratio. The exchange of two *alternate* elements, as x_1 and x_4, *inverts* the ratio. Thus, if $(x_1x_2x_3x_4)=r$, then $(x_1x_4x_3x_2)=1:r$. To exchange two *consecutive* elements, as x_2 and x_3, takes the *complement* of the ratio to 1. Thus $(x_1x_3x_2x_4)=1-r$. The six values are r, $1:r$, $1-r$, $1:(1-r)$, $(r-1):r$, $r:(r-1)$.

Geometric Interpretation of Anharmonic Ratio in Range and Pencil.—Let x_1, x_2, x_3, x_4 be the distances of the points P_1, P_2, P_3, P_4 of a range from the origin. Then x_1-x_2, x_3-x_4, x_2-x_3, x_4-x_1 represent, in sign and magnitude, the distances $\overline{P_1P_2}$, $\overline{P_3P_4}$, $\overline{P_2P_3}$, $\overline{P_4P_1}$. Hence

$(x_1x_2x_3x_4) = (P_1P_2P_3P_4) =$ the *ratio* of the *distance ratios* $\overline{P_1P_2}:\overline{P_2P_3}$ and $\overline{P_1P_4}:\overline{P_4P_3}$. In case of a pencil, if the x's denote the tangents of the angles α_1, α_2, α_3, α_4 made by the lines p_1, p_2, p_3, p_4 with the origin, or fixed line, o, then x_1-x_2, . . . are the tangent differences $\tan\alpha_1-\tan\alpha_2$, . . . , and $(x_1x_2x_3x_4)=(p_1p_2p_3p_4)=\{(\tan\alpha_1-\tan\alpha_2)(\tan\alpha_3-\tan\alpha_4)\}:\{(\tan\alpha_2-\tan\alpha_3)(\tan\alpha_4-\tan\alpha_1)\}=\{(\sin\overline{\alpha_1-\alpha_2})(\sin\overline{\alpha_3-\alpha_4})\}:\{(\sin\overline{\alpha_2-\alpha_3})(\sin\overline{\alpha_4-\alpha_5})\}=$ the *ratio* of the *sine ratios* $(\sin\overline{p_1p_2}):(\sin\overline{p_2p_3})$ and $(\sin\overline{p_1p_4}):(\sin\overline{p_4p_1})$, where p_ip_κ means the angle between p_i and p_κ reckoned from the former to the latter.

Special Relations of Four Elements.—These correspond to equalities among the six anharmonic ratios, and conversely. By equating r in succession to each of the other ratios, the following special values of the ratios are found: 1, −1, 0, ∞, 2, ½, ω, and ω', the last two being the imaginary cube roots of − 1. If $r=1$, the six values are 1, 1, 0, 0, ∞, ∞; if $r=-1$, the six are −1, −1, 2, 2, ½, ½; if $r=\omega$ or ω', they are ω, ω, ω, ω', ω', ω'; finally, if $r=0$ or ∞, the six values are 0, ∞, 1, ∞, 1, 0. The special relations accordingly fall into three cases, *viz.*, $r=1$, $r=-1$, $r=\omega$. If $r=1$, either $x_1=x_3$ or $x_2=x_4$, *i.e.*, two of the points (lines) coincide. Hence this case is called the *coincident* case. If $r=-1$, then, if s_1 and s_2 are the intervals into which the range (pencil) is divided by a pair of alternates, one element of the remaining pair is in s_1 and the other is in s_2; the pair x_1, x_3 is said to be *harmonically* related to the pair x_2 x_4; and conversely. In particular if one of the points bisects the finite segment s_1 the alternate point bisects the other segment s_2, *i.e.*, it is the infinite point of the range. And if one line bisects the angle s_1, the alternate line bisects the supplementary adjacent angle s_2. The case, $r=-1$, called the *harmonic* case, is of great importance, leading to the theory of *involution;* all point (line) pairs of a range (pencil) that are each harmonic (conjugate) to a fixed pair are said to constitute an involution of points (lines.) The case, $r=\omega$, is called *equianharmonic* (by Cremona) because the six values fall into two triplets, instead of three pairs, of equals. This case serves as a door for the entrance of imaginary elements into the geometry of the range (pencil), for obviously four *real* points (lines) cannot have an imaginary anharmonic ratio.

Conjoined Range and Pencil.—From any line a range is cut by any pencil, as in Fig. 1. If the elements be paired so that each line

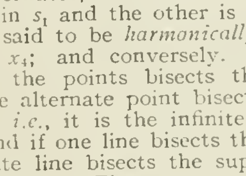

FIG. 2.

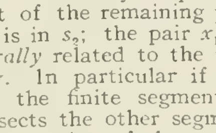

FIG. 3

corresponds to the point it passes through, the range and pencil are said to be *in perspective* or to be *conjoined.* *Two ranges* (Fig. 2) conjoined with a same pencil are said to be *in perspective;* the vertex of the pencil is called the *centre* of perspective. Also *two pencils* (Fig. 3) conjoined with a same range are said to be *in perspective;* the base of the range is named *axis* of perspective. If a range and a pencil are conjoined and if P_1, P_2, P_3, P_4 be any four points of the range and p_1, p_2, p_3, p_4 are the corresponding lines of the pencil, then, by definition of anharmonic ratio, $(P_1P_2P_3P_4)=(p_1p_2p_3p_4)$, a theorem which in another form was known to Pappus (about 300 A.D.). It follows that corresponding anharmonic ratios of any two perspective ranges (pencils) are equal.

If the elements of two ranges or pencils or a range and a pencil be paired in such way that corresponding anharmonic ratios are equal, the two systems are said to be *projective.* Obviously, if the anharmonic ratio of four elements of which three are known be given, the fourth element is uniquely determined. It follows that any two projective systems can be placed in perspective. To place two projective ranges P_1, P_2, P_3, P_4, . . . , and P_1', P_2', P_3', P_4', . . . , in perspective, it suffices to place P_1 on P_1' and to take for perspective center the common point of the lines joining P_2 to P_2' and P_3 to P_3'. Similarly for two projective pencils.

The Anharmonic Ratio as Coordinate.—Let $(abcx)=r$ be the anharmonic ratio of four elements of which a, b, c are *fixed* and x is *variable.* To each value of x, *i.e.*, to each point (line) of the range (pencil), there corresponds one value of r, and conversely. Hence the anharmonic ratio r may be taken as coordinate of the point (line) of a range (pencil), referred to three arbitrarily taken fixed points (lines) of it. Now, $(\infty\ 1\ 0\ x)=x$; hence, if x in case of a range denote distance from the origin, it appears that the ordinary *distance-coordinate* of a point is its anharmonic ratio referred to the infinite point, the point 1 and the origin, of the range. Similarly, if for fixed lines be taken two perpendicular lines (of which one is the ordinary origin) and the bisector of their angle, the anharmonic ratio of those lines and a (variable) fourth line is the tangent (coordinate) of the angle of this line and the origin. The anharmonic ratio is thus seen to be the coordinate par excellence of the element of any one-fold continuum.

Linear Transformation.—The importance of the anharmonic ratio in the theory of simple continua comes clearly to view in connection with the linear transformation of them. The general equation of such transformation is $x'=(ax+b):(cx+d)$. To any point (line) x corresponds one point (line) x'. Viewing the transformation as an operation on all the elements at once, we say that each element x is transformed or converted into an element x'. Obviously the range (pencil) is converted into itself as a whole, the arrangement of the elements being in general changed. It is plain, too, that the transformation can be used to pair the elements of a range (pencil) with those of a pencil (range) or to pair two ranges or two pencils. The three independent ratios of the coefficients a, b, c, d are the parameters of the transformation. Hence there are ∞^3 transformations. Any two of them are equivalent to a third, and so they constitute a *group* (see GROUPS, THEORY OF); and the parameters can be so determined as to convert any specified three elements into three specified elements. If x_1, x_2, x_3, x_4 be any four elements of a system (range or pencil) and if x_1', x_2', x_3', x_4' be the correspondents of the same or other system of the same or the other kind, then $(x_1x_2x_3x_4) = (x_1'x_2'x_3'x_4')$; *i.e.*, the anharmonic ratio is an absolute *invariant* (see INVARIANTS) under every transformation of the group. It is this property of invariance that lends the anharmonic ratio its great importance in geometry. Because anharmonic ratios are preserved by it, the linear transformation is called *projective:* any two systems paired by it are projectively related. Every transformation of a system into itself leaves two elements *fixed*. These are found by writing x for x' and then solving for x. The fixed elements, variously called the *poles*, *foci*, *double* or *conjugate* elements, of the transformation, will be real and distinct, coincident or imaginary, according as the *discriminant*, $D \equiv (d-a)^2 + 4bc$, is positive, zero, or negative; and the corresponding transformations are described respectively as *hyperbolic*, *parabolic*, and *elliptic*,—distinctions that cannot be here further pursued. In homogeneous coordinates the linear transformation is defined by the pair of equations $\rho x_1' = ax_1 + bx_2$, $\rho x_2' = cx_1 + dx_2$.

Range and Pencil; Dual Elements of the Plane.—Hitherto we have been mainly concerned with the line and the point (the range and the pencil) considered *in themselves*. These one-dimensional spaces are now to be viewed as *elements* of a twofold space, the plane. In Cartesian coordinates the equation of the line is $Ax + By + C = 0$, or $ux + vy + 1 = 0$. The equation, which represents the line as a *range* of points (x, y), contains *two* parameters u and v, which determine the range, or line. Hence the plane is two-dimensional in *ranges* (lines) as well as in *pencils* (points). Since one and but one line is determined by any pair of values of u and v, u and v may be employed as *coordinates* of the *line*. We may speak of the line (u, v) as of the point (x, y). If u and v vary and x and y do not, the equation *represents the point* (x, y) as a *pencil* of lines (u, v). We have here simple illustrations of three important *principles* of modern analytical geometry. As the equation of the line contains two independent parameters, we conclude that the plane is two-dimensional in lines. The dimensionality of any space in an element is always the number of independent parameters involved in the general analytic representation of the element. This principle of "enumerating constants" to determine questions of dimensionality is one of many principles introduced into analytical geometry by Julius Plucker (1801–1868). Another is that of *multiple interpretation* of equations. Thus we have seen that a same equation may be interpreted to represent now a point and now a line. Another great principle is that of *duality* or *reciprocity* introduced into *analytical* geometry by Plücker, though it was before employed in *pure* geometry by Poncelet (1788–1867) and his contemporary Gergonne, to the latter of whom geometric nomenclature is indebted for the word duality. Two elements e and e' of a given space are dual elements of it when its dimensionality is the same in both and when the analytic representations of e and e' are identical in form. Thus the point and the line (more properly, the pencil and the range) are reciprocal elements of the plane. The analogues for space are the point and the plane, the equation $ux + vy + wz + 1 = 0$ representing either a plane (u, v, w) as a field of points or a point (x, y, z) as a *sheaf* (*bundle*) of planes. The mentioned reciprocity of the point and the line is immediately evident in such familiar pairs of propositions as: two points (lines) determine a line (point); three points (lines) determine three lines (points). In general, to any proposition about points (lines) corresponds an immediately derivable proposition about lines (points). So arise two parallel geometries of the plane, or, say, two reciprocal aspects of one geometry. The two algebras are one, dually interpretable. Using two variables, as ξ, η, to denote either point or line, any equation $f(\xi, \eta) = 0$ will represent either a curve as an assemblage or *locus* of points or a curve as an assemblage or *envelope* of lines (tangents). The degree of the equation is called the *order* of the locus, *i.e.*, the number of points common to it and an arbitrary range, and it is called

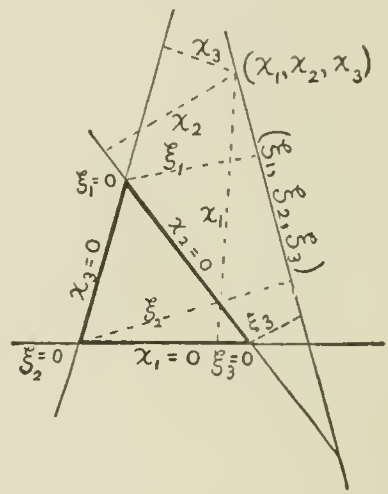

FIG. 4.

the *class* of the envelope, *i.e.*, the number of lines common to it and an arbitrary pencil. The two curves are in general not the same. But every curve, the point and line excepted, is conceivable as both a locus and an envelope and may at once be doubly generated as such: *i.e.*, by the figure of a point and a line through it so moving that the line is continuously tangent to the point's path at the point; such twofold genesis being another conception due to Plucker. Accordingly a curve has a point equation and a line (tangential) equation. For example, the ordinary point equation of the circle, centre at origin and radius r, is $x^2 + y^2 = r^2$; the line equation is $r^2(u^2 + v^2) = 1$. These are of the same degree, exemplifying the fact that every curve of *second* order is of *second* class, and conversely. In general, however, the order and the class of a curve are not equal; for example, the curve whose point equation is $x^3 + y^3 + 1 = 0$ has for line equation the sextic, $u^6 + v^6 - 2(u^3 + u^3v^3 + v^3) + 1 = 0$, and is accordingly of order 3 and class 6.

Homogeneous Point and Line Coordinates and their Geometric Interpretation.—By replacing x by $x_1:x_3$, y by $x_2:x_3$, u by $\xi_1:\xi_3$, and v by $\xi_2:\xi_3$, all equations of loci and envelopes may be rendered homogeneous. In particular the equation of the line (point) becomes $\xi_1x_1+\xi_2x_2+\xi_3x_3=0$. The three ξ's (x's), or arbitrary multiples $\mu_i\xi_i$ (m_ix_i) of them, on whose two independent ratios the line (point) depends, are called the *homogeneous coordinates of the line (point)*. Such coordinates admit of various closely allied interpretations of which the simplest is that, Fig. 4, in which the x's (ξ's) are the distances of the point (line) from the sides (vertices) of an assumed *fundamental* triangle, or triangle of *reference*, signs being so determined by convention that a point within the triangle is on the positive side of the three sides and that any two of the ξ's agree or do not agree in sign according as the corresponding line does not separate or separates the corresponding vertices. Such coordinates are often called *triangular* or *trilinear*. Plainly, they may be replaced by arbitrarily chosen multiples of them The x's (ξ's) are, of course, not independent. If Δ denote the area of the triangle and a_1, a_2, a_3 the lengths of its sides, the distances x satisfy the identity $a_1x_1+a_2x_2+a_3x_3=2\Delta$. An analogous identity connects the ξ's. The x's and the ξ's need not be referred to the same triangle, but when they are (and that is generally the most convenient convention), the foregoing equation of the line (point) signifies also that the line and point it represents are united in position. Homogeneous coordinates were first employed, from mechanical motives, by Möbius in his 'Barycentrischen Calcul,' 1827, and by Plücker, from geometric motives, in his 'Analytisch-geometrischen Entwickelungen,' 1828. The artistic and economical device of denoting several coordinates by a single letter distinguished by subscripts was introduced by Hesse (1811–1874), whose 'Analytische Geometrie des Raumes,' 1861, remains a model of elegance.

The Method of Abridged Notation, and the Conics.—This powerful method, simultaneously and independently introduced into geometry by Plücker (cf. 'Entwickelungen,' above) and by Bobillier (*Annales de Gergonne*, vol. 18, 1827–8), consists primarily in denoting by a single letter the left-hand member of the equation of a curve or surface, whence the curve or surface is represented by placing the letter equal to zero. The advantages of the method, as combining ideally with the method of parameters and as greatly economizing at once both physical and intellectual energy, are obvious. For an illustration, let $P^i\equiv x_1{}^i\xi_1+x_2{}^i\xi_2+x_3{}^i\xi_3$ and $L^i\equiv\xi_1{}^ix_1+\xi_2{}^ix_2+\xi_3{}^ix_3$, then the equations $P^i=0$, $L^i=0$ will respectively represent a point and a line. If $P'=0$ and $P''=0$ be two points, their range is represented by $P'+\lambda P''=0$, definite points of the range corresponding to definite values of the parameter λ; in like manner the pencil determined by two lines $L'=0$ and $L''=0$ is $L'+\lambda L''=0$. In general the points (lines) common to any two loci (envelopes) $C'=0$ and $C''=0$ are common to all the loci (envelopes) of the family $C'+\lambda C''=0$. If $\lambda'=(a\lambda+b).(c\lambda+d)$, the two pencils, $L'+\lambda L''=0$, $L'''+\lambda' L^{iv}=0$, are projectively related. Any pair of corresponding lines determine a point. By elimination of λ and λ', the equation of the locus, Fig. 5, of all such points is found to be $aL'L^{iv}-bL''L^{iv}-cL'L'''+$

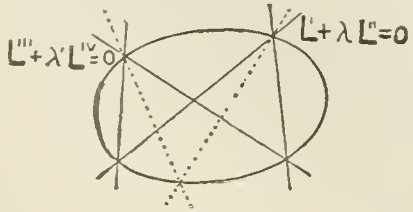

FIG. 5.

$dL''L'''=0$. This being of second degree in point coordinates, the locus is of second order, a conic containing the vertices of the given pencils. Reciprocally, the envelope, Fig. 6,

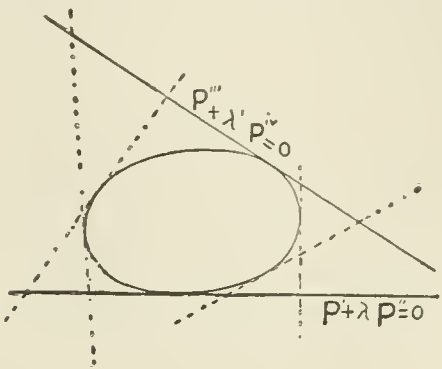

FIG. 6.

$aP'P^{iv}-bP''P^{iv}-cP'P'''+dP''P'''=0$, of the lines joining corresponding points of two projective ranges, $P'+\lambda P''=0$, $P'''+\lambda'P^{iv}=0$, is of second class, a conic touching the (bases of) the given ranges. The number and species of the conic depend on the ratios of the constants a, b, c, d. Obviously there are ∞^3 loci of second order (envelopes of second class) passing through two given points (touching two given lines).

Near-lying subjects such as the general conic, systems of conics, poles and polars, transformations, the circular points at infinity, circle and other geometries of the plane, cannot here be broached, much less the corresponding subjects in space.

Bibliography.—In addition to the works above cited, the following may be named as those which render the subject most readily accessible: Charlotte A. Scott, 'An Introductory Account of Certain Modern Ideas and Methods in Plane Analytical Geometry'; Fiedler's German edition of Salmon's 'Conic Sections' and 'Geometry of Three Dimensions'; Lindemann's 'Vorlesungen über Geometrie von Clebsch' (also in French, by Benoist).

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Geometry, Non-Euclidean. The primitive meaning of Non-Euclidean Geometry was the system which follows from the denial of Euclid's Postulate: "Through a given point there is not more than one parallel to a given straight line,» when all of Euclid's other assumptions, explicit and unconscious, are retained.

It has sometimes been used in the sense of what Bolyai called Absolute Geometry and Lobachévski Pangeometry, namely, the system which simply dispensed with the above Euclidean Postulate, using neither it nor any contrary assumption; undifferentiated, therefore, as between Euclidean and primitive non-Euclidean.

When Euclid's tacit assumption, «the straight line is infinite,» is also dispensed with, we have Metageometry.

When this tacit assumption is denied, we have two new systems, to which the name non-Euclidean was immediately extended.

At present, by a non-Euclidean geometry is meant any system of geometry which, while differing in essential particulars from that of Euclid, is nevertheless in accord with experience and experiment, within the limits of the errors of observation. The space in which such a geometry is true is a non-Euclidean space.

The easiest way to get an appreciation of non-Euclidean geometry is to begin by following its early development historically.

The promise of its birth goes back almost to Euclid's very day, for it arose from endeavors to improve his treatment of the theory of parallels, which was the one point where his wonderful Elements had been criticised from antiquity. The attempts of Proklos and Claudius Ptolemæus to improve on Euclid here have been preserved to us. They were the first of a long line of geometers of every rank who have toiled over what they thought a blemish.

Such attempts may be classified under the three following heads:

1. *The Substitution of a Different Definition of Parallels.*—Euclid's own definition was: Two parallels are coplanar straights with no common point. It remains to this very day the only good definition of parallels for elementary geometry. The introduction of infinity in modern geometry gives its characteristic definition due to Desargues, 1639: Parallels are straights on a common point at infinity (figurative point). This has the advantage (1) of being freed from the necessity of specifying coplanarity, and (2) hence of giving an exact analogue for planes: Parallel planes are planes on a figurative straight; (3) of being wholly positive instead of chiefly negative; (4) of giving the dual in the plane of the fundamental «2 points determine a straight,» namely, «2 straights determine a point,» and hence the inestimable advantages of duality for the plane, including the doctrine of poles and polars.

But so far was the explicit use of infinity from being considered allowable in elementary geometry, that Borelli in 1658 objected to even so much of infinity as is implicit in Euclid's phrasing of «with no common point,» namely, «and which being produced ever so far both ways do not meet,» and so proposed as substitute: Parallels are straights with a common perpendicular

Géminos (about 100 B.C.) had defined parallels as straights everywhere equidistant, but Giordano da Bitonto (1680) saw that this presupposed the assumption of Clavius, 1574, that a line coplanar with a straight and everywhere equidistant from it is itself straight; so using a figure found in Clavius, made by joining together the ends of two equal perpendiculars to a straight, he tried to prove this join everywhere equidistant from the straight. This very figure reappears in Saccheri, of whom more anon.

Another definition is, Parallels are straights having the same direction. This also is worse than worthless.

2. *The Substitution of a Different Postulate.*—Of these the most famous is due to W. Ludlam, fellow of Saint John's College, Cambridge, who, in his 'The Rudiments of Mathematics' (1794), says: « The 12th axiom is not properly an axiom; but, instead of it, you may substitute the following simple proposition. Axiom: Two straight lines meeting in a point, are not *both* parallel to a third line.» This axiom has been persistently attributed to Playfair, despite the fact that he explicitly credits it to Ludlam in a note in his Euclid, on Prop. XXIX, where he says: «This axiom has been assumed by others, particularly by Ludlam, in his very useful little tract entitled 'Rudiments of Mathematics.' »

Other famous alternative postulates are those of Wallis, 1663: «To any triangle another triangle as large as you please can be drawn which is similar to the given triangle»; of Saccheri. «There is a triangle whose angle-sum is two right angles»; of Bolyai, F.. «Every three points are costraight or concyclic.»

3. *The Attempt to Deduce Euclid's Postulate from his Other Assumptions.*—The most famous is by Saccheri in his book 'Euclid Vindicated from Every Fleck' (Milan, 1733).

Ostensibly this is simply a very long demonstration of Euclid's Postulate by the indirect method, *reductio ad absurdum.* Denying this postulate and assuming a contradictory postulate together with all Euclid's other assumptions, if contradiction follows, this contradictory postulate is disproved. If thus the only possible alternatives to Euclid's Postulate are disposed of, it is demonstrated.

On the surface, then, it seems that Saccheri supposed himself to have proved the indemonstrable postulate.

If so, he has no claim to be the discoverer of non-Euclidean geometry. But upon a profounder study of his marvelous work, the suspicion comes that he knew the logical and mathematical truth of one at least of his non-Euclidean hypotheses and the consequent final and eternal indemonstrability of Euclid's Postulate. In that case, he cherished his work, just as we do, not for its fallacious conclusion, necessitated to get for his book the *imprimatur* of the Inquisition and of the Society of Jesus, Saccheri being a Jesuit, but for the beautiful non-Euclidean results which immortalize it.

The angles at the extremities of two equal perpendiculars are equal and either right, obtuse, or acute. These are Saccheri's three hypotheses: the hypothesis of right angle, the hypothesis of obtuse angle, the hypothesis of acute angle.

The first is Euclid. The last is the primitive non-Euclidean geometry.

This was consciously discovered by Schweikart in 1812 at Charkow, communicated to Bessel, and in 1818 a written statement of it sent to Gerling which he was afterwards asked to transmit to Gauss. He did so, and thus this precious document, the first published (not printed) non-Euclidean geometry, is still preserved. (Translated by Halsted, 'Science,' N. S., Vol. XII, pp. 842–846.) Two of its theorems are: (*a*) The sum of the three angles in the triangle is *less* than two right angles; (*b*) This sum becomes smaller the more content the triangle encloses.

The first to print a non-Euclidean geometry (1829–30) was a Russian–Lobachévski, professor of mathematics in the new University of Kazan.

In place of Euclid's Postulate he substitutes the following, which directly contradicts it: «All straight lines which, in a plane, radiate from a point, can, with reference to any given straight line in the same plane, be divided into two clasess—into *cutting* and *not cutting*. The *boundary lines* of the one and the other class are called *parallel to the given line.*»

If the length of the perpendicular from the given point to the given straight line be p, the acute angle it makes with either of the two parallels is denoted by $\Pi(p)$. With a suitable choice of the unit of length, $\tan \frac{1}{2}\Pi(p) = e^{-p}$.

Lobachévski never claimed to have discovered the non-Euclidean geometry before 1826, and the tell-tale title of his paper of 1826, 'Exposition succincte des principes de la Géometrie avec une demonstration rigoreuse du théorème des parallèls,' has never been explained.

Even in 1837 in Crelle's Journal he made the mistake of calling his discovery «Géométrie Imaginaire.»

How different the brilliant young Hungarian, John Bolyai, who in 1823 had written to his father Bolyai Farkas (Wolfgang Bolyai): «I have discovered such magnificent things that I am myself astonished at them. It would be damage eternal if they were lost. *From nothing I have created another wholly new world.*»

His brief exposition of this new world, with the same unflinching recognition of its momentous importance, he calls «The Science Absolute of Space.» It is the most extraordinary two dozen pages in the history of human thought. It was published in 1831 as an appendix to the first volume of a work by his father.

In this tiny appendix, with unparalleled boldness and power, the young Magyar hero squares the circle in Bolyai space, shows that the area of the greatest possible triangle (which has all its sides parallel and all its angles zero) is πi^2, where i is what is now called the space constant, shows how through a given point to draw a parallel to a given straight, and how to draw a perpendicular to one arm of any acute angle which shall be parallel to its other arm.

To get a sharp idea of this primitive non-Euclidean geometry, which may be named after either Lobachévski or Bolyai, contrast a few of its theorems with some of Euclid's:

Proposition 32, Book I of Euclid, is that the sum of the angles in every rectilineal triangle is *just exactly* two right angles. In Bolyai geometry, on the contrary, the sum of the angles in every rectilineal triangle is *less* than two right angles.

In the Euclidean geometry parallels *never* approach. In this non-Euclidean geometry parallels *continually* approach.

In the Euclidean geometry all points equidistant from a straight line are on a *straight* line. In this non-Euclidean geometry all points equidistant from a straight line are on a *curve* called the equidistantial.

In the Euclidean geometry the limit approached by a circumference as the radius increases is a *straight* line. In this non-Euclidean geometry this limit is a *curve* called the oricycle. Thus the method of Kempe's book, 'How to Draw a Straight Line,' would here draw not a straight line, but a curve.

In the Euclidean geometry, if three angles of a quadrilateral are right, then the fourth is *right*, and we have a rectangle. In this non-Euclidean geometry, if three angles of a quadrilateral are right, then the fourth is *acute*, and we never can have any rectangle.

In the Euclidean geometry two perpendiculars to a straight line remain *equidistant*. In this non-Euclidean geometry two perpendiculars to a straight line *spread away from each other* as they go out; their points two inches from the straight line are farther apart than their points one inch from the line.

In the Euclidean geometry every three points are either on one straight line or on one circle. In this non-Euclidean geometry there are triplets of points which are *neither costraight nor* concyclic. Thus three points each one inch above a straight line are neither on a straight line nor on a circle.

In 1867, after Riemann's death, was published an inaugural lecture he had delivered in 1854: 'On the Hypotheses which are at the Foundation of Geometry.' Here occurs for the first time the extraordinary advance that the straight line may be closed and finite; that space though unbounded may still be finite, that, for example, a finite number of our common building bricks might be written down which might be more than our universe could contain. This at once gave Saccheri's «hypothesis of obtuse angle» equal standing with his other two, giving a new genus of non-Euclidean geometry, the Riemannian, with two species, the elliptic and the spheric. These varieties of Riemann's space are also called the polar and antipodal forms of elliptic space, Euclid's space being called parabolic, and that of Bolyai and Lobachévski hyperbolic, space. Riemann gets his profound hold of this matter with the aid of two fundamental conceptions, that of a *manifold*, and that of what he called the *measure of curvature* of a continuous manifold having flatness in its smallest parts. This phraseology, especially the use of the word curvature, proved unfortunate, misleading philosophers and even mathematicians into supposing non-Euclidean spaces curved and necessarily contained in Euclidean spaces. How far this is from being the case is shown by the beautiful «Theorem of Barbarin»: «Each of the three spaces, Euclidean, Lobachévskian, Riemannian, contains surfaces of constant curvature of which the geodesic lines have the metric properties of the straight lines of the three spaces.» Riemann himself created point-manifolds with measure of curvature not zero utterly without reference to anything not contained in the manifold itself. Hence to avoid all appearance of implying for non-Euclidean spaces a curvature in Euclidean space, the phrase *space-constant* serves, it being equal to the reciprocal of the square root of Riemann's measure of curvature.

Lambert in his 'Theorie der Parallellinien' (1766), showed that Saccheri's «hypothesis of obtuse angle» holds on a sphere, and to-day pure two-dimensional spherics is not only the best Euclidean analogue of a Riemannian geometry, but inversely the geometry of two-dimensional antipodal Riemannian space gives the best insight into Euclidean spherics and spherical trigonometry. These reciprocal advantages will be found utilized in Chapter XV, *Pure Spherics*, of Halsted's 'Rational Geometry,' which may be taken as the simplest, most detailed, most complete Riemannian geometry in print.

But it must not be supposed that the surface of a sphere *is* a plane of antipodal Riemannian space. They have the same internal relations, abstraction made of all points not *on*, that is, *in* them. To realize how tremendously different they are in other respects, you have only to recall that the sphere has a triple infinity of points within it, including the center, while the antipodal Riemannian plane has no points within it, no points toward which it is concave.

In the polar form of Riemannian space two coplanar straight lines always intersect once and only once. A complete straight line does not divide a plane; a plane does not divide space, it is unilateral. In this space alone do we have complete, absolute point and plane duality.

Another genus of Euclidean analogues of non-Euclidean spaces was obtained by Klein by a variation of the absolute in Cayley's projective metrics. The coordinates employed in the projective foundation of metrics must be defined non-metrically. This is accomplished by means of the pure projective geometry of von Staudt founded on his famous quadrilateral construction, by which, entirely without any metrical presuppositions, order is assigned among the points of a line. This Cayley-Klein translation of non-Euclidean systems furnished a final proof that no logical outcome of a non-Euclidean geometry could ever be self-contradictory, since any self-contradiction in a non-Euclidean system would be but a like self-contradiction in the Euclidean system. Another equally sweeping but much simpler proof of this on the same principle is given by Poincaré in his remarkable book, 'Science and Hypothesis.'

To the genius of Helmholtz is due the conception of studying the essential characteristics of a space by a consideration of the movements possible therein. Felix Klein it was who first called the attention of Lie to this work of Helmholtz, and pointed out its connection with Lie's group-theory. In 1886 Lie gave briefly his weightiest results. The whole investigation, published in Vol. III of his 'Theorie der Transformationsgruppen,' 1893, was in 1897 awarded the first Lobachévski Prize, a great recurring prize founded at Kazan by contributions from all over the world in honor of the Russian creator of the first non-Euclidean geometry. If Hungary had a man like Vasiliev of Kazan, she too would be honoring herself by marking with a Bolyai Prize her pride in the greatest idea which ever originated in a Magyar brain.

Lie proves that free motion in the strict meaning of the word can happen in three and only three spaces, namely, the traditional or Euclidean space and the two kinds of non-Euclidean space, a Bolyai space, a Riemann space, of which latter there are two species. These four are thus the only spaces allowing free motion as a whole.

A new genus of non-Euclidean spaces, forms of space which do not allow free motion as a whole, called by Killing the Clifford-Klein spaces, may be said to have arisen from Clifford's unbounded surface of finite extent and zero curvature, whose connectivity and geometry are those of a plane Euclidean parallelogram whose opposite sides correspond point for point, these opposite pairs being considered as one point. The connectivity is that of an anchor-ring.

In this the moving on itself of the closed surface in its totality is sharply restricted, while the movements of a comparatively small area on the closed surface remain unrestricted. Clifford's surface is the locus in the polar form of Riemannian space of the point whose perpendicular to a given straight is congruent to a given sect, that is, of points at a constant distance from a given axis. This locus is a ruled quadric surface. The joins of the correlated points of two projective ranges whose bearers are not coplanar form a «ruled system» or regulus of straights no two coplanar. For were two coplanar, then two points on the bearer m and two on the bearer m_1 would all four be on this plane, and so m and m_1 coplanar, contrary to hypothesis.

Let the straights n, n_1, n_2 be any three of the elements of a ruled system, and N_2 any point on n_2. Put a plane on N_2 and the straight n_1, and let its pass with n be called N. The straight NN_2 cuts n, n_1, n_2 all three. Projecting the generating ranges of the ruled system (on the bearers m and m_1) from the straight NN_2 (or m_2) as axis produces two projective axial pencils, which having three planes m_2n, m_2n_1, m_2n_2 self-corresponding are identical. Therefore every pair of correlated points of the ranges on m and m_1 is coplanar with m_2; that is, m_2 cuts every element of the ruled system.

By varying the point N_2 we obtain ∞^1 straights, all cutting all the ∞^1 straights of the original ruled system and making on every two projective ranges. Of the straights so obtained no two cross, for that would make two of the first ruled system coplanar. Either of these two systems may be considered as generating a «ruled surface,» which is the bearer of both.

Each of the two systems is completely determined by any three straights of the other, and therefore so is the ruled surface also. From the construction follows that the straights of either ruled system cut all the straights of the other in projective ranges. So any two straights of either system may be considered as bearers of projective ranges generating the other system, or indeed the ruled surface. On each point of this ruled surface are two and only two straights lying wholly in the surface (one in each ruled system). The figure of two so united ruled systems, due to Monge, is one of the most noteworthy creations of modern geometry.

In Clifford's surface any two of the elements of the same ruled system have an infinity of common perpendiculars all congruent, as have also any element and the axis of the surface Clifford called all the elements of the same ruled system '*parallel*' to each other and to the axis.

Generalizing, a transformation in this polar space of three dimensions in which all straights of a certain straight-congruence remain fixed while any point is displaced along the straight of the congruence on which it lies is called a *translation*, and the straights of the congruence are called *Clifford Parallels.* From any point of either of two Clifford parallels a common perpendicular can be drawn to the two, and all such are congruent. Moreover, if a straight cut two Clifford parallels, the corresponding angles are congruent.

The Clifford parallels are of two kinds, according as the generators of the fundamental quadric which determine them are elements of one or the other of the two ruled systems of the quadric. Similarly translations are to be distinguished as of two kinds. Two successive translations of the same kind are equivalent to a translation, but two translations of different kinds are not equivalent to a translation.

From these considerations we get, even when the measure of curvature is taken as zero, by the side of ordinary Euclidean space three other types or species of the genus Clifford-Klein space, given by the use of translations alone. These may be studied from the Euclidean geometry: 1° Within a parallelopiped with three finite edges; 2° Within a parallelopiped one of whose edges becomes infinite; 3° Within a parallelopiped two of whose edges become infinite.

In the Clifford-Klein space corresponding to 1°, geodesics may have the finite length $la+mb+nc$, where a, b, c are the lengths of the edges of the parallelopiped and l, m, n are any three relatively prime integers. Geodesic surfaces may be like a plane, a cylindric, or an anchor-ring surface.

If, finally, the same considerations be applied to the case where the measure of curvature is a negative constant, there results an infinity of varieties corresponding exactly to the configurations considered by Poincaré and Klein in the theory of automorphic functions. The great importance of the Clifford-Klein space-forms rests upon this, that they show with especial clearness what a mighty difference it makes whether we, from the beginning, assume the geometric axioms as valid for space as a whole or merely for an every way bounded piece of space. In the first case we obtain, besides the Euclidean, only the three now well-known non-Euclidean space-forms. In the second case appears also a manifold, at present not yet dominated, of different space-forms, new non-Euclidean universes.

Bibliography.—A bibliography of non-Euclidean literature down to the year 1878 was given by Halsted, 'American Journal of Mathematics,' Vols. I, II, containing 81 authors and 174 titles, and reprinted in the collected works of Lobachévski (Kazan, 1886) giving 124 authors and 272 titles, which was incorporated in Bonola's 'Bibliography of the Foundations of Geometry' (1899), reprinted (1902) at Kolozsvár in the Bolyai Memorial Volume. Bonola adds the titles of 27 articles written by Halsted, a study and synthesis of which will be found in 'Euclid's Parallel Postulate' (Chicago, 1905, pp. i–x, 1–192). See also 'Report on Non-Euclidean Geometry' (American Association, 1899, and Supplementary Report on Non-Euclidean Geometry, 1901).

Saccheri, rediscovered, was first given to the world by a translation in the 'American Mathematical Monthly' (Vols. I and II). Lobachévski and Bolyai we have in the 'Neomonic Series,' published at The Neomon, Gambier, Ohio: (Vol. I); Vasiliev's 'Address on Lobachévski': (Vol. III); Bolyai's 'Science Absolute of Space': (Vol. IV); Lobachévski's 'Geometrical Researches on the Theory of Parallels': (Vol. V); 'Introduction to Lobachévski's New Elements of Geometry.' In French, 'La Géométrie non euclidienne;' par P. Barbarin, is a little gem. In German, for exposition, 'Nichteuklidische Geometrie,' von H. Liebmann (1905); for the sources, Stäckel and Engel, 'Die Theorie der Parallellinien' (1895); Engel, 'Lobatschefskij' (1899).

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Geometry, Pure Projective. *Introductory.*—Projective geometry, as the name indicates, has to do with the theory of projection. Pure projective geometry is that which is conducted by means purely geometric, without initial recourse to algebraic methods (see Geometry, Modern Analytical), and which makes only subordinate mention of properties other than projective. The adjective synthetic is frequently used as practically a synonym for pure.

The process of projection is of constant occurrence—*e.g.*, in photographing (the lens must be strictly rectilinear), in preparing a lantern-slide from the photographic plate, and in throwing the image upon a screen. Thus in passing from an object to its representation upon the screen there are three successive projections—a fourth enters with the visual image formed upon the retina when the screen is viewed. Fig. 1 serves to illustrate the process of projecting a line $ABCD$ into another $A''B''C''D''$.

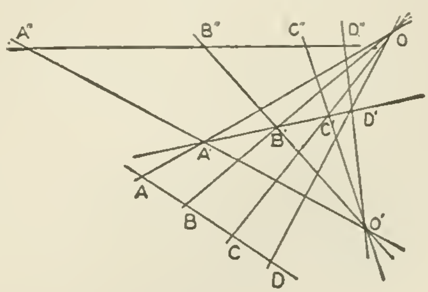

Fig. 1.

Reference to the figure will show that the length of a line is changed by projection AB is not equal to $A''B''$. Moreover, even the ratio of two lengths is changed. $AB \div BC$ is not equal to $A''B'' \div B''C''$. The study of projective geometry is the study of such properties of figures as are unaltered by successive projections. Lengths and ratios of lengths are not such properties, and by right enter only subordinately into pure projective geometry.

Historically considered, projective geometry arose by considering changes in lengths, and was thus far from pure. A theorem attributed to PAPPUS (q.v.) states that the *double ratio* of the lengths is unchanged by projection—thus,

$$\frac{AB}{BC} \div \frac{AD}{DC} = \frac{A'B'}{B'C'} \div \frac{A'D'}{D'C'} = \frac{A''B''}{B''C''} \div \frac{A''D''}{D''C''}.$$

It was upon such basis as this that the subject developed until VON STAUDT (q.v.) in his famous 'Geometrie der Lage,' published in 1847, showed how the development might proceed in a manner more truly in the spirit of pure projective geometry. From the publication of this book dates the modern point of view in treating projective geometry as a pure self-sustaining branch of mathematics. It is this point of view that is here adopted.

Fundamental Notions.—Properly to appreciate pure projective geometry it is necessary definitely to take a point of view radically distinct from that taken in ordinary elementary geometry. This may perhaps be done best by making a first appeal, as von Staudt did, to the physical sensation of sight. What characterizes ordinary geometry (which is usually called *metrical*, as opposed to projective geometry) is its close relation to the conceptions of rigid motion, of distance, and of measurement—in short, to things connected with the sensation of touch. Whereas projective geometry is intimately concerned with the look (Schein) or projection of objects and not with their actual dimensions. Thus in the figure the set of points A, B, C, D would have the same 'look' to an observer at O as would A', B', C', D'; and these in turn would appear the same from the point O' as would A'', B'', C'', D''. There is, however, one respect in which the idea of 'looking' must be generalized. If the view-point is situated between the points A', B', C' and A'', B'', C'', as in Fig. 2,

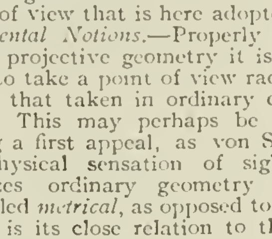

FIG. 2.

the sets of points are still said to 'look' the same, or to be projections of one another with respect to the point O'. Precisely herein lies the distinction between projective geometry and what has been called descriptive geometry (B. Russell, 'Principles of Mathematics,' p. 393). Namely, the former considers the line of vision or projection to be the whole line through the point of observation, whereas the latter takes it as merely a half-line and thus corresponds somewhat more closely to the real visual space.

The point, the straight line, and the plane are assumed as the fundamental geometric elements. They are denoted respectively by italic capitals A, B, C, . . . ; by lower case italics, a, b, c, . . . ; and by Greek letters, α, β, γ, . . . It may be noted that these elements are themselves projective, that is, appear respectively as points, line, and plane from any view-point not situated upon them. A circle has not this property: for when viewed from any point, not upon the line through its center and perpendicular to its plane, it appears noncircular. Hence the circle could not serve as a fundamental locus in pure projective geometry.

Fundamental Propositions. Parallelism.—There are a considerable number of immediately obvious relations connecting the fundamental elements, points, lines, planes. From among these it is necessary to select a certain number to serve as fundamental propositions or premises for future deductions. (Note. The propositions so selected may be called axioms or postulates. This, however, is not the place to discuss such matters, which belong to the foundations of mathematics. See LOGIC, SYMBOLIC.)

F. P. 1. Two points determine a line—the line joining them and upon which they lie.

F. P. 2. Two planes determine a line—their line of intersection and through which they pass.

F. P. 3. Three points not in the same line determine a plane—the plane passed through them and in which they lie.

F. P. 4. Three planes not passing through the same line determine a point—their point of intersection.

F. P. 5. A point and a line not passing through the point determine a plane.

F. P. 6. A plane and a line not lying in the plane determine a point—their point of intersection.

From these propositions follow a number of theorems:

Th. 1. If two points lie in a plane, the line joining them lies wholly in the plane. Proved from F. P. 3 and F. P. 5.

Th. 2. If two planes pass through a point, their line of intersection passes through the point. Proved from F. P. 4 and F. P. 6.

Th. 3. If two lines have a point in common, they determine a plane. Proved by F. P. 3 and Th. 1.

Th. 4. If two lines lie in the same plane, they intersect in a point. Proved by F. P. 4 and Th. 2.

Th. 5. If two triangles are so situated that the lines joining corresponding vertices meet in a point, the points of intersection of corresponding sides lie on a line.

The proof in case the triangles do not lie in the same plane is as follows: Let ABC and $A'B'C'$ be the triangles. As AA' and BB' meet in a point, the lines AB and $A'B'$ determine a plane (Th. 3, Th. 1) in which they intersect (Th. 4). But as AB lies in the plane ABC, and $A'B'$ in the plane $A'B'C'$, they can only intersect on the line common to these two planes. Hence the intersection of AB and $A'B'$ is on this line. Similarly BC and $B'C'$, and CA and $C'A'$, intersect on this line. The proof in case the triangles lie in the same plane is obtained by comparing each of them with a triangle out of their plane.

Th. 6. Converse of Th. 5. Proof similar.

Th. 7. If two triedral angles are so situated that the lines of intersection of corresponding faces lie in a plane, the planes determined by corresponding edges pass through a line. The proof follows that of Th. 5.

Th. 8. Converse of Th. 7. Proof similar.

From the point of view of elementary geometry theorem 4 is incorrect and should read 'if two lines lie in the same plane they either intersect or are parallel.' What has become of parallelism? Reflexion will disclose that for projective geometry there is no such thing as parallelism. For, consider two parallel lines upon a horizontal plane and project them upon a vertical plane (as is done in photographing a straight, flat railroad track). In the projection the lines meet upon the horizon (Fig. 3). Thus the property

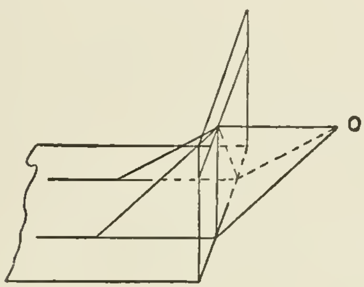

Fig. 3.

known as parallelism in elementary geometry is not unchanged by projection and cannot enter into projective geometry. From the visual point of view all lines seem to intersect. F. P. 2, F. P. 4, and F. P. 6 are subject to the same comment. From this it will be seen that the statements for projective geometry are much simpler than those for elementary geometry, inasmuch as no special cases or exceptions need be introduced to cover the possibility of parallelism. At first this might seem unnatural or even wrong, but it is in the true spirit of the subject and after a little usage appears as one of the principal beauties.

The expression is often used that parallel lines and planes meet «at infinity.» This is convenient in expressing the relations of projective to elementary geometry (§ 7), but it must not be allowed to introduce confusion. There is no such thing as distance, much less infinite distance or infinity, in pure projective geometry. (See, however, § 8.)

4. *Harmonic Elements. Duality.*—A set of points situated upon a line is called a *range*. A set of planes passing through a line is called a *pencil* of planes. A set of lines lying in a plane and passing through a point is called a *pencil* of lines.

It may be said that the fundamental construction of projective geometry is the construction of a harmonic range. Given a pair of points A, B on a line (Fig. 4) and a third point C. To find the fourth harmonic point D draw through C any line. In the same plane draw AE and BE cutting the line through C in F and G. Join F to B and G to A by lines intersecting in H. Draw the line connecting E and H, and let it cut the line AB in D. Then D is said to be the fourth harmonic point in the range $AB \cdot C$. It may be proved by the theorems given above that: 1° no matter how the construction be carried

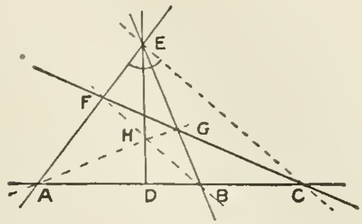

Fig. 4.

out, it always leads to the same point D; 2° if the three given points be $AB \cdot D$, the fourth harmonic is C, and hence the pair of points C, D may be said to divide the pair A, B harmonically; 3° the pair A, B also divide C, D harmonically, and hence the pairs $AB \cdot CD$ may simply be called harmonic pairs or a harmonic range.

A pencil of lines such as $E\text{-}AB \cdot CD$ which cuts a line in a harmonic range is by definition a harmonic pencil. It may be shown that if any line cuts a harmonic pencil, the range of points is harmonic. Similarly if a pencil of planes cuts one line in a harmonic range, it cuts every line in a harmonic range and is said to be a harmonic pencil. The harmonic property is thus evidently a true projective property, being unchanged by projection.

A characteristic of higher geometry is the frequent use of correspondences—that is, of methods for obtaining from a given group of theorems another group merely by substituting different words in the statement of the given theorem. The simplest of these correspondences is *duality*. There are several dualities established in projective geometry. Of these the most important are duality in space and duality in the plane.

Spatial duality is obtained by substituting respectively for 'point,' 'line,' 'plane,' the words 'plane,' 'line,' 'point,' and making such corresponding changes from 'pass through' to 'lie on' as may be necessary. In the fundamental propositions the duality appears. Thus F. P. 1 and F. P. 2 are dual statements. The same is true of F. P. 3 and F. P. 4 and of F. P 5 and F. P. 6. As this dual relation extends through all the fundamental propositions, it must extend through all propositions immediately derived from them. For, the proof of a dual proposition may be given by merely making in the proof of the given proposition the same changes as in its statement. As this may be done at every step, the two sets of propositions may be developed side by side, and the duality can never break down until the introduction of some additional definition or fundamental proposition which is not accompanied by its dual. Thus Th. 1 and Th. 2 are dual, and the proof of Th. 2 is the exact dual counterpart of the proof of Th. 1.

The duality in the plane may be obtained by substituting for 'point' and 'line' the words 'line' and 'point.' A 'range of points' becomes a 'pencil of lines' and *vice* *versa.* Thus Th. 1 and Th. 4, and in case the construction be confined to a plane Th. 5 and Th. 6, are duals. According to the definitions above given it did not appear that the harmonic pencil was the dual of the harmonic range. It is, however, possible to give for a harmonic pencil a construction which is the dual of that given for the range, and it may be proved that this construction is equivalent to the earlier definition. Therefore all theorems concerning harmonic properties have dual counterparts.

If four lines no three of which pass through the same point be drawn in the plane, they will intersect in six points. This figure is called the *complete quadrilateral* (the heavy lines of Fig. 4, except ED. The three dotted lines are the three diagonals). In a dual manner the six lines which may be drawn through four points (no three of which lie on a line) in the plane constitute the *complete quadrangle*. The properties of these two figures are much studied in plane projective geometry.

5. *Order, Continuity, Projectivity, Correlation.*—If three lines a, b, c, lying in a plane, pass through a point, they determine a certain *order* in which the pencil may be conceived as described by a movable line—the order *abc* to which *cba* is opposed. Two lines alone cannot determine the order of description: for it is possible to pass from one to the other in either of two ways. Similarly three points upon a line determine an order upon the line, and three planes through a line fix an order about that line: but two cannot (see § 7). Thus a new element, *order*, is added to the fundamental elements, point, line, plane. It is intuitively obvious that:

F. P. 7. Order is unchanged by projection. Thus if a point describe a range in the order ABC, its projection will describe the projected range $A'B'C'$ in the same order (see Figs. 1 and 2).

One more fundamental proposition, the so-called postulate of continuity, the importance of which is quite overlooked in all but the best and most recent works, may be stated as follows:

F. P. 8. If a line be ordered and if Y follow X in that order; if, moreover, the points of the segment XY be divided into two classes so that 1° every point of the segments belongs in one of the classes and 2° every point of one class precedes all points of the other class, then there must be a point Z in the XY such that every point which precedes Z lies in the first class and every point which follows Z lies in the second.

If one range may be obtained from another by successive projection, the two ranges are said to be projective. The relation between the ranges is called a *projectivity*. (Similar definitions cover the relations between ranges and pencils or between two pencils. For simplicity the treatment will be confined to ranges.)

Fundamental Theorem.—Three corresponding points A, B, C and A', B', C' determine uniquely the projectivity between two ranges. That three elements of one range may be projected into any three elements of another range may be seen from Fig. 2. That the projective relation is thereby uniquely determined follows from F. P. 8. In like manner the correspondence of four points, no three of which lie on a line, determines the projectivity between two planes (which may coincide); and five points determine the projectivity between two spaces (these must coincide).

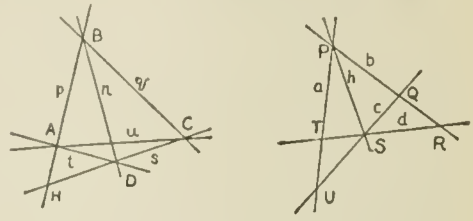

Plate I. Plate II.

Fig. 5

If the points of one plane are placed in correspondence with the lines of a second plane (which may be coincident with the first) in such a manner that to each point corresponds one line and conversely, and to the intersection of two lines corresponds the line joining their corresponding points, the relation is called a *correlation*. A correlation is completely determined by the correspondence of four given elements. (In the figure corresponding elements have the same letters.)

6. *Conics.*—If in one and the same plane a correlation be so established that when the point P corresponds to the line p, then conversely the line p corresponds to the point P, the correlation is called a *polarity*. Corresponding points and lines are *poles* and *polars* in the polarity. In general the poles do not lie on the polars: but certain of the poles do usually lie on their polars. The locus of the poles which lie on their polars is a curve to which the polars themselves are tangent and is called a *conic*. This definition is self-dual. A large number of theorems and their duals follow from the definition. For example, with their duals:

1. Pole, polar, and conic cut out a harmonic range on any line through the pole.

2. The locus of the intersections of corresponding lines of two projective pencils is a conic.

3. If a hexagon be inscribed in a conic, the points in which the three pairs of opposite sides intersect lie on a line.

This last is the famous Pascal's theorem, which with its dual, Brianchon's theorem, is very useful in the theory of conics. The second theorem is taken to define conic sections by many less modern writers. It is a very convenient graphical method. From it the various other properties may be deduced, though with much less directness and power than in the way here sketched. The first theorem is taken to define pole and polar by most of the writers who base conic sections on the second theorem. Another method of treating poles and polars is to consider projectivities not merely on a line but on a conic. The points of a conic are associated so that to each point A, B, C, ..., corresponds a point A', B', C', . . . Three pairs of corresponding points determine the projectivity. If it so happens that A', B', C', ..., correspond conversely to A, B, C, the projectivity is called *involutory* (just as the polarity was the involutory correlation, § 4) or merely an *involution.* The study of involutions on a conic leads to an elegant theory of poles and polars.

Quadric surfaces may be defined analogously to conic sections. The treatment of cubic curves on such surfaces has been considerably developed. The treatment of plane curves of order and class higher than conics may be developed to some extent synthetically, but is generally carried on analytically (see CURVES, HIGHER PLANE). The linear and tetrahedral line complexes and certain line congruences have received synthetic treatment. The analytical discussions are, however, better known (see GEOMETRY, LINE-).

7. *Relations to Metrical Geometry.*—If the word meet be changed to meet or are parallel, every theorem of projective geometry becomes a theorem of metrical geometry. But in order conversely to interpret a metrical theorem as a theorem of projective geometry, it is first necessary to state the theorem in terms unchanged by projection—that is, in terms of double ratios (§ 1). This is usually done in one of two ways.

First, if the point D retreats indefinitely, AD/DC approaches -1 and the double ratio

$$\frac{AB}{BC} \div \frac{AD}{DC}$$

approaches the simple ratio AB/CB. Thus any ratio in metric geometry may be turned into a double ratio and rendered projective by adding the point at infinity upon the line to the three finite points A, B, C. In the particular case of a harmonic range (§ 4) $AB \cdot CD$ if D be at infinity, C bisects AB. This introduction of a point at infinity also accounts for the fact that a pair of points AB suffice in metric geometry to determine an order on the line (§ 5). The order is that of $AB\infty$.

The relation between metric and projective geometry may be used to obtain metrical theorems from projective theorems by specialization of the figure, or to obtain projective theorems from metrical by generalizing the figure by projection. Thus the theorems «the diagonals of a parallelogram bisect each other» and «a diagonal of a complete quadrangle is divided harmonically by the other two diagonals» may be obtained one from another. (See Fig. 4.)

Second, the double ratio of four lines a, b, c, d may be written as

$$\lambda = \frac{\sin \measuredangle ab}{\sin \measuredangle bc} \div \frac{\sin \measuredangle ad}{\sin \measuredangle dc}.$$

If only a simple angle such as $\measuredangle bd$ is given, the two other lines of the pencil may be assumed to be the «minimal lines» or «lines to the two circular points» determined by

$$x \pm \sqrt{-1}\, y = 0.$$

The double ratio λ becomes

$$\lambda = e^{2\phi i} = \cos 2\phi + i \sin 2\phi,$$

$$\phi = \frac{1}{2i} \log \lambda.$$

Thus an angle ϕ has been expressed in terms of a double ratio λ by the introduction of the two circular points. If, in particular, ϕ is a right angle, $\lambda = -1$, and the pencil is harmonic.

The properties of circular points most necessary to establish the relation of metrical to projective geometry are: They lie on the line at infinity. All circles pass through them. The lines (imaginary) joining the center of a circle to the circular points are tangent to the circle. Thus the theorem «the locus of the vertex of a right angle (or any angle) whose sides pass through two fixed points is a circle through the fixed points» becomes «the locus of the vertex of a harmonic pencil (or any pencil of constant double ratio) whose sides pass through four fixed points (two of these correspond to the circular points) is a conic section passing through the four fixed points.»

8. *Relations to Analytic and Non-Euclidean Geometry.*—The fact that in metrical geometry the point 1 upon a line is half-way between the points 0 and 2 furnishes a clue for constructing a projective scale purely by harmonic constructions. Let three points A, B, C be arbitrarily assigned the numbers 0, 1, ∞. By finding the fourth harmonic to 0 with respect to 1 and ∞, a point is constructed to which the number 2 is assigned. In like manner all the positive integers may be located. The negative integer $-N$ is assigned to the point harmonically situated with respect to $+N$ and the pair 0, ∞. By projecting 0, N, ∞ into 0, 1, ∞ the points $1/N$, $2/N$, . . . can be located. Thus all the rational numbers are assigned to points on a line. By use of F. P. 8 it may be shown that to each point of the line corresponds a number rational or irrational or ∞, and to each number corresponds just one point.

To obtain a system of coördinates for the plane, assume two lines in the plane. Mark their intersection as 0 and upon each of them mark arbitrarily the points 1, ∞. Then to

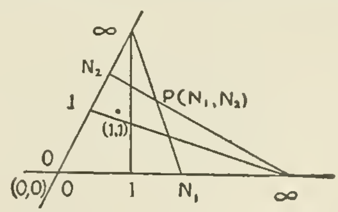

FIG. 6.

each point of each line corresponds one number. To find the coördinates of any point P of the plane draw lines connecting P to the two infinite points. The points in which these intersect the given two lines furnish the coördinates of P. A more convenient system may be obtained by rendering the coördinates homogeneous (see GEOMETRY, MODERN ANALYTICAL). Upon this purely projective basis all analytical geometry may be built up. The system is evidently that which is obtained by projecting the ordinary Cartesian system of coördinate axes into the system here assumed. In practically all treatises upon analytical geometry the coördinates are introduced as metrical quantities and are only later proved to be truly projective. Analytical projective geometry is closely related to Invariants and Covariants (q.v.), Geometry of Hyperspaces (q.v.), Modern Analytical Geometry (q.v.), Higher Plane Curves (q.v.), and Determinants (q.v.).

Projective geometry includes in itself not only metrical geometry, but the ordinary non-Euclidean geometries as well. This is seen from examining the fundamental propositions upon which those geometries are based, or, better, by following the analytical method of A. Cayley (q.v.), and defining distance in the various geometries as the logarithm of a double ratio. (See GEOMETRY, NON-EUCLIDEAN.)

9. *New Problems and Bibliography.*—It may well be said that pure projective geometry, which rose with von Staudt in 1847 and was carried on by numerous investigators during the next fifty years, has now reached a stage that is near finality, and that new problems are likely to be on neighboring fields. Thus at present there is a great deal of work on the foundations of mathematics. For pure projective geometry this means the determination of one or more sets of postulates and fundamental concepts which shall be 1° projective, 2° complete, 3° compatible, 4° independent and irreducible, and 5° as nearly self-dual as possible. This problem is not yet settled in a wholly satisfactory manner, despite the researches of Pieri, Schur, Moore, and Veblen. The fundamental propositions assumed in earlier sections are far from satisfying rigorously all these conditions. They are, however, sufficiently good for most purposes.

The theory of involutory projectivities has been satisfactorily developed as far as its application to transformations which leave a quadratic form fixed is concerned, but for the general case there remains much to be done. And so with many other special problems which might be enumerated.

Of late Wilczynski has been developing a projective theory of curves and surfaces which, though not wholly in touch with pure projective geometry, promises valuable additions to the subject.

A complete bibliography of memoirs and books may be found in the historical account of the subject by Ernst Kotter, 'Die Entwickelung der synthetischen Geometrie,' the first volume of which appeared in 1901. The work is not yet complete. The same is true of the 'Encyclopedie der mathematischen Wissenschaften' (vol. III, Pt. 1). The following text-books may be cited: von Staudt, 'Geometrie der Lage' (1847); 'Beiträge zur Geometrie der Lage' (1856–1860); Reye, 'Geometrie der Lage' (1892–1899), partly translated by Holgate, 'Geometry of Position' (1898); Boger, 'Geometrie der Lage' (1900); Sannia, 'Geometria proiettiva' (1895); Enriques, 'Lezioni di Geometria proiettiva' (1898), translated into German, 'Vorlesungen über projektive Geometrie' (1903). From the older standpoint: Steiner, 'Vorlesungen über synthetische Geometrie' (1898); Cremona, 'Projective Geometry' (1893, translated by Leudersdorf); Poncelet, 'Traité des Projections' (1866); Duporcq, 'Premiers Principes de Géométrie modernes' (1899).

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Geophagy, jē-ŏf'a-jĭ, **Geophagism,** or **Dirt-eating,** the practice of eating some kind of earthy matter, as clay or chalk, common among uncivilized peoples, such as the South American Ottamacs, the Indians of the Hudson Bay country, the West Indian blacks, the negroes in some of the United States, and among the less civilized whites in the mountain districts of Tennessee and Kentucky. In some cases it is probably used to allay hunger, but it is also practised where the supply of food is sufficient. Among chlorotic young women a similarly depraved appetite is not uncommon.

George, surnamed «THE BEARDED,» duke of Saxony: b. 27 Aug. 1741; d. 17 April 1539. He was the son of Albert the Brave, the founder of the Albertine line of Saxony, and succeeded, in 1500, to the hereditary dominions of the Albertine house. Later on he became involved in the turmoils of the Reformation Period. He was not at first wholly hostile to reform, but thought that it could be better effected by means of papal edicts than by the revolt of Luther. Accordingly he became embittered by the uncompromising tone of Luther's later writings, and endeavored to suppress the Reformation in his dominions by violent measures. These, however, were unsuccessful, and in 1539, on the accession of his brother Henry, who was a Protestant, the Reformation was introduced into the dominions of the Albertine house of Saxony.

George, Saint, the especial patron of chivalry, and tutelary saint of England: d. Nicomedia 23 April 303. Though venerated both in the Eastern and Western Churches, his history is extremely obscure, the extant accounts containing very much less history than legend. The story in the 'Acta Sanctorum' ('Deeds of the Saints') is that he was born of noble Christian parents in Cappadocia, became a distinguished soldier, and after testifying to his faith before Diocletian, was tortured and put to death. He was adopted by the Genoese as their patron saint, and in 1222 the Council of Oxford ordered that his day (the 23d of April) should be observed as a national holiday in England. In 1344 an order was instituted in his honor by Edward III., and in 1350 this was made the Order of the Garter, of which accordingly Saint George is the patron.

George I. (GEORGE LOUIS), king of Great Britain, and Elector of Hanover: b. Hanover, Germany, 28 March 1660; d. Osnabrück 11 June 1727. He was the son of the Elector Ernest Augustus, by Sophia, daughter of Frederick, elector palatine, and granddaughter to James I. In 1682 he married his cousin, Sophia Dorothea, daughter of the Duke of Celle. The union was not a happy one. George I. was both a faithless and a jealous husband, and when his wife, who was guilty of some imprudences, brought on herself the suspicion of carrying on an illicit intrigue with Count Königsmark, he caused her to be imprisoned, and kept her in confinement for the rest of her life. The offspring of the marriage were George, Prince of Wales, afterward George II., and Sophia, the mother of Frederick the Great. In 1698 he succeeded to the electorate, and in this succession was joined in the alliance against France. The command of the imperial army was conferred upon him in 1707, but owing to jealousies among his confederates he resigned the command at the end of three campaigns. At the Peace of Rastadt Louis XIV. recognized the electoral dignity in the house of Lunenburg, as he had already by the Treaty of Utrecht recognized the succession of the same house to the throne of Great Britain, which event took place on the death of Anne in 1714, when the elector was in the 55th year of his age. His reign in England was disturbed first by a rising of the Scottish Jacobites in favor of the son of James II., and afterward by wars with Spain, undertaken first in conjunction with Holland and France (the Triple Alliance of 1717), afterward in addition with Austria (the Quadruple Alliance of 1718), with the view of checking the schemes of the Spanish minister Alberoni. George I. was plain and simple in his taste and appearance; he possessed much natural prudence and good sense, and his management of his Germain dominions, to which he showed more attachment than to his English dominions, was able. See Coxe, 'Life of Walpole' (1808); Wright, 'England Under the House of Hanover' (1848); Thackeray, 'The Four Georges' (1860).

George II. (George Augustus), king of Great Britain, son of George I.: b. Hanover 10 Nov. 1683; d. London 25 Oct. 1760. He married in 1705 Wilhelmina Carolina of Brandenburg-Anspach. In 1708, then only electoral prince of Hanover, he distinguished himself under the command of Marlborough. He came to England with his father at the accession of the latter, and was created Prince of Wales. He was made regent during the king's visit to the continent in 1716, but a political difference ensuing, he lived some time estranged from the court. This breach was finally accommodated, and in 1727 he succeeded to the throne. He inherited in full force the predilection of George I. for Germany; and the same system of politics and the same ministers continued to govern the nation after his accession as before it. In the earlier part of his reign, during the greater part of the ministry of Walpole, the neutrality of England was preserved during the wars on the continent. In 1739 the depredations committed by the Spaniards in America on the commerce of England led to war, which brought about the resignation of Walpole in 1742. England next took part in the war of the Austrian Succession, in which George II. himself shared, being present at the battle of Dettingen, in 1743. His reign is also memorable on account of the second Jacobite rising in Scotland in 1745–6, headed by Prince Charles Edward. In 1755 the disputes between Great Britain and France in relation to their respective boundaries in Canada produced hostilities in that country, and an open war between the two nations the following year. The events of this war, in which the principal powers of Europe became engaged, raised Great Britain, under the able auspices of Pitt (first earl of Chatham), to the pinnacle of power. George II. was a prince of very moderate abilities, parsimonious, and wholly regardless of science or literature; hasty and obstinate, but honest and open in his disposition. His queen, the cultivated and well-informed Caroline, acquired a great ascendency over him, which did not, however, prevent some of the irregular attachments so common with royalty. See Hervey, 'Memoirs of the Reign of George II.' (1854); Walpole, 'Memoirs of the Last Ten Years of the Reign of George II.' (1822–46); Schmucker, 'History of the Four Georges' (1860); Thackeray, 'The Four Georges' (1860); Jesse, 'Memoirs of the Court of England from the Revolution of 1688 to the Death of George II.' (1843).

George III., king of Great Britain: b. London 4 June 1738; d. Windsor 29 Jan. 1820. He was the eldest son of Frederick, Prince of Wales, by the Princess Augusta of Saxe-Gotha. On the death of his father in 1751, his education was entrusted to the Earl of Harcourt and the Bishop of Norwich; but the formation of his opinions and character seems to have been materially influenced by the maternal ascendency of the princess dowager, who was principally guided by the counsels of the Earl of Bute. George III., who had been previously created Prince of Wales, ascended the throne on the demise of his grandfather, George II., being then in his 23d year. In the following year he married the Princess Charlotte Sophia of Mecklenburg-Strelitz, a union which in its result operated materially on the domestic character of this reign. In 1763 the Seven Years' war was concluded by the Peace of Paris under the ministry of Lord Bute. In 1764 Mr. George Grenville, who had become premier by the retirement of the Earl of Bute, began those measures in relation to the American colonies, the consequences of which proved so momentous; and the Stamp Act was passed the following year. About the same time, in consequence of some appearances of the mental derangement of the king, a bill was passed to enable his majesty to appoint the queen, or any of the royal family residing in England, guardian to his successor, and regent of the kingdom. In 1766 the Rockingham administration repealed the American Stamp Act; at the same time passing a declaratory act asserting the right of taxing the colonies. The Rockingham cabinet was dissolved 30 July 1766, and succeeded by one formed by Pitt, now earl of Chatham. In 1768 Lord Chatham, disgusted with the conduct of his colleagues, resigned the privy-seal, and was succeeded by Lord Bristol. The same year was distinguished by the return of John Wilkes for Middlesex, and the popular tumults attendant upon his imprisonment and outlawry. In 1773 the discontents in America burst into an open flame, and a royal message, in the commencement of the session of 1774, called on Parliament to maintain the English supremacy. Notwithstanding the subsequent loss of an empire, George III., by the steadiness with which he put down the coalition administration, acquired a degree of popularity which never afterward entirely deserted him. The smooth course of the early years of the administration of Pitt materially added to this disposition, which exhibited itself very strongly when the constitutional malady of the king again displayed itself in 1789, and still more upon his subsequent recovery. In reference to the French Revolution, and the important contests which arose out of it, it is sufficient to remark that George III. zealously coincided in the policy adopted by his administration. A similar observation will apply to the domestic, and Irish and Indian policy of the Pitt cabinet; as also to the transactions connected with the Irish rebellion. George III. was immovable in his opposition to the demands of the Irish Catholics, and, seconded by the influence of the Church and the popular feeling, was enabled to eject the Fox and Grenville administration, which succeeded on the death of Pitt. The proceedings of the Perceval administration, until the final retirement of the king in 1810, need not be detailed here; while the insanity of the monarch renders the interval which elapsed from his retirement to his death a blank in his biography. George III. possessed personal courage and steadiness of character in a high degree. Of a plain, sound, but not enlarged understanding, he acted upon his convictions with sincerity. His tastes and amusements were plain and practical. Literature and the fine arts engrossed but a small share of his attention, and hunting, agriculture, mechanical contrivances, and domestic intercourse, seem to have chiefly occupied his leisure. Religious, moral, and temperate, the decorum of his private life was always exemplary. His deportment as a father and a husband, according strictly with the national notions of propriety, rendered him and the queen a constant theme of praise; and the throne was regarded as a pattern in respect to the conjugal duties. See Walpole, 'Memoirs of the Reign of George III.' (1894); Massey, 'History of England During the Reign of George III.' (1855).

George IV. (George Augustus Frederick), king of England: b. London 12 Aug. 1762; d. Windsor 26 June 1830. He was the son of George III. and the Princess Charlotte of Mecklenburg-Strelitz. His dissipated life, his extravagance, his supposed marriage with a Roman Catholic, Mrs. Fitzherbert, and his connection with the most prominent members of the Opposition, alienated from him the affection of his father and the esteem of the nation. In 1795 he consented, on condition of the payment of his debts, to marry the Princess Caroline of Brunswick, but he soon began to treat her with neglect, and after the birth of their daughter, Charlotte Augusta, abandoned her. (See Caroline Amelia Elizabeth.) On 3 Feb. 1811, he was appointed regent, with limited powers, on account of the king being attacked the previous year by a repetition of the mental malady to which he was subject. The Whigs, his former friends, now hoped to come into office, but the prince showed a sudden change of sentiments, and maintained the Perceval ministry in power. The distress caused by the interruption of the demand for manufactures, and the high price of the means of subsistence after the general peace of 1815, occasioned great discontent among the people, and the violent measures adopted by the government increased the unpopularity of the regent, upon whose life an attempt was made in 1817 when he was going to open the session of Parliament. In 1820 he became king, on the death of George III. In February 1827, Canning became head of the government. The most important event after his attaining the throne was the passing of the Catholic Emancipation Act, by the Wellington ministry, in 1829. George IV. left no descendants, his only daughter, the Princess Charlotte, wife of Leopold of Saxe-Coburg, having died childless in 1817. He was therefore succeeded by his brother William, Duke of Clarence (William IV.). See McCarthey, 'History of the Four Georges and of William IV.' (1884–1901); Thackeray, 'The Four Georges' (1860); Cooly, 'Life of George IV.' (1830); Lady Bury, 'Diary of the Times of George IV.' (1838).

George I., king of Greece, with the title, King of the Hellenes: b. Copenhagen 24 Dec. 1845. He was second son of the king of Denmark. In 1863 he was elected king by the Greek National Assembly. In 1867 he married the Princess Olga, a niece of the Russian czar. His conduct as a constitutional monarch has been always correct and regular, and he won the popular sympathies by the efforts he made on behalf of the expansion of Greek nationality. His children have been bred in the Greek faith.

George V., king of Hanover: b. Berlin 27 May 1819; d. 12 June 1878. He was son of Ernest Augustus. He ascended the throne of Hanover in 1851; in the war between Prussia and Austria in 1866 took side with the latter, and in the same year was removed by Prussia, which annexed the kingdom on 20 September. As ex-king he assumed the titles of Duke of Cumberland and Teviotdale (Great Britain) and Earl of Armagh (Ireland).

George II., duke of Saxe-Meiningen: b. Meiningen 2 April 1826. He was educated at Bonn, received the commission of major in the Prussian cuirassier-guards, succeeded to power upon the abdication of Duke Bernhard, his father, in 1866, and served in the Franco-German war as Prussian general of infantry. Assisted by the manager Cronegk he did much to improve the artistic presentation of German drama.

George, prince of Denmark: b. 1653; d. 1708. He was son of King Frederick III., and husband of Queen Anne of England. He sided with William of Orange in the Revolution of 1688, and received the title of Duke of Cumberland. Later he became grand-admiral. From his favorite exclamation he was jocosely known as *Est-il-possible*.

George, Greek prince, 2d son of George I., king of the Hellenes: b. Corfu, Ionian Islands, 25 June 1869. He was appointed lieutenant in the Greek navy 19 July 1889. While traveling in Japan, in 1891, with his cousin, the grand-duke (afterward Nicholas II.) of Russia, he rescued the latter from death at the hands of a religious fanatic. He was appointed high commissioner in Crete in December 1898.

George, duke of Clarence, and brother of Edward IV., king of England; d. 1478. He espoused the cause of Henry VI. and his queen, Margaret of Anjou, against his brother and sovereign. Some years afterward he was accused of having sought the hand of Mary, duchess of Burgundy. He subsequently married a daughter of the Earl of Warwick (the "kingmaker"), and joined him in his revolt against the royal authority. Being taken prisoner, he was condemned to death. The unfortunate prince, being allowed to choose the mode of his death, is said to have drowned himself in a butt of Malmsey wine.

George, Ernest, English architect: b. London 13 June 1839. He studied at the Royal Academy and received the queen's gold medal of the Royal Institute of British Architects in 1896. He has conducted extensive restorations, etc., at Welbeck Abbey and has built various country-seats and churches in Devon, Hertfordshire, and other parts of England.

George, Henry, American political economist: b. Philadelphia 2 Sept. 1839; d. New York 29 Oct. 1897. He made his way to California as a sailor in 1858, and worked there as a printer for several years, until he became a reporter for the San Francisco *Times,* and in 1867 the editor of the same paper. In 1871 he published 'Our Land and Land Policy' in which he advocated the single tax theory, later developed more fully in 'Progress and Poverty' (1879). In this latter work, he not only explained his policy of land taxation (see SINGLE TAX), but also attacked the doctrine of Malthus (q.v.), and the "wages fund" theory, advancing the theory that the wages of labor are paid out of the value that the laborer creates, not from a "fund" of capital. The book did not at once attract much attention, and was first widely noticed in England; later attaining great popularity in this country. George visited England in 1880–1, and on his return settled in New York, where he devoted his time to writing, and agitation and organization for the single tax movement. In 1886 he was nominated for mayor of New York by the United Labor party, but was defeated, though receiving over 67,000 votes. In 1897 he was again nominated for mayor and took an active part in the campaign, but died before election day. His works, besides those already mentioned, include: 'The Irish Land Question;' 'Social Problems' (1883); 'Property in Land;' 'The Condition of Labor;' 'Protection or Free Trade' (1886.

George, Hereford B., English writer: b. Bath, Somerset, 1838. He was educated at Winchester and Oxford, was called to the Bar in 1864 but returned to Oxford in 1867, and was tutor at New College, Oxford, till 1891. He has published: 'The Oberland and Its Glaciers;' 'Genealogical Tales Illustrative of Modern History;' 'Battles of English History;' 'Napoleon's Invasion of Russia;' 'The Relations of Geography and History;' etc.

George, James Zachariah, American politician: b. Monroe County, Ga., 20 Oct. 1826; d. Mississippi City, Miss., 14 Aug. 1897. He fought in the ranks in the Mexican war, afterward studied law, became brigadier-general in the Confederate army during the Civil War, and in 1879–81 was chief justice of the supreme court of Mississippi. In 1880 he was elected to the United States Senate as a Democrat, and in 1886 and 1892 was re-elected. As a jurist he aided in drafting the present State Constitution of Mississippi, and in the Senate he was well known as an orator.

George, William Reuben, American philanthropist: b. West Dryden, N. Y., 4 June 1866. From 1880 he was in business employment in New York. His study of conditions among poor children resulted in the formation of the George Junior Republic (q.v.), of which he became director.

George Eliot. See ELIOT, GEORGE.

George Sand. See SAND, GEORGE.

George Junior Republic, the community established (1895) near Freeville, N. Y., by W. R. George (q.v.) as a method of reform in the treatment of dependent and delinquent children. The organization is that of a miniature republic, with a constitution and machinery of government based on that of the United States. Originally the founder was president with other adults in the more important posts, but from 1896 all offices have been held by citizens. Each citizen may work for the founder or for other citizens who contract for labor. All purchase is made by the Republic's aluminum coin, later redeemed by United States currency. School is held, and farming, carpentry, printing, care of the establishment, dressmaking, domestic service, and cookery are the other activities followed. The entrance age is from 12 to 18.

George, Lake, in the eastern part of the State of New York, is one of the most beautiful, noted, and picturesque lakes in the world. It is fed mostly by ice cold springs, there being less than half a dozen living streams flowing into it. Its outlet is Lake Champlain in the Saint Lawrence river basin. It is the headwaters of one of the most noted of the Saint Lawrence valleys. It narrows at its outlet and the waters enter Lake Champlain by a short creek, which has a descent of about 230 feet in a mile with a series of cascades and an abrupt fall of 30 feet at Ticonderoga. Its length is about 36 miles, and it is 346 feet above the sea, and at its headwaters it is 247 feet above Lake Champlain.

In 1609 Champlain sailed up the lake which bears his name, and Indians told him of the beautiful water called Andiatarocti (Place Where the Lake Contracts) but there is no record that he ever saw Lake George. Father Jogues, a Jesuit missionary, first saw the lake on 29 May 1646, and because it was the eve of Corpus Christi he called it Lac du St. Sacrament, or Lake of the Blessed Sacrament, a name which it retained until it was changed by Gen. William Johnson, 28 Aug. 1755, and given that of Lake George, after George II. The name "Horicon" given it by Cooper, is an historical fraud, the creation of the novelist's brain.

This lake is on the direct route of travel which was used in the early days of exploration and colonization in journeying to and from Canada and New York. It was on the Great War Trail of the Nations, and was in turn under the control of the French, the English, and the Colonists, while our country was in its formative stage. During the French and Indian War, forts were built at Carillon (Ticonderoga) by the French, and at the head of Lake George (Fort William Henry, Fort George, and Fort Gage) by the English. It has been the scene of numerous bloody contests, between the whites and the Indians, the French of Canada and the English of the colonies. The encounter known as the "Battle of Lake George" occurred 8 Sept. 1755, between the French and Algonquins under Baron Dieskau, and the English and Iroquois under Sir William Johnson, with an Indian chief, King Hendrick, in charge of the Indians. A monument commemorative of this battle was unveiled at Lake George 8 Sept. 1903. It consists of heroic figures of Sir William Johnson and Chief Hendrick, designed by Albert Weinert. The State of New York has purchased here a large tract of land, containing the battlegrounds and Fort George, the reservation being known as "Battle Park." A few miles to the south King Hendrick fell, while a monument marks the spot where Col. Ephriam

Williams, founder of Williams College, met his death. Among the more important were the siege by Montcalm, capture and massacre at Fort William Henry 9 Aug. 1757; the gathering of Lord Abercrombie's great army, its defeat, and death of Lord Howe at Ticonderoga, 5-8 July 1758; the building of Fort George, advance down the lake and capture of Fort Ticonderoga by Lord Amherst, July 1759; capture of Fort Ticonderoga by Ethan Allen, May 1775; removal of guns and stores over the lake, winter of 1775-76 to Boston by Col. Henry Knox; and occupancy by American forces, spring 1776, followed by devastating smallpox epidemic; seizure by General Burgoyne, summer 1777; unsuccessful attack on Diamond Island by Americans under Colonel Brown on English forces, 22 Sept. 1777; capture of Fort George by Major Christopher Carlton (English) Oct. 1780; visit of General Washington and staff, July 1783.

The State has bountifully stocked its waters with fish. Deer, black bear, rabbits, partridges, foxes, minks, and rattlesnakes are to be found among its mountains, and ducks, eagles, gulls, and all kinds of wild birds fly above its waters. The lake is surrounded by mountains, the most striking of which are Prospect (1,800 ft.), Buck (2,000 ft.), Tongue, with its succession of mounts, Erebus, Shelving Rock, Black (2,315 ft.), Anthony's Nose, named after Anthony Wayne, and Rogers' Slide, after the fabled exploit of Rogers the Ranger, in 1757-58.

Lake George has more than 200 islands, among the largest of which are Long and Big Burnt Islands; Dome Island is the highest, Green Island is the most beautiful, and Diamond the most celebrated historically and sentimentally; Tea — so-called from "a tea house" erected there in 1828; Recluse and Floating Battery, occupied by Abercrombie 1758; Fourteen Mile, used by Burgoyne's forces for camping purposes; Harbor Islands, scene of a bloody conflict 25 July 1757 between French and Indians and English; and Prisoners', at foot of lake, used by the French as a place of confinement for captives. "The Narrows," half way down, are narro passages in the lake, filled with large and small islands, known generally as the "Hundred Islands."

There are many indentations in the lake line, some forming large bays. The best known are Dunham's, Kattskill, Bolton, Northwest, in itself a considerable lake; Fourteen Mile, and Paradise, the most beautiful bay in the world. The lake is well served by three fine steamers run in connection with the D. & H. Railroad and Champlain Transportation Line. The principal villages on the lake are — Lake George, at the head, located in the town of Caldwell (pop. [1900] 534); Bolton Landing, and Hague, near which are the Dixon graphit mines, the largest of their kind in existence. The ruins of Fort Ticonderoga (q.v.) are not far from the foot of the lake. Geologically, Lake George is thought to be a formation of the glacial age. To the mineralogical expert specimens of value are readily accessible in the surrounding mountains. Garnets, resinites, cocolite, pyroxene, sphene, graphite, and tourmaline are found at Rogers' Slide; feldspar, hermatite at or near Anthony's Nose; while the beach sands contain powdered garnet, amethyst, crystal quartz, magnetic sand, and epidote; on Diamond Island are found quartz crystals; gold in nonpaying quantities has also been discovered.

James A. Holden.

George, Order of St. See Garter, Order of the; Orders (Royal): *Russia, Bavaria, Hanover, Sicily, Great Britain.*

Georgetown, capital of British Guiana, situated on the eastern side of the Demarara River, at its mouth, with the Caribbean Sea for a second frontage. The city covers an area of 1,200 acres. Nearly every building is isolated from its neighbor and surrounded by palms, shrubs, or forest trees. The streets cross each other at right angles; those which run north and south in some cases have long canals in the centre, beyond which are the roadways — the width of such streets being more than 100 feet. On Main (or High) street are situated the town-hall, Victoria law courts, police magistrate's office, Colonial Bank, Presbyterian Church, Portuguese Roman Catholic Church, and the Methodist Church. The public buildings, where the Court of Policy sits, and the Anglican Cathedral are also in this section. Another fine street is the Brick Dam, the two rows of houses in which constituted the entire town of Stabroek before the colony was captured by the British. The finest building in the colony, the Roman Catholic Cathedral, stands a short distance east of this street. The Royal Mail Company, with its fortnightly mail service, makes the port of Georgetown a terminus; boats of the French Compagnie Generale Transatlantique call monthly on the way to Cayenne; the Dutch Mail does the same when going to Surinam; and steamers of a Canadian line also call every fourth week. Vessels drawing more than 20 feet cannot cross the bar at the mouth of the river, and those of even lighter draught are obliged to wait for high water. A line of steamers subsidized by the government makes daily trips from Georgetown to Essequebo; three times a week a steamer runs to Berbice; twice a week up the Demarara and Berbice rivers; and there is fortnightly communication by boat with Morawhanna, the capital of the northwestern district. A railway connects Georgetown with Mahaica, on the east coast. The West India & Panama Telegraph Company also puts the city and colony in communication with other countries. There are good streetcar and telephone services. The city water, brought from creeks 20 miles distant through the Lamah Canal, is chiefly valuable in case of fire; it is not sufficiently pure for household use. The city is lighted by gas and electricity. Municipal affairs are managed by a mayor and town council. The value of real property is nearly $8,000,000; the portion held by Europeans and creoles (other than Portuguese) being valued at $4,611,575; the portion held by Portuguese at $1,938,370; by East Indians, $101,930; and by Chinese, $45,750. The tax-rate is usually 2 per cent per annum on the appraised value of private property. There is a well-equipped and trained fire brigade. Among the important institutions are the Royal Agricultural and Commercial Society, which has a library of over 17,000 volumes, and maintains reading-rooms, etc.; the Institute of Mines and Forests, and the Chamber of Commerce. Of the newspapers, one is issued daily, and a number weekly, bi-weekly or tri-weekly. The port is regarded as healthy. There were two or three severe attacks of yellow fever half a century ago; but since that time the drainage has been improved, and the neighborhood of the wharves kept clean, and during the past 50 years only one serious outbreak has occurred. The number of inhabitants is given as 53,176. (See GUIANA, BRITISH.) Consult Rodway, 'Handbook of British Guiana.'

MARRION WILCOX,
Authority on Latin-America.

Georgetown, Col., a town and the county-seat of Clear Creek County; situated at an altitude of 8,475 feet, in a picturesque valley in the heart of the Rocky Mountains, 52 miles west of Denver on Clear Creek and the Colorado & Southern railway. It is the centre of an important silver district, and has also important gold-mining interests. There are several public parks, and gas, water, and electric-light plants. Pop. (1900) 1,418.

Georgetown, Del., a town and the county-seat of Sussex County, 40 miles south by east of Dover; on the Philadelphia, Wilmington & Baltimore railway. It is situated in an agricultural section. The chief interest is the canning industry. Pop. (1890) 1,353; (1900) 1,658.

Georgetown, D. C., at one time a town in the District of Columbia; now included within the limits of Washington (q.v.), and sometimes called West Washington. It was at the head of Potomac navigation, and the port of entry for the District of Columbia.

Georgetown, Ky., a city and the county-seat of Scott County, 12 miles north of Lexington and 20 miles east of Frankfort; on the Frankfort & C., the Cincinnati, N. O. & T. P., and the Louisville S. R.R.'s. It is in the heart of the "blue grass" region, and the centre of an important stock-raising and agricultural district. Flouring-mills, brick-works, and other industries are also located here. Georgetown College (q.v.) is here situated. The "Royal Spring," which rises in the centre of Georgetown and furnishes about 200,000 gallons of water per hour, supplies the municipal water plant and affords the power for the street railway, an ice plant, a flour mill, and other establishments. Georgetown was settled in 1776, incorporated in 1790, and received its charter in 1894. The government is administered by a mayor, chosen for four years, and municipal council, elected on a general ticket. Pop. (1900) 3,823.

Georgetown, Ohio, a village and the county-seat of Brown County, 42 miles east by south of Cincinnati and 7 miles north of the Ohio River; on White Oak Creek and the Cincinnati, Georgetown & Portsmouth railway. It is the centre of an agricultural region, the growing of tobacco being an especially important industry. There are also some manufactures, and blue limestone is quarried in the vicinity. Pop. (1900) 1,529.

Georgetown, Ontario, a town of Halton County, 25 miles west of Toronto; on Credit River and the Grand Trunk railway. The water-power is excellent. There are paper-mills, knitting-machine manufactories, and knitting and woolen factories. Pop. (1901) 1,313.

Gorgetown, P. E. I., town and port on the eastern coast; by rail 39 miles east of Charlottetown. It is the chief winter port of the island. Pop. about 1,500.

Georgetown, S. C., a city and the county-seat of Georgetown County, about 55 miles northeast of Charleston; at the head of Winyah Bay and on the Georgetown & Western railway. It is a port of entry and a seaport of considerable importance, being the central market for an excellent agricultural region whose rivers, with a total navigable distance of 1,000 miles, empty into Winyah Bay. There are exports of rice, pine lumber, turpentine, fish, cotton, shingles, and other commodities. Georgetown was first settled about 1700 and was incorporated in 1805. The Marquis de Lafayette landed here at the beginning of his first visit to the United States (1784). The government is by a mayor, biennially elected, and a municipal council, chosen at large. Pop. (1900) 4,138.

Georgetown, Tex., a city and the county-seat of Williamson County, 30 miles north of Austin; on the San Gabriel River and a branch of the International & Great Northern railway. The surrounding region is an agricultural one. Georgetown has cotton-gins, cottonseed-oil mills, and planing-mills, and manufactories of plows, ice, harness, and woodwork. Here are located mineral springs whose waters are similar to those of the well-known springs at Karlsbad, Germany. Georgetown is also the seat of Southwestern University, an institution of the Methodist Episcopal Church, South, founded in 1873. It was settled in 1854, incorporated in 1874, and is governed by a mayor and council, biennially chosen. Pop. (1900) 2,790.

Georgetown College, Ky., a coeducational institution in Georgetown, founded in 1829 under the auspices of the Baptist Church; reported at the close of 1900: Professors and instructors, 19; students, 360; volumes in the library, 12,000; productive funds, $235,000; grounds and buildings valued at $194,000; income, $23,500; number of graduates, 580.

Georgetown University, D. C., an institution of higher education, under the direction of the Roman Catholic Church. The plan of the institution was undertaken as early as 1785 by the Rev. John Carroll, later first archbishop of Baltimore. In 1786 the corporation of clergymen in the chapter held at Whitemarsh, Md., adopted a series of resolutions directing the establishment of the institution and the erection of its first building. The year 1789 is generally considered the year of the foundation of the university, though students were not received until 1791. Upon the reorganization of the Society of Jesus in Maryland in 1805, the Georgetown College, as it was then called, was transferred to that society, under whose direction it still remains. In 1815 the university was empowered by act of Congress to confer any degree in the arts, sciences, and liberal professions which are conferred in other colleges and universities, and, in 1833, the Holy See empowered the university to confer, in the name of the Church, degrees in philosophy and theology. The university is composed of the college; the school of medicine, organized in 1851 and including since 1901 a school of dentistry;

and the school of law, organized in 1870. The college comprises three distinct departments, the graduate school, the undergraduate department, and the astronomical observatory. A preparatory department is also connected with the university. The teaching of the university is guided by the principles of the Ratio Studiorum, formulated by the Jesuit order, and a strict standard of scholarship is maintained. The facilities of the university include the Coleman Museum of Natural History, the Beauchamp Hughes Art Cabinet, and the Riggs Memorial Library. In 1904–5 there were reported a faculty of 140 and a student enrolment of 544.

George Washington University, The (formerly Columbian), a non-sectarian university with graduate departments for post-graduate and professional studies, and colleges conducting undergraduate, technical, and specialized work, located in Washington, D. C.; organized by special act of Congress in 1821 and by special amendatory acts of Congress. The University is divided first into departments for graduate work: a department of arts and sciences leading to the masters' degrees and the degree of doctor of philosophy; a department of politics and diplomacy, leading to the degrees of master of diplomacy and doctor of philosophy; a department of medicine comprising a four-year course, leading to the degree of doctor of medicine, and a three-year course leading to the degree of doctor of dental surgery; a department of law and jurisprudence with a three-year course leading to the degree of bachelor of laws, a fourth year additional leading to the degree of master of laws, a graduate course of one year leading to the degree of master of patent law, and a three-year course for graduate students in arts and law, leading to the degree of doctor of jurisprudence; Columbian College for undergraduates with courses leading to the degrees of bachelor of arts and bachelor of science; Washington College of Engineering, with courses for undergraduates leading to the degrees in engineering; and a division of architecture with courses for undergraduates and graduates leading to the degrees in architecture.

By an act of Congress amending the charter, approved 3 March 1905, colleges may be organized under the charter of the University upon independent financial foundations, but educationally a part of the University, for educational work in arts, sciences, liberal and technical knowledge. The University reported (1904–5): professors and instructors, 186; pupils, 1,408.

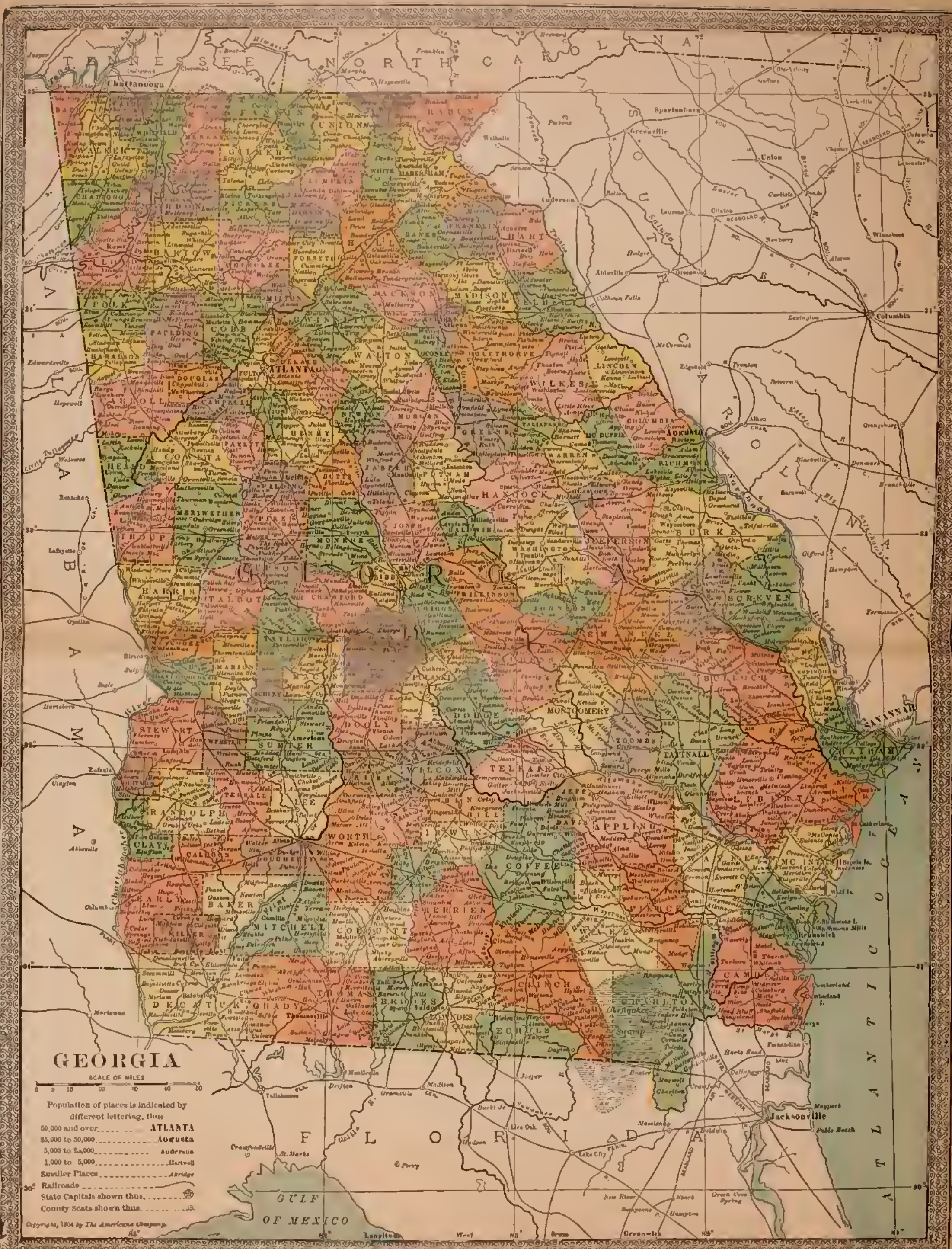
Otis D. Swett,
Registrar.

Georgia, in Europe (by the Russians called Grusia, by the natives Karthli), formerly a kingdom, but now included in the Russian government of Tiflis and Kutais, though the name is sometimes loosely employed to designate a much larger portion of the territory possessed by Russia south of the Caucasus. Area, in the latter sense, about 34,000 square miles; of Georgia proper, about 15,000 square miles; pop. 2,110,000. The history of the Georgians first becomes trustworthy about the time of Alexander the Great, to whom they became subject. After Alexander's death, in 323 B.C., they gained their independence under Pharnvas. The country was then governed by various dynasties of kings. Christianity was introduced toward the close of the 4th century; soon after the death of Mohammed, numerous followers of his entered the country and compelled the inhabitants to accept Islam. In the 11th century Georgia was twice invaded by the Seljuk Turks, and in the 13th, after widespread devastation, was captured by the Mongols under Timur. The Mongols were expelled in 1403 by George VII. In the 16th and 18th centuries Georgia was harried by the Persians, and at the same time the Turks were continually making encroachments. Aga Mohammed Shah in 1795 razed Tiflis to the ground, the king, Heraclius II., abandoning all resistance and taking refuge in the mountain fastnesses. In 1799 George XIII. formally resigned the crown in favor of the Emperor Paul of Russia, and in 1801 Russia annexed the country. Consult: Brosset, 'Eléments de la Langue Georgienne' (1837); Chubinov, 'Russian-Georgian Dictionary' (1846; new ed. 1886); Leist, 'Georgische Dichter Verdeutscht' (1887); Wardrop, 'The Kingdom of Georgia' (1888). See Georgian.

Georgia, the last settled of the 13 original States of the American Union; bounded on the north by North Carolina and Tennessee, on the northeast by South Carolina, on the east by South Carolina and the Atlantic Ocean, on the south by Florida, and on the west by Alabama; capital, Atlanta; area 59,475 square miles, of which 495 are water. Pop. (1900) 2,216,331, of which the white population numbers 1,181,109 and the colored 1,034,998.

Topography.— The northeastern part of Georgia is traversed by that part of the Appalachian chain of mountains known as the Blue Ridge, which in Georgia has an altitude of from 3,000 to 5,000 feet above sea-level. After running one third the distance across the State, it terminates abruptly, but appears again in short ranges and detached peaks. Northwest Georgia, the limestone region embracing about 3,600 square miles, has an altitude ranging from between 600 and 700 to 2,500 feet above sea-level. About 6,000 square miles of northern Georgia are above the altitude of 1,000 feet. About 20 miles to the west of the Blue Ridge lies the Cohutta Range, a continuation of the range known in Tennessee as the Unaka. The Cohutta has an altitude of 3,000 feet above sea-level with an abrupt escarpment toward the valley of the Oostenaula on the west, and then continues into Alabama in a low elevation called Dugover Mountain. To the northwest are Lookout and Sand Mountain ranges, which with their table-lands constitute a part of the Alleghany range, which, like the Blue Ridge, belongs to the great Appalachian system.

High Point, the loftiest part of Lookout Mountain, has an elevation of 2,408 feet. Its northeastern spur, called Pigeon Mountain, has an elevation of from 1,800 to 2,000 feet above the sea, its highest point rising to 2,331 feet. Another spur of Lookout, called Round Mountain, has an elevation of over 2,200 feet. Taylor's Ridge and its prolongation, called the White Oak Mountains, rise to an elevation of from 1,300 to 1,500 feet above sea-level. A little farther south, Rocky Face Ridge, with an elevation of from 1,500 to 1,700 feet, forms the



GEORGIA
SCALE OF MILES
0 5 10 20 30 40 50
Population of places is indicated by different lettering, thus
50,000 and over ATLANTA
25,000 to 50,000 Augusta
5,000 to 25,000 Anderson
1,000 to 5,000 Hartwell
Smaller Places Abridge
Railroads
State Capitals shown thus
County Seats shown thus
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TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
ALABAMA
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
Chattanooga
Columbia
Savannah
Jacksonville

eastern watershed of Chickamauga Creek (or river, as it is sometimes called), which flows through the valley at an elevation of 900 feet above the sea. There are several detached peaks, among which the most noted are Pine, Lost, and Kennesaw Mountains, the last named with its double peak rising to the height of 1,809 feet. In De Kalb County, 14 miles east of the city of Atlanta, in a comparatively level country, Stone Mountain, a vast mass of granite, rises to the height of 1,686 feet.

One of the most prominent features of northeast Georgia is the Blue Ridge chain of mountains, already mentioned. Some of the peaks of this chain rise to an elevation of 5,000 feet. The following is a list of the most noted of the mountain peaks of Georgia with their height above the level of the sea: Sitting Bull (middle summit of Nantahela) in Towns County, 5,046 feet; Mona (east summit of Nantahela) 5,039 feet; Enota in Towns County, 4,797 feet; Rabun Bald, in Rabun County, 4,718 feet; Blood, in Union County, 4,468 feet; Tray, in Habersham County, 4,403 feet; Cohutta, in Fannin County, 4,155 feet; Dome, in Towns County, 4,042 feet; Grassy, in Pickens County, 3.290 feet; Tallulah, in Habersham County, 3.172 feet; Yona, in White County, 3,167 feet. In all the mountain section of Georgia are charming valleys abounding in very productive lands. The most noted are Cedar, Texas, Broomtown, and Vann's valleys in northwest Georgia, and Nacoochee (Evening Star) and Santee valleys in the northeast section of the State. Among the interesting features of northwest Georgia are numerous caves. Hardin's Cave, near Kingston, has chambers 20 to 30 feet high. Middle Georgia is the most thickly settled section of the State. With the exception of two mountains, this region varies in altitude from 180 to 500 feet, and in a few instances to 1,000 feet. Lands too steep for the plow are seldom found in middle Georgia.

South Georgia embraces more than half the area of the State and extends from the southern limit of middle Georgia to Florida and the Atlantic coast. Its altitude ranges from 100 to 500 feet. About 3,000 square miles of the coastal region have an elevation of 100 feet.

Rivers.— The drainage system of Georgia comprises nine basins. The Tennessee basin is drained by tributaries of the Tennessee River. The Mobile basin is drained into the Gulf of Mexico by the Coosa and Tallapoosa rivers, and their tributaries. The Apalachicola basin is drained by the Chattahoochee and Flint rivers. These, uniting in the southwestern corner of Georgia, form the Apalachicola River which, flowing through Florida, empties into a bay of the same name, an arm of the Gulf of Mexico. The Altamaha basin is drained by the Oconee and Ocmulgee rivers, which empty into the Altamaha, flowing into the Atlantic Ocean. The Ogeechee basin is drained by the Ogeechee River into the Atlantic Ocean through Ossabaw Sound. The Savannah basin is drained by the Savannah River and its tributaries into the Atlantic Ocean. The Ocklockonee basin is drained by the river of that name into the Gulf of Mexico through Ocklockonee Bay. The Suwanee basin is drained by the river of that name into the Gulf of Mexico. Although the Suwanee runs for the greater part of its course through the State of Florida, it rises in southeast Georgia, and two of its main tributaries, the Allapaha and Withlacoochee rivers, are streams of south-central Georgia. The Satilla and St. Mary's basin is drained by the Satilla and St. Mary's rivers. The Satilla is the more northern and enters the Atlantic through St. Andrew's Sound. The St. Mary's enters the Atlantic Ocean through Cumberland Sound. Between these rivers lies the noted Okefinokee swamp. Its numerous large rivers furnish the State with excellent water transportation. Although the extensive railroad lines have built up in Georgia flourishing cities and towns remote from any water highway, yet those which are upon navigable streams enjoy the advantage of a competing water line. The Savannah is the most important river of Georgia for the reason that over 18 miles of its course is navigable for ocean vessels. The Savannah is navigable for river steamboats to Augusta, 230 miles to the north. The Chattahoochee is navigable for steamboats from Columbus to the Apalachicola and through that stream to the Gulf of Mexico. Through its several steamboat lines Columbus has a considerable river trade. The city of Rome in northwest Georgia has besides its several railroad lines a fine river trade through the Oostanaula and the Coosa. Steamboats carry to Rome the productions of the Coosa valley, lumber, iron, grain, and cotton, and the staple products of the Oostanaula valley. Albany, in southwest Georgia, enjoys an extensive steamboat traffic by the Flint River. The St. Mary's River is navigable for the largest vessels up to and beyond the town of that name, which is nine miles from the ocean. The Satilla and Ogeechee are each navigable for some distance, but their advantages have not been utilized to any considerable extent. Other navigable waters of Georgia are the inlets and sounds, flowing between the mainland and the islands that skirt the coast from the Savannah to the St. Mary's rivers. Through St. Simon's Sound the largest vessels pass up the Turtle River, a short but deep stream, to the city of Brunswick, the second in importance of the ports of Georgia, being, like Savannah, the centre of a fine fruit and trucking section. Every section of Georgia is drained by rivers of considerable size, and is consequently a splendid agricultural country. Its numerous navigable streams, supplementing its great railroad system, conspire to give its people unusual advantages for both internal and foreign commerce.

Climate.— Of nine climate belts in the United States eight are represented in Georgia. The lowest of these eight belts in mean annual temperature is below 40°, the highest between 70° and 75°. The climate of less than 40° mean annual temperature is found only on some of the mountain peaks. On the sides of these mountains below the summit the mean annual temperature is between 40° and 45°, corresponding with upper New England and New York and the mountain region of Virginia. There is a still larger climate zone of between 45° and 50° which corresponds with that to be found in portions of New York, Pennsylvania, and Ohio. The zone of between 50° and 55° embraces a narrow strip which runs northward through North Carolina and Virginia up to New Jersey. The zone between 55° and 60° of mean annual temperature contains an area two or three times as large as all the preceding zones together and, passing through both Carolinas, ends in Virginia. The zone between 60° and 65° embraces nearly all of middle Georgia, corresponding with that of upper Alabama, Mississippi, Louisiana, Texas, West Tennessee, and Arkansas, and extends into Virginia. The mean annual temperatures at some of the important stations in this area are: Rome, 61.9; Gainesville, 61.3; Atlanta, 61.4; Carrollton, 62.; Athens, 63.; Augusta, 64.; LaGrange, 64.1; Thomson, 64.7.

The climate of southern Georgia is between 65° and 70° of mean annual temperature and corresponds with that of southern Texas, Louisiana, Mississippi, and upper Florida. At Macon it is 66.1°; Cuthbert, 68.1; Americus, 68.2; Brunswick, 68.7. Blackshear with 70.2° is the only station touching the zone between 70° and 75°. For the whole State the mean temperature for July is 81.8°. The isothermal line of 80°, July temperature, runs above Augusta and Macon to West Point. Above this line embracing the greater portions of north and middle Georgia the July temperature is between 75° and 80°. Below this line, embracing the greater part of East Georgia and nearly all of southeast and southwest Georgia the July temperature is between 80° and 85°. The climate of Atlanta, situated as it is on a ridge 1,050 feet above sea-level, corresponds with that of Washington, St. Louis, and Louisville, the winters being warmer and the summers cooler. Snow seldom falls in southern Georgia, and then rarely to a depth of more than two inches. In middle Georgia the fall of snow is a little more frequent and to a greater depth, while both its frequency and depth are greatly increased in the mountain region. The annual average rainfall of Georgia is 40.3 inches, the highest being at Rabun Gap, 71.7 inches, the lowest at Swainsboro, 39.4 inches. Atlanta's annual rainfall is 52.12 inches. The average for different sections of the State is: Middle Georgia, 49.7 inches; east Georgia, 41.4 inches, and northwest Georgia, 60.3 inches. The summer rainfall averages: For north Georgia, 13.6 inches; for southwest Georgia, 14.5 inches, and for the entire State, 13.4 inches. The summer rainfall averages at different localities: Rome, 10.2 inches; Atlanta, 10.8 inches; Rabun Gap, 15.4 inches; Americus, 16 inches; Brunswick, 16.6 inches.

Agriculture.— The northwestern section of Georgia presents a great variety of surface and soil. The slopes of the mountains and hills are well suited for the grazing of stock, and abundance of land, either rolling or entirely level in the valleys, is adapted to the raising of vegetables, fruits, corn, wheat, rye, oats, barley, buckwheat, cowpeas, clover, timothy, orchard grass, Bermuda, Johnson, crab, red top, and many other grasses useful for hay and pasturage. Cotton also is a profitable crop as far north as Floyd County, above which very little of this crop is raised. Some of the chief fruits are peaches, apples, pears, cherries, all kinds of berries and grapes of every variety. The forest timbers are oaks of several varieties, pines of two varieties, also the poplar, ash, beech, elm, chestnut, hickory, maple, walnut, iron wood, sugar berry, sycamore, sweet-gum, dogwood, persimmon, sassafras, wild cherry, rosebud, warhoo, cedar, and buckeye. In northeast Georgia but little over 12 per cent of the land is under cultivation, because this part of the State is thinly inhabited; but many of the tillable lands have a very rich, dark red soil. Little Tennessee valley in Rabun County and Nacoochee valley in White County are noted for fertility, bearing all kinds of crops, fruits, and grasses. About 75 per cent of the whole area known as middle Georgia is under cultivation. The central cotton region of the State includes the southern part of middle and large areas of southern Georgia. This region embraces the sand and pine hills belt, the red hills belt, and the yellow loam region. The first of these covers about 3,000 square miles, the other two about 12,000 square miles. Large crops of corn and cotton are raised throughout this area except in the sand hills belt. In the long-leaf pine region there are 17,000 square miles, and here the vast forests of long leaf pine are a great source of wealth to the State. Wherever the timber lands are cleared, they are being put under cultivation. The marls and swamp muck found in this section, when mixed, form a cheap and excellent fertilizer. The pine and palmetto flats around Okefinokee swamp furnish large quantities of long leaf pine, cypress, and saw palmetto, while along the creek-bottom and hummock lands are found these same trees, black-gum, tupelo-gum, titi, and maple. The coast region, about 2,045 square miles, includes the savannas, live-oak lands and islands. The coast lands from the Savannah to the St. Mary's River are noted for magnificent live oaks, also red and water oaks, red cedar, hickory, chinkapin, sassafras, cabbage and blue palmetto. Along the coast lands rice is cultivated, and the Georgia sea-islands produce the larger part of the finest cotton known to commerce. All over middle and southern Georgia grows the sugarcane, richer in saccharine matter than any other known plant from which sugar is extracted.

By reason of its more than 4½° of latitude and different altitudes of its various sections Georgia produces the crops and fruits of every section of the Union, and on its sea islands and extreme southern section of its mainland many of those of the tropics, such as oranges, lemons, bananas, etc. Pomegranates and figs are found all over the State.

The census of 1900 gives the total value of Georgia's agricultural products at $86,345,343. Of this amount $42,534,235 represented the value of the cotton crop, and $17,155,868 that of the corn crop. The sugarcane crop brought $1,690,704; Irish potatoes, $326,853; sweet potatoes, $2,354,390; miscellaneous vegetables, $3,009,306. But in that year both the cotton and corn crops were below normal in Georgia. The value of the peach crop that year was insignificant, because of unfavorable seasons. The normal value of Georgia's corn crop for several years has been in the neighborhood of $19,000,000, and in 1902 her cotton crop brought above $69,000,000, these two crops alone showing a greater value than all her agricultural products combined in the census year. The peach trees in commercial orchards number 16,000,000, of which over half are now in bearing. In a good fruit year the produce of these orchards brings into the State many millions of dollars. In any ordinary year the peach crop of Georgia is worth at least $4,000,000, and in some years it will far exceed those fig-

STATE CAPITOL AT ATLANTA.

ures. Georgia outranks all the States in the number and quality of her watermelons.

Stock raising is very profitable to those who engage in it. In southern Georgia cattle and sheep need very little shelter and for only a few weeks of the winter. The total value of all live stock on farms in 1900, including poultry, was $35,200,507 and the total value of all domestic animals not on farms was estimated at $2,281,059, making in all $37,481,566. The number of specified domestic animals on farms in 1900 was: Dairy cows, 276,024; other neat cattle, 623,467; horses, 127,407; mules and asses, 267,840; sheep (lambs not included), 258,894; swine, 1,424,298. Of poultry there were 4,549,144 chickens, 103,416 turkeys, 208,997 geese, and 64,895 ducks. The total value of all the poultry was $1,458,055. There were 187,919 swarms of bees valued at $242,769.

Geology and Mining.— There are three main geological divisions of Georgia. The Palæozoic in the northwest embraces the counties of Dade, Walker, Catoosa, Whitfield, Chattooga, Floyd, and the greater parts of Murray, Gordon, Bartow, and Polk. Cambrian, Silurian, Devonian, and Carboniferous formations are represented. The rocks are chiefly shales, sandstones, limestone, quartzites and cherts. This is a region of parallel valleys and mountain ridges in which are found valuable deposits of coal, iron, aluminum (or bauxite), manganese, and roofing slate. Hydraulic cement rock is found in large quantities in Bartow County. The crystalline area includes that portion of the State not in the Palæozoic area that runs north of a line extending through Columbus, Macon, Milledgeville, and Augusta. In this area are granites, schists, and gneisses, and in the region which borders both the Palæozoic and crystalline areas are found the marbles for which Georgia is so famous. The marble belt traverses Fannin, Gilmer, Pickens, and Cherokee counties, the most important quarries being in Pickens County. Large quantities of granite and gneiss are found in many localities in the crystalline area.

The gold deposits are found in four belts. The first runs through Rabun, Habersham, White, Lumpkin, Dawson, Forsyth, Cherokee, Cobb, Bartow, Paulding, and Haralson counties. The second belt traverses Rabun, Habersham, Hall, Gwinnett, Forsyth, Milton, De Kalb, and Fulton counties. A third belt traverses Cobb, Paulding, and Carroll counties. A fourth belt goes through Lincoln, Columbia, McDuffie, and Warren counties in the southeast part of the crystalline area. There are some irregular deposits in Towns, Union, Gilmer, Fannin, and Meriwether counties. The iron ores are in the Palæozoic area. The brown iron ores are mined in Bartow, Polk, and Floyd counties. The red iron ores are mined in Walker and Chattooga counties. Ochre occurs in Bartow County, manganese in Bartow and Floyd. The largest bauxite deposits are in Floyd and Bartow counties, but it occurs also in Polk, Walker, and Chattooga counties. Corundum deposits are found in Rabun, Towns, Union, Habersham, Carroll, and Heard counties. Laurel Creek mine in Rabun County near the Carolina line is the largest in Georgia, and one of the most noted in the United States. Pyrite is found in Lumpkin County; copper in Murray and Fannin counties, graphite near Emerson; asbestos in several localities in the crystalline area; talc in Murray, Fannin, and Cherokee; mica in Union and Fannin; barite in Bartow. Of precious stones amethysts are found in Rabun County, a few diamonds in Hall County, some good moonstones in Upson County. Rubies and sapphires of small size have been found in the northeast part of the crystalline area. The coal fields of Georgia are in Dade and Walker counties.

Limestone beds of good quality for both calcimining and building purposes are found in the Palæozoic area and in Hall and Habersham counties in the crystalline area. Limestone for calcimining is also found in different localities in the coastal plain region, which takes in all the southern portion of Georgia. In this region are found marls and phosphates. Through all that part of the State north of the fall line, which runs from Columbus through Macon to Augusta are found clays suitable for the manufacture of common brick and the coarser grades of earthen-ware, while immediately below the fall line in a narrow belt across the State are clays suitable for the manufacture of porcelain, enameled brick, china-ware, terra-cotta, sewer pipes, etc. The annual output of all the mineral products of Georgia is nearly $5,000,000.

Manufactures.— Georgia stands in the front rank of the Southern States in the variety and value of its manufactures and the number of its manufacturing establishments. The total value of all its manufactures by the census of 1900 was $89,789,656. The number of establishments engaged in the manufacture of cotton goods was reported as 68, with 817,345 spindles and 19,398 looms. The capital invested was $24,222,169. But in 1901, after a more searching investigation than ever before in regard to the growth of cotton spinning in the South, the United States Department of Agriculture reported that in 1899 there were 79 mills in operation and that in 1900 the number in operation had increased to 86 with 969,364 spindles. The same report stated that during 1900 there were completed 28 more mills and that the stock had been raised and plans prepared for 13 more. This report agrees very closely with one prepared early in 1901 by the Georgia department of agriculture, which gave a list of the mills by name and showed 111 mills in operation with 1,192,486 spindles and 26,645 looms. In bleached cotton goods Georgia stands fourth in the Union with 24,265,583 square yards. The cotton gins reported in the census of 1900 numbered 4,729 running for four months. Eli Whitney was living in Georgia, when he invented the cotton gin. The cotton oil mills in operation in 1901 numbered 58. They paid above $5,000,000 for cotton seed, which they manufactured into various products, valued at $14,000,000. The fertilizer factories registered with the commissioner of agriculture for the season of 1902 and 1903 numbered 82, many of them being of great capacity and having an immense trade all over the Southern States. In the manufacture of turpentine and rosin Georgia easily leads all the States, exporting in 1900 the vast amount of 14,623,328 gallons of spirits of turpentine and 1,408,928 barrels of turpentine, rosin, and pitch. In 1900 there were 1,254 establishments with a capital of $11,802,716 engaged in the lumber industry. Among the other manufactures the most important are printing establishments, flour and grist mills, woolen mills, furniture factories, ornamental iron works, foundries, blast furnaces, carriage factories, car shops, blacksmithing and wheelwrighting, brick, tile and pottery manufactories, marble and stone works, manufactories of paints, chemicals, ice, electric light plants, carpenter work, canning factories, creameries, and numerous others.

Railroads.— The principal railway lines are the Central of Georgia, 1,302.23 miles; Southern, 919.90 miles; Seaboard Air Line, 648.49 miles; Atlantic Coast Line, 607.70 miles; Georgia Railroad, 302.50 miles. There are many other important railroads in the State whose combined mileage is 2,104.50. The total railroad mileage of the State is 6,035.32. Besides these are numerous electric lines in the cities of the State and their suburbs, connecting them in many instances with neighboring towns.

Finances.— In 1903 the assessed valuation of the State was $467,310,646 and the bonded debt $7,531,500 net. The tax rate was $5.30 per $1,000.

Banks.— There are 39 national banks, with a capital stock of $5,046,000, deposits of about $20,000,000, and reserve of about $9,000,000; 243 other banks with about $10,100,000 capital, and over $30,000,000 deposits.

Education.— In addition to her public school system Georgia has numerous private schools and several noted colleges for both sexes. In the public school system there are 7,700 schools, of which 4,919 are for whites and 2,781 for colored. The total number of teachers is 9,180 of whom 5,997 are white and 3,183 colored. The number of normal trained teachers is 2,238, of whom 1,791 are white and 447 colored. The number of pupils admitted during 1901 were 439,645, of whom there were 258,984 whites and 216,359 colored. The average daily attendance was 159,562 white and 105,826 colored, making a total of 265,388. Among the leading higher institutions of learning are: University of Georgia, Athens; and its branches as follows: North Georgia Agricultural College at Dahlonega, Georgia School of Technology at Atlanta, Georgia Normal and Industrial College (for ladies) in Milledgeville, Georgia State Normal School (for both sexes) at Athens, and the Georgia State Industrial College for Colored Youths, near Savannah; affiliated with the University of Georgia, but not receiving State funds: South Georgia Military and Agricultural College at Thomasville, Middle Georgia Military and Agricultural College at Milledgeville, West Georgia Agricultural and Mechanical College at Hamilton. Other noted colleges are: Emory College, Oxford; Mercer University, Macon; Wesleyan Female College, Macon; Shorter Female College, Rome; Agnes Scott Institute, Decatur; Lucy Cobb Institute, Athens; Southern Female College, College Park (near Atlanta); Southern Female College, La Grange; La Grange Female College, La Grange; Andrew Female College, Cuthbert; Monroe Female College, Forsyth; Young Female College, Thomasville; St. Stanislaus College, near Macon; Young L. Harris Institute, Young Harris; Brenau Female College, Gainesville; Piedmont Institute, Rockmart; South Georgia College, McRae. With the exception of the State Industrial College for colored youths, at College near Savannah, all the above-named institutions are for whites exclusively. For the colored people there are the following institutions: Atlanta University, Clark University, Spellman Seminary, Morris Brown College and Gammon University, all at Atlanta; Payne Institute at Augusta, under the auspices of the Methodist Episcopal Church, South.

The number of pupils enrolled in private schools and colleges is 10,097 whites and 4,877 colored, total 14,974.

Religion.— The Baptists have 368,000 members, 3,586 church buildings, and 76,000 Sunday-school pupils; the Methodists have 272,000 members, 3,205 church buildings, and 117,828 Sunday-school pupils; the Presbyterians have 18,000 members, 327 church buildings, and 12,600 Sunday-school pupils; the Congregationalists have 4,714 members, 65 church buildings, and 4,284 Sunday-school pupils; the Episcopalians have 7,070 members, 137 church buildings, and 4,400 Sunday-school pupils; the Disciples of Christ have 9,805 members, 110 church buildings, and 7,147 Sunday-school pupils; the Roman Catholics have 20,000 church members, 40 church buildings, and 2,500 Sunday-school pupils. The Hebrews in Georgia number about 6,200.

Charitable Institutions.— The principal benevolent institutions of Georgia are: the Orphan House at Bethesda, near Savannah, founded in 1739; the State Lunatic Asylum at Milledgeville; Georgia Institute for the Deaf and Dumb, at Cave Spring; Academy for the Blind at Macon; Female Asylum at Savannah; Augusta Orphan Asylum at Augusta; Orphan Home of the North Georgia Conference of the Methodist Episcopal Church South, at Decatur; Orphan Home of the South Georgia Conference of the Methodist Episcopal Church South, at Macon; Mumford Industrial Home for boys and girls, near Macon; Appleton Orphan Home (Episcopal), Macon; Baptist Orphans' Home, Hapeville, near Atlanta; Hebrew Orphan Home, Atlanta; Abram's Home for widows in Savannah.

State Government.— The State Constitution adopted in 1877 carefully guards the rights of the people and prevents extravagant appropriations by the legislature. The governor is elected for two years and receives a salary of $3,000. The state-house officers are: the attorney-general, comptroller-general, adjutant-general, treasurer, secretary of state, state school commissioner, commissioner of agriculture, state geologist, state librarian, commissioner of pensions, three prison commissioners, and three railroad commissioners. The supreme court consists of one chief justice and five associate justices. There are 24 superior court circuits, each having a judge and solicitor. Georgia is represented in the National Congress by two senators and 11 representatives.

Population and Division.— The population of Georgia at each census is as follows: (1790) 82,548; (1800) 162,686; (1810) 252,433; (1820) 340,985; (1830) 576,823; (1840) 691,392; (1850) 906,185; (1860) 1,057,286; (1870) 1,184,109; (1880) 1,542,180; (1890) 1,837,353; (1900) 2,216,331. The total white population in 1900 was 1,181,109 and the total colored 1,034,998. There were also 204 Chinese, 1 Japanese, and 19 Indians. The foreign-born population numbered 7,603 males and 4,800 females. There are 137 counties in the State.

Of 372 incorporated places in Georgia 40 had a population in 1900 of more than 2,000 and 13 of these had a population in excess of 5,000. Atlanta, the capital, had 89,872; Savannah, the chief seaport, had 54,244; Augusta, the greatest cotton manufacturing city of the South, had 39,441; Macon had 23,272; Columbus, the second great cotton manufacturing city of the South, had 17,614. Other cities of the State having over 5,000 inhabitants in 1900 are: Athens, 10,245; Brunswick, 9,081; Americus, 7,674; Rome, 7,291; Griffin, 6,857; Waycross, 5,919; Valdosta, 5,613; Thomasville, 5,322.

History.— A charter for the establishment of the colony of Georgia was obtained from George II., king of England, in June 1732, by a number of benevolent gentlemen of London, whose design was to found a home for the poor of Great Britain and a place of refuge for the Salzburgen and other persecuted sects of the continent of Europe. The colony was also intended as a military settlement to serve as a barrier against encroachments of the Spaniards upon South Carolina. Gen. James Edward Oglethorpe, a man of great liberality and of marked ability and experience in military affairs, being selected by the trustees as governor, brought over 116 emigrants. Landing at Yamacraw Bluff on 12 Feb. 1733, they laid the foundations of the city of Savannah and colony of Georgia. At first rum and slavery were prohibited, but in 1747 these restrictions were removed. During the 10 years of Oglethorpe's administration many settlers of a very desirable kind were brought into the colony, peace with the Indians was secured by treaties, their lands being in every instance procured by purchase, a formidable Spanish invasion was defeated, John and Charles Wesley and George Whitefield preached to the people and Whitefield founded the Orphan Home at Bethesda a few miles from Savannah. In 1752 the trustees of Georgia surrendered their rights to the crown and in 1754 John Reynolds was appointed governor. At the close of the French and Indian war the boundaries of Georgia, which had embraced a territory between the Savannah and the Altamaha rivers, were extended to the Mississippi on the west, and to latitude 31° and the St. Mary's River on the south. Subsequently they were extended on the south to latitude 30° 21′ 39″. Georgia united with the other colonies in resisting the aggressions of the mother country. On 11 May 1775 Col. Joseph Habersham and Commodore Bowen with 30 volunteers seized the powder magazine at Savannah and secured 13,000 pounds of powder, of which the Georgia authorities sent 5,000 pounds to the Continental army at Boston. In March 1776 the Georgians under Col. McIntosh aided by the Carolinians under Col. Bull burned 3 and disabled 6 out of 11 merchant vessels which under the protection of some British war vessels were endeavoring to carry on trade with some loyalist planters. In April 1776 Georgia instructed her delegates in Congress to vote for independence. The signers of the declaration on the part of Georgia were Button Gwinnett, Lyman Hall, and George Walton. In December 1778 the British captured Savannah and early in 1779 Augusta. But the Carolinians under Andrew Pickens and the Georgians under John Dooly and Elijah Clarke by the victory of Kettle Creek recovered Augusta. Subsequently the British defeated Ashe at Brier Creek and repulsed the combined attack of the Americans under Lincoln and the French under D'Estaing at Savannah. This battle at Savannah was one of the most important conflicts of the Revolution. After the fall of Charleston, S. C., in 1780, the British overran all eastern Georgia. But Col. Elijah Clarke made a desperate effort to retake Augusta. Failing he tried again in 1781 and, by the assistance of Pickens and "Light Horse" Harry Lee, succeeded. Almost the last fight of the Revolution was Wayne's victory over the Indian allies of the British near Savannah, 23 June 1782. On 11 July 1782 Savannah was evacuated by the British and the authority of Georgia was established over all her borders. On 2 Jan. 1788 a convention of delegates from the different counties of the State at Augusta ratified the Constitution of the United States on behalf of Georgia.

In 1802 Georgia ceded to the Federal government all her lands west of the Chattahoochee embracing the greater part of the present States of Alabama and Mississippi. In 1807 Milledgeville became the capital. During the second war with Great Britain 1812–15 the Georgians under Gen. John Floyd gained several battles over the Indians and shared with the Tennesseeans in the decisive victories won over the savages by Gen. Andrew Jackson. In the Mexican war Georgia's sons were distinguished, among whom Col. James S. McIntosh was killed at Molino del Rey and W. H. T. Walker was desperately wounded at Chapultepec.

Georgia seceded from the Union 19 Jan. 1861 and furnished to the Confederate army 94 regiments and 36 battalions, embracing every arm of the service. On Georgia soil were fought the battles of Chickamauga, Ringgold, Resaca, New Hope Church, Kennesaw Mountain, Peach Tree Creek, Atlanta, Jonesboro, Allatoona, and numerous smaller engagements and skirmishes. At the close of the Civil War Georgia resumed her career of enterprise in every industrial line, not waiting even for her re-entrance into the Union, which occurred in 1870. During the Spanish-American war Georgia furnished more volunteers in proportion to population than any other State.

Among prominent Georgia citizens have been Gen. Joseph Wheeler, William H. Crawford, John McPherson Berrien, George M. Troup, George R. Gilmer, Herschel V. Johnson, Howell Cobb, Robert Toombs, Alexander H. Stephens, Joseph E. Brown, John B. Gordon, Alfred H. Colquitt, Benjamin H. Hill, Sidney Lanier, the poet; Dr. J. Crawford Long, the discoverer of anæsthesia; Bishop George F. Pierce, Allen D. Candler.

JOSEPH T. DERRY,
Editor of 'Georgia, Historical and Industrial.'

Georgia, South, an island in the South Atlantic, lat. at its north point, 53° 57′ S.; lon. 38° 13′ W. It is 90 miles long, and has high and rocky coasts, inaccessible from ice during a greater part of the year.

Georgia, Strait of, a large inlet of the North Pacific Ocean, between the continent of North America and Vancouver's Island; about 120 miles in length from north to south; the breadth varies greatly in its different parts, from 6 miles to 20. It communicates with the ocean on the north by Queen Charlotte's Sound, and on the south by the Strait of Juan de Fuca.

Georgia, University of, an important university which is at the head of State education in Georgia. It was chartered in 1785 and is the oldest State university. The charter coordinates primary and secondary schools with the university in the scheme of education by the State. The institution was located at Athens, and began academic work in 1801. This is the parent institution and includes four colleges: (1) Franklin College, the college of the liberal arts; (2) State College of Agriculture and the Mechanic Arts, on the Morrill foundation. (3) Law School. (4) Graduate School. The phrase "University of Georgia" in the wider sense includes the various colleges in different parts of the State which are declared by law to be "parts" of the university. These are: North Georgia Agricultural and Mechanical College, at Dahlonega; Medical College, at Augusta; School of Technology, at Atlanta; Georgia Normal and Industrial College, for women, at Milledgeville; State Normal School, for men and women, at Athens; Industrial College, for negroes, at Savannah. The university, in the collective sense, has (1903) 1,884 students of college grade; 156 in professional schools; 585 in preparatory schools; total, 2,527. The members of the faculties number 160. All these institutions are managed for the most part by local boards or commissions, but legal title and control of all of them is vested in the single Board of Trustees of the university. This is a unique feature of organization of the higher education of the State and differentiates it from the system of any other State. Understood in the narrower sense, the single institution at Athens has 359 students, and its income is $50,000 per annum. Among the alumni of national reputation are Howell Cobb, speaker of the House of Representatives and secretary of the treasury; Alexander H. Stephens, John A. Campbell, justice of the United States Supreme Court; senators Robert Toombs, Benjamin H. Hill, Augustus O. Bacon; Joseph and John LeConte, afterward president and professer in the University of California; Henry Timrod, poet; Henry W. Grady and J. L. M. Curry, diplomat and educator. As the university is a State institution, tuition is free for residents of Georgia in all schools except the professional schools; non-residents pay a small fee.

Georgia Bark, a small tree of the Southern States closely resembling the cinchona or Peruvian bark, and belonging to the natural order *Cinchonaceæ*. It has pretty large white flowers, with longitudinal stripes of rose-color, disposed in beautiful clusters at the extremities of the branches; each flower is accompanied with a floral leaf, bordered with rose-color near the upper margin; the corolla is tubular; the stamens five, with a single style; and the capsule contains two cells and numerous seeds. The wood is soft and is therefore unfit to be used in the arts. The inner bark is extremely bitter, and is employed with success in intermittent fevers.

Georgian Architecture, a neo-classic style of architecture that flourished in England from about 1715 to 1800, during the reigns of the four Georges, from whom it derives its name. It was a union of the Italian and Palladian styles divested of excessive ornamentation, and is to be found throughout the United States in buildings of the Colonial period. Among its prominent exponents were Gibbs, Campbell, Chambers, and Dance; Somerset House, and the church of St. Martin's-in-the-Fields, London, are fine types of the style.

Georgian Bay, Canada, formerly Lake Manitoulin, the northeastern part of Lake Huron, partly separated from the main body of the lake by the peninsula of Cabot's Head and the island of Great Manitoulin, province of Ontario. It is about 120 miles long and 50 broad.

Georgian, or **Ibernian**, or **Grusinian**. The people (about 600,000) who speak the Georgian language call themselves Karthveli, but are also named Grusini, and inhabit the valley of the upper and middle Kur, those of the Rion and Tchoruk, as far as the promontories of the Ararat chain, and north to the Alazan, beyond which their language is mixed with the tongues of Shirvan and Daghestan, as far as the Caspian Sea. Probably descendants of the Colchi and Albani, they were anciently called Iberi, and, according to tradition, are akin to the Armenians, although their language differs from the Haikanian (*Somasi* in Georgian), and is believed by their learned prince Theimuraz to be primitive. Brosset and Voss (1847) place it among the Indo-European languages. It consists of several dialects, namely: The Karthveli or Georgian proper in the centre, the Kakheti and Imerethi next, then the Mingreli and Guri, and more remotely the Suani and the Lazi, which reaches almost to Trebizond. A colony transported into Asterabad in Persia in 1622 is said to speak a purer idiom than any of those now spoken in Georgia. Georgian literature is mostly founded on that of Greece. The Bible was partly translated in the 8th century, finished in the 18th, and splendidly printed at Moscow, Tiflis, and St. Petersburg. Arabic and European works have also been translated into Georgian. We can mention but a few of the many remarkable national works. Among the romances are the following: 'Tariel' (Of the Man in the Tiger Skin), by Skhotta of Rusthvel, a general of the heroic queen Thamar, with a commentary by King Wakhtang VI. (Tiflis 1793); 'Daredjamiani' (Deeds of Amiran, son of Daredjan, a hero of Bagdad), by the courtier Moses of Khoni; 'Visramiani' (Love of the Princess Vis for Prince Ramin), somewhat resembling Rousseau's 'Héloïse'; 'Miriani' (story of the Chinese Princess Miri), imitated from the Persian. These and many others exhibit lively imagination and good taste. The 'Thamariani' is a panegyrical epic on Queen Thamar, by Tchakhakhadze. In poetry, there are versions of lyrical poems from the Greek, etc., by Georgi Aphoni (11th century); a collection of historic odes; there is also a very keen satirical work by Bessarion Gabas Khoili. There are many histories of Georgia, chronicles, biographies, histories of families, monasteries, etc. The drama began to be cultivated at a late period, especially by Prince Eristov. Wakhtang VI. established a printing office at Tiflis. There are also there at present a national theatre and opera house. The 'Aurora,' a periodical established in 1857, and the 'Kavkas,' a Russian newspaper, are published at Tiflis.

Geotropism, jē-ŏt'rō-pĭzm, the influence which causes a tendency in plants and animals to grow toward the centre of the earth; it is defined by Dr. John Coulter as "sensitiveness to gravity." Geotropism in its simplest form, called "positive," causes growth directly downward, as in the tips of roots, which strike straight down into the earth. So strong is this influence upon roots that they will turn from any abnormal position in which they are placed and bend downward until they reach and penetrate the ground,— an adaptation for the preservation of plants against dislodgment by wind or water. The reverse of this is negative geotropism (apogeotropism), the influence which causes parts of plants, particularly stems, to grow *away from* the earth. A demonstration of these opposing influences in regulating plant-growth is found in the fact that when seedlings are caused to revolve continuously and rapidly for a period, their stems point and increase toward the centre of the centrifugal force, while the roots take the opposite line of growth. A third form of the tendency is called "diageotropism," and leads parts subject to its influence, as runners and rhizomes, to grow horizontally; that is, in a direction at right angles to the plane of positive geotropism. This influence is seen in the tendency of branches and foliage to assume a horizontal position. In all these cases, however, the result is modified and complicated by influences of sunlight, moisture, etc., styled heliotropism, hydrotropism, chemotropism, etc. (qq.v.); and sometimes, as in the case of twining plants, it is impossible at present to extricate them and assign to each its part in the result.

Geotropism, or the influence of gravity, has had a great effect, also, upon the forms of animals, especially in determining proportions and strength of parts with reference to weight. Associated with other influences it determines the "instinct" which leads many of the lower forms of life to seek the earth whenever possible, or at the proper time, a striking example of which is found in those caterpillars which, born in tree-tops, migrate to the ground as soon as born or when ready to begin their metamorphoses.

Gephyrea, jĕf-ĭ-rē'a, worms allied to the chætopod annelids, but differing from them in not being segmented, though provided with bristles. The mouth is either surrounded with a circle of tentacles, or is overhung by a large broad "proboscis," which in the European *Bonellia* may be several times as long as the body and forked at the end. The vent is either terminal or situated dorsally on the anterior end of the body. They possess a true blood system similar to that of annelid worms. The young free-swimming larvæ of certain forms (*Echiurus*) are like the Trochophores (see LARVA) of ordinary annelids. The male of *Bonellia* differs remarkably in shape and size from the female, being only 1 millimetre in length, while the female measures 3 inches, with a proboscis from 8 to 12 inches in length. Our most common form is *Phascolosoma*, which is cylindrical, its mouth surrounded with tentacles, the vent opens near the head, it is without bristles, and lives in dead shells, building out the aperture by a conical tube of sand. Its larva is cylindrical, the head small, with a circle of cilia.

Gepidæ, jĕp'ĭ-dē, a people of Gothic origin who settled about the mouth of the Vistula in the 3d century. Before the 5th century they had migrated to the Lower Danube, where they were subjugated by the Huns; but, revolting against Attila's son, they recovered their freedom and established themselves in Dacia. There their power grew so great that they levied tribute from the Byzantine emperors down to Justinian's days. In the end of the 5th century a powerful enemy arose to them in the Ostrogoths; and after them came the Longobards, who, in alliance with the Avars, inflicted a crushing defeat on the Gepidæ in 566. A part of the last named then submitted to the Avars, while a part accompanied the Longobards to Italy. Henceforward they passed out of history.

Gera, gā'rä, Germany, a town in the principality of Reuss-Schleiz, on the right bank of the White Elster, 35 miles from Leipsic. Among the chief buildings are the castle, the old Trinity Church, the town-hall, gymnasia, theatres, library, museum, town-hospital, etc. There are municipal water-works, electric tramways, scientific and artistic societies, etc. Pop. (1901) 45,640.

Gerace, jā-rä'chā, Italy, city in Calabria, on the east slope of the Calabrian Mountains and the shores of the Ionian Sea, 34 miles northeast of Reggio, and 64 miles by rail. It is on the site of the celebrated Greek Colony of Locri Epizephyrii. The cathedral, rebuilt in 1783, is partly of ancient materials. The district produces grapes, oranges, olives, and grain; and coal, iron, and marble are worked in the neighboring mountains. Pop. (1901) 10,595.

Gerah, gē'rä, the smallest piece of Hebrew money, being the 20th part of a shekel, or about 3 cents. Also, in Hebrew weights, a weight corresponding to the coin.

Geraldini, jā-ral-dē'nē, **Allesandro**, the first Roman Catholic Bishop of Santo Domingo: b. in Italy, 1455; d. in Santo Domingo, 1525. He was a soldier, and served in the army of Spain against Portugal, 1475-6, before taking orders. His learning and his friendship with Archbishop Mendoza, of Toledo, procured for him the tutorship of the royal princesses of Castile. He had great influence in the Spanish Court, and is said to have first interested Ferdinand and Isabella in behalf of Columbus. In 1520 he was made Bishop of Santo Domingo, after having held many high places in church and State. His residence and labors in the island, where he spent the remainder of his life, went far toward bringing law and order out of the chaos that followed upon the rule of the Spanish conquerors. His narrative of his journey thither and his description of Santo Domingo, printed in Latin (1631), is of great value and interest. He also wrote a life of Catharine of Aragon in verse.

Gerando, Joseph Marie, zhō-zĕf mä-rē zhā-rŏn-dō, BARON DE, French author: b. Lyons, France, 29 Feb. 1772; d. Paris, 11 Nov. 1842. He became governor of Catalonia in 1812, and was professor of public law in the law faculty of the University of Paris from 1828 to 1842. His works, treating law, philosophy, and other subjects, include: 'Des signes et de l'art de penser' (1800); 'Histoire comparée des systèmes de philosophie' (1803); 'Institutes de droit administratif' (1829); and 'Cours normal des institutions judiciaries' (1839).

Geraniaceæ, jē-rā-nĭ-ā'se-ē, the geranium family, consisting of herbaceous plants or shrubs with opposite or alternate leaves, and white, red, yellow, or purple flowers with five sepals and five petals. Sixteen genera and about 750 species are known. They are found in temperate or hot climates, rarely in the arctic regions. They are often astringent and aromatic, abounding in vegetable oil.

Geran'ium, the typical genus of the *Geraniaceæ* (q.v.), having palmately lobed leaves, regular flowers and a five-lobed ovary, terminated by a long thick beak and five stigmas. On coming to maturity the carpels separate from the base and become resolute or spiral. The spotted crane's-bill (*G. maculatum*) is a very familiar species in the eastern and northern States. The root is astringent and has been used medicinally. The tubers of *G. parviflorum* are eaten in Van Diemen's Land, where it is called the native carrot. Indian geranium is the name given by perfumers to a species of *Andropogon*. The so-called geraniums of gardens are mostly species of *Pelargonium*, and are natives of southern Africa. See CRANE'S-BILL; PELARGONIUM.

Gerard, jē-rärd', **Dorothea**. See LONGARD DE LONGGARDE.

Gerard, Emily. See LASZOWSKI-GERARD.

Gérard, Etienne Maurice, ā-tē-ĕn mō-rēs zhā-rär, French marshal: b. Damvillers, Meuse, France, 4 April 1773; d. Paris 17 April 1852. For his brilliant services at Austerlitz (1805) he was appointed general of brigade; he also took a notable part at Jena (1806), Erfurt (1806), and Wagram (1809). During the Russian campaign of 1812 he rendered conspicuous service at the capture of Smolensk in the battle of Valontina-Gora, and at the passage of the Beresina. In 1831 he commanded the French army sent to the assistance of the Belgians against the Dutch, whom he drove out of Flanders, and 27 Dec. 1832 compelled the citadel of Antwerp to capitulate. After the July revolution of 1830 he was appointed marshal and war minister by Louis Philippe; he was again war minister from July to October in 1834.

Gérard, François Pascal, frän-swä päs-kāl, a French portrait and historical painter: b. of French parentage, Rome, Italy, 11 March 1770; d. Paris 11 Jan. 1837. At 10 he was brought to France, and at 16 became the pupil of David. In 1795 he exhibited 'Belisarius,' which first brought him into notice; shortly afterward he painted 'Psyche receiving the First Kiss from Cupid.' His portrait of Madame Bonaparte in 1799 was the beginning of his career as the "painter of kings." Almost all the royal and other celebrities who visited Paris between 1799 and 1837 were painted by Gérard, who owed his success not alone to his skill as a portraitist, but also to the charm of his manners and conversation. His most celebrated portraits are those of Napoleon in his coronation robes, the Queen of Naples and her children, Talleyrand, Talma, Louis Philippe, and Madame Recamier. The grandest of his works are, however, historical pictures, the 'Battle of Austerlitz' (1810) and the 'Entry of Henry IV. into Paris' (1814). Gérard was appointed first court painter and made baron by Louis XVIII.

Gerard de Nerval, zhā'raar'de-ñar'vaal, the pen-name of GERARD LABRUNIE, a French author: b. Paris 21 May 1808; d. there 25 Jan. 1855. His first book to attract attention was a volume of poems, 'Élégies Nationales.' In 1828 he produced his translation of Goethe's 'Faust,' which brought him the author's personal approval, and which Berlioz (q.v.) used largely as the score for his 'La damnation de Faust.' Gerard also wrote several original plays; was a regular contributor to various periodicals; and published 'Les illumines' and 'Contes et facéties' (1852), and 'Scenes de la vie orientale' (1848–50). While insane he committed suicide. His writings were collected in five volumes in 1868.

Gerard Thom (and variously also TUNC, TUM, or TENQUE), Italian monk, founder of the order of the knights hospitallers of St. John of Jerusalem: b. Amalfi about 1040; d. 1120. In the latter part of the 11th century he first visited Jerusalem, and while there was appointed the superior of a hospice for the convenience of pilgrims, and there he organized the religious order afterward so celebrated, duly recognized by a bull of Pascal II. in 1113.

Gerber, gār'ber, **Ernst Ludwig**, a German musical authority: b. Sondershausen, Germany, 29 Sept. 1746; d. there 30 June 1819. He published 'Historische-biographisches Lexicon der Tonkunstler,' a work which, commenced in 1790, was not completed until 1814.

Gerbers. See GUEBERS.

Gerbert. See SILVESTER II.

Gerda, jĕr'dä, (1) In Scandinavian mythology, wife of Freyr, and daughter of the giant Gymer; she is so beautiful that the brightness of her naked arms illuminates both air and sea. (2) In astronomy, an asteriod, the 122d found; discovered by Peters, 31 July 1872.

Gerez, hā-rēs, **Serra de**, Portugal, a mountain chain which ramifies from the mountains of Asturias and stretches between the basins of the Douro and Minho, from north to south, for about 18 miles. It consists generally of a succession of granite peaks, the loftiest of which, Murro de Burageiro, has a height of 4,296 feet.

Gerfalcon, or **Gyrfalcon**. See JERFALCON.

Gerhard, William Paul, American sanitary engineer: b. Hamburg, Germany, 30 July 1854. He was educated in Germany and came to the United States in 1877. He was chief assistant engineer to Col. George E. Waring (q.v.) at Newport, R. I., 1881 3, and has since practised his profession in New York. He is the author of 'House Drainage and Sanitary Plumbing' (1881, 7th ed. 1897); 'Sanitary House Inspection' (1885); 'The Prevention of Fire' (1886); 'Recent Practices in Sanitary Drainage of Buildings' (1890); 'Disposal of Household Waste' (1890); 'Gas Lighting and Gas Fitting' (1894); 'Theatre Fires and Panics: their Causes and Prevention' (1896); 'Sanitary Engineering' (1898); etc.

Gerhardt, Karl, American sculptor: b. Boston, Mass., 7 Jan. 1853. He studied in Paris and has exhibited in the Paris salon. His works include busts of Gen. U. S. Grant, Henry Ward Beecher, Samuel L. Clemens, etc.; and statues of Nathan Hale, Gen. Israel Putnam in the Connecticut State capitol, etc.

Gerhardt (Fr. zhâ-rär) **Karl Friedrich,** a French chemist: b. Strasburg 21 Aug. 1816; d. there 19 Aug. 1856. He studied chemistry under Liebig at Giessen. In 1838 he went to Paris, where he lectured on chemistry, and there with his friend Cahours he commenced his researches on the essential oils. In 1844 he was appointed professor of chemistry at Montpellier. About this time he published his 'Summary of Organic Chemistry.' In 1848 he resigned the chair and returned to Paris. In 1855 he became professor of chemistry at Strasburg. His ideas and discoveries are embodied in his 'Treatise on Organic Chemistry' (1853-6).

Gerhart, Emanuel Vogel, American German Reformed clergyman: b. Freeburg, Snyder County, Pa., 13 June 1817; d. Lancaster, Pa., 6 May 1904. He entered the ministry in 1842, was president of Tiffin College, Ohio, 1851-5, and of Franklin and Marshall College, Lancaster, Pa., 1855-66; and professor of theology at the theological seminary at Lancaster from 1868. He published: 'Philosophy and Logic'; 'Institutes of the Christian Religion' (1891); etc.

Gerizim, ger'ĭ-zĭm, one of the highest mountains in the central Palestine chain (3,000 feet), separated from Ebal Mountain by a deep narrow valley, in which stands the town of Nâblus. The valley between them is very fertile. Jacob's well stands where the vale joins the plain of Moreh. The Samaritans built a temple on Mount Gerizim as a rival to that of Jerusalem, and organized a rival priesthood; and the Samaritan Pentateuch closed the Decalogue with the injunction, "Thou shalt build a temple on Mount Gerizim, and there only shalt thou worship." And, though the Samaritan temple was destroyed by Hyrcanus about 200 years after, the mountain on which it stood continued to be held sacred by the Samaritans. It was to Mount Gerizim that the "woman of Samaria," referred when she said to our Saviour: "Our fathers worshipped in this mountain, and ye say that in Jerusalem is the place where men ought to worship." See EBAL.

Germ, in medicine, a general term meant to include any microscopical form of life, plant or animal, supposed to have some relation to a disease process. In the earlier history of the study of the germ theory of disease most of these low forms of life were thought to be of animal origin, but in recent years it has become appreciated that both lowly organized plants and animals may cause characteristic forms of disease processes. Thus it is well known that malaria is due to a minute animal, and also that spotted fever, cattle fever, tryponosoma, filariasis result from infection by minute animal parasites, while typhoid fever, pneumonia, cholera infantum, influenza, septicæmia, tuberculosis, and others of the infectious diseases are known to be occasioned by minute forms of plant life, the bacteria. Higher forms of both animal and vegetable parasites are capable of causing characteristic reactions in the human body, as well as in lower animals and also in plants. Man is not the only organism that has diseases. There is no living animal and no living plant that does not have to struggle with either plant or animal parasites or, it may be, both. See BACTERIA; DISEASES, GERM THEORY OF; DISEASES OF PLANTS; PARASITES; PROTOZOA.

Germ-plasm, the peculiar form of protoplasm supposed by some embryologists to constitute the germinative part of the egg; and to contain in each case the qualities peculiar to that organism, and inherited from generation to generation. Compare GEMMULE and see EMBRYOLOGY.

Germ Theory of Diseases. See DISEASES, GERM THEORY OF.

Germain-en-Laye, St. See ST. GERMAIN-EN-LAYE.

German, Edward, English composer: b. Whitchurch, Shropshire, 17 Feb. 1862. He was educated at the Royal Academy of Music and since his graduation in 1887 has conducted at many important English musical festivals. He has been a prolific composer, among his works being the music to Irving's productions of 'Richard III.'; 'Henry VIII.'; 'Much Ado About Nothing,' and 'Romeo and Juliet'; music to 'Nell Gwyn' (1900); 'The Emerald Isle,' with Sullivan (1901); 'Symphonic Poem, Hamlet' (1897); 'Symphonic Suite, The Seasons' (1899); 'Operetta, The Rival Poets' (1901); 'Rhapsody on March Themes' (1902); 'Welch Rhapsody' (1904); 'Just So Song Book' (with Rudyard Kipling); etc., and the operas 'Merrie England' (1902); and 'A Princess of Kensington' (1903).

German Architecture. During the period which elapsed between the withdrawal of the Romans and the reign of Charlemagne Germany seems to have been in such a state of anarchy that no great buildings were or could be undertaken. At all events no trace of any edifice of this age remains, nor even a tolerably distinct tradition of any one being founded by the unsettled barbarian tribes who occupied that country when deprived of the protection of the Roman empire. With the accession of Charlemagne commences a brighter era. He restored the authority of the laws, and encouraged the arts of peace, and founded many noble structures, some of which, in whole or in part remain to the present day. This gleam of tranquil brightness appears to have been more owing to the individual greatness of the sovereign than to the ripeness of the people for more civilized institutions; for on his death they relapsed into confusion and barbarism. From this state the land partially recovered under the first three Ottos, in whose reigns church building seems to have been renewed with some energy. Up till the end of the 12th century the prevalent style of architecture was the Byzantine, the low state of German civilization compelling the employment of Greek or Italian artists. The cathedrals of Spires, Worms, Mainz, Bamberg, Basel, Würzburg, Limburg, Erfurt, Treves, Nuremberg, all conform in their primitive parts to the Byzantine style. But about the 12th century the Gothic began to make its appearance;

from that time the ogival and semicircular arch were both in equal favor.

Toward the close of the following century the Gothic, as a purely German style, replaced those brought from the south. The churches of that period are all of the pure Gothic character. Such were the cathedrals of Meissen and Magdeburg, buildings of a severe and simple taste. This style was succeeded by a second, not less grand, but more ornate and elegant. The Cathedral of Freiburg opened this new era; its front spire, erected in 1272, is the first and finest in the open style, and altogether the church is one of the most perfect monuments of Gothic art. The cathedrals of Cologne and Strasburg were both commenced about the same epoch. The latter edifice has a peculiar interest for the student of art, as in it is plainly marked the progress of architecture from the heavy Lombardo-Byzantine style to the degenerated after-Gothic style. In spite of these traces of bad taste the Strasburg Cathedral was considered in the Middle Ages and at the era of the Renaissance the finest structure in Germany. The Cathedral of Cologne commenced in 1248 was completed in 1863 with the exception of its towers, which were finished in 1880. It is said to be the noblest specimen of Gothic architecture in Europe. Another *chef d'œuvre* of German art is the Church of St. Stephen at Vienna, commenced about the middle of the 12th century. It is regarded as the last expression of the pure Gothic style. Among the other noble churches of this epoch may be mentioned those of St. Lawrence and of St. Sebald, the latter remarkable for its Gothic general plan with Arabic ornamentation; that of St. Mary in the same town, by Georg and Fritz Ruprecht; St. Catharine's of Oppenheim, the Cathedral of Goslar, St. Mary's of Königsberg, etc. The 14th and 15th centuries witnessed the erection of the magnificent Cathedral of Ulm, commenced under the direction of Matthias von Ensingen, and continued by Boblinger and Engelberger; the Cathedral of Augsberg; the beautiful church of Landshut; that of Esslingen, renowned for its elegance; that of Dunkelsbühl, by Nicholas Eseller; St. Giles' of Prague, constructed by Peter von Arler and Matthias von Arras; St. Mary's of Würtzburg, the cathedrals of Innspruck, Salzburg, Bremen, Dantzig, Constance, Berne, Zürich, Lausanne, etc. Among the most remarkable monasteries must be classed those of St. Gall, Fulda, Lindau, Lorsch, Treves, Hildesheim, St. Blaise in the Black Forest, Einsiedeln in Switzerland, etc.

Civil architecture took its rise shortly after ecclesiastical. After the towns had succeeded in securing their freedom and become prosperous, they first erected a church to their patron saint, and then constructed handsome council halls, bridges, quays, custom-houses, immense warehouses, hospitals, etc. All these edifices are characterized by their simple and elegant forms, appropriate to the uses for which they were intended. The public buildings of Dresden and Mainz, are among the most celebrated specimens. About the beginning of the 15th century the pure Gothic art commenced to decline. The sanguinary religious wars of Bohemia destroyed the unity of belief, and diminished the spirit of enthusiasm which had led to lavish expenditure in the interest of the Church. From that time new ecclesiastical structures were not only not undertaken, but those partially built were for long left unfinished. The war of the Hussites, and the Reformation inaugurated by Luther, were fatal to the magnificent old Gothic style. About this time the revival of art in Italy was making itself felt, and Germany, in consequence of her relations with that country, adopted in some measure the ideas of the Italian architectural school; and though in the churches several of the ancient forms were adhered to, the new style soon gained complete possession of the field. As instances of a compromise between the two styles we may cite the Jesuits' church at Munich; the town hall and the tower at Perlach; the churches of St. Charles and St. Peter at Vienna (the last-mentioned on the plan of St. Peter's at Rome).

This style, characterized by its intricacy of outline and prodigality in ornamentation, prevailed up till the end of the 18th century, when three eminent men, Raphael Mengs, Winckelmann, and Lessing, opened their campaign in favor of purer and more dignified forms. Weinbrenner, an architect of Baden, animated by their spirit, lent his powerful aid, and became the head of a school which, in spite of its imitation of classical antiquity, has given Germany a host of learned and enlightened architects: Hansen, who found a sphere of activity in Hamburg and Denmark; Fischer, who planned the Munich theatre, and others. After them the school (called the archæological and æsthetical) was represented by Klenze. This architect, in the many edifices erected from his designs at Munich, has shown a wide and profound knowledge of the various styles of architecture. The Glyptothek is Ionian in style; the royal palaces, Florentine; the Church of All Saints is Byzantine; several details of the Pinakothek are borrowed from the Vatican; and in the Valhalla of Ratisbon he has imitated the rude Cyclopean walls. His royal patron, Louis of Bavaria, who merits the title of regenerator of the arts, employed many other famous architects, such as Gästner, Ohlmüller, Liebland, Pertsch, and Probst, and had the honor of leaving to his country a city of palaces. The king of Prussia followed his example to some extent, and his architect Schinkel planned many of the best edifices in Berlin and the provinces. Among his principal works in the capital are the royal palace, the museum, the theatre, the conservatory, etc. Knoblauch is a more recent architect, who erected some fine buildings in Berlin; while Semper is equally distinguished for edifices erected in Zürich, Dresden, and Vienna.

German Art. See GERMANY—HISTORY OF GERMAN PAINTING AND SCULPTURE.

German Baptist Brethren (in their own name simply "Brethren"; by outsiders often called Dunkers or Dunkards, German *Tunkers* or "dippers" as immersion Baptists), a flourishing sect of German origin, but now existent chiefly in the United States, with some congregations in Europe, re-founded by missions, located chiefly from Pennsylvania to Virginia, in the central West from Ohio to the Rockies, and in North Dakota. At the end of 1902 they numbered 1,101 congregations, 3,001 ministers, and 115,194 members, mostly farmers. They support seven colleges,—Elizabethtown and Huntingdon, Pa.; Uniontown, Md.; Bridgewater, Va.; Mount Morris, Ill.; Manchester, Ind., and McPherson, Kan.; missions in France and Switzerland, Scandinavia, Asia Minor, and India, with a mission endowment fund of over $250,000; and a publishing house at Elgin, Ill., which issues their organ, the 'Gospel Messenger.' There are other papers in their interest.

The sect was the product of the great outburst of religious zeal and mysticism in the German Lutheran Church near the end of the 17th century; it was almost identical with the Mennonites (q.v.) in all except insistence on immersion, which they perform face forward and "trine" (once at the mention of each name in the Trinity). It began with Alexander Mack a miller of Schwarzenau on the Eder, in the little principality of Wittgenstein west of Hesse-Cassel. Wittgenstein was a curious nest of zealots, mystics, hermits, etc.; and in 1708 Mack baptized eight like-minded companions in the Eder. The sect—whose vital principle, like that of the Quakers and Mennonites, was rejection of creeds and reliance on the "inner light," abhorrence of war, litigation, oaths, and sumptuous living, and return to primitive simplicity and the Golden Rule—grew rapidly; but the authorities forbade the public baptisms, and they withdrew to Crefeld beyond the Rhine, another great home of dissent. Here they were unmolested; but the skeptical mockery of outsiders was more dangerous to their steadfastness than persecution, and in 1719 part of the band came to Pennsylvania and settled among the Mennonites near Germantown, founding a "prayer-house" in 1823. The rest followed by 1729. Thence they pushed south and west. One of them was Christopher Saur, whose German press, established 1638, printed the first—long first—European Bible in America.

The stories of their communism and celibacy, marriage only within the sect, and other antisocial practices or tenets, are fictions; perhaps originally confounding them with Conrad Beissel, a zealot who lived with the early Brethren in Pennsylvania for a while, but broke with them and set up a monastic community. But to retain apostolic simplicity they are obliged, like all such sects, to lay prime stress on separatism of habits and manners; outlawing or reprobating fine dress, lawsuits (choosing referees instead), politics, oaths, secret societies (as oath-bound), intoxicants, and tobacco. Before the close of the 18th century they denounced the slave trade, and prohibited the manufacture, sale, or use of strong drinks. They dislike "hireling" ministers, and most of theirs are unpaid. In doctrine they are simply orthodox Protestants; they accept the Bible as the verbally inspired utterance of God, the Trinity, and reward or punishment in a future life. Grace is free to all; the only requisites are faith, repentance, and baptism (as above), hence the latter is for converted adults only. The Lord's Supper is an evening meal (as originally), preceded by mutual foot-washing (each sex separate), and followed by the right-hand of fellowship and the kiss of peace, and then by communion. Their organization is episcopal, the bishops or elders being elected by the members out of the higher of two grades of ministers, who with the deacons are also elected by the congregations. The latter with the State districts elect delegates (of either sex) to an annual conference, which is the binding legislative and executive authority on a two-thirds vote.

The sect had the curious and unique fortune in the early eighties of having one party secede from it, as too progressive, and the other as not progressive enough. The Old Order Brethren objected to its humanitarian, missionary, and Sunday-school activities; the Progressive Brethren to the rules of dress and other conservative decisions of the conference. The Old Order numbering in 1902 80 congregations, 140 ministers, and about 4,000 members, publish a newspaper, the 'Vindicator,' to oppose education, missions, Sunday-schools, and revivals. The Progressives had 145 congregations, 231 ministers, and 13,000 members, and are increasing at the expense of the "Conservatives," or mother body. They support a college and publishing house at Ashland, Ohio, and issue an organ, the 'Evangelist.' A small body of seventh-day German Baptists, with five churches and some 200 members, is usually included among the Brethren, and its tenets often absurdly accredited to them; but it is a separate church, long since parted from the others.

German Catholics, a religious sect which sprang up in Germany about the close of 1844, which rapidly increased during the four or five following years and then as rapidly declined. The immediate cause of the formation of this sect was the exhibition by Arnoldi, bishop of Trèves, of the holy coat preserved in the cathedral of that city and said to be the coat of Christ. The bishop accompanied the exhibition of the holy coat by a promise of plenary indulgence to whoever should make a pilgrimage to Trèves to honor it. The announcement of this proceeding on the part of the bishop of Trèves produced a feeling of general astonishment in Germany and drew from a Silesian priest called J. Ronge, who had already been suspended from his charge on acount of his independent views, a letter protesting against the exhibition of the holy coat and denouncing the projected pilgrimage as idolatry. This letter was published in the 'Sächsische Vaterlandsblätter' on 16 Oct. 1844, and produced an amount of excitement that was quite unanticipated by the writer. Ronge was excommunicated, but this only increased the general enthusiasm in his favor, and when he entered into relations with Czerski, another independent priest who had seceded from the Church, and made along with him an appeal to the lower grades of the clergy to unite in founding a National German Church independent of the Pope and governed by councils and synods, the appeal received a ready answer from a considerable number of those to whom it was addressed. A number of congregations belonging to the new body were formed in the more important towns, especially in Leipsic, under the celebrated Robert Blum, and in Magdeburg under the teacher Kote. In the spring of 1845 there were already about 100. At this time (March 1845) a council was summoned to meet in Leipsic to deliberate on the affairs of the body. Only 20 congregations were represented there, but these nevertheless at once proceeded under the presidency of Prof. Wigard to arrange a system of doctrine and practice which was to form the basis of union for the whole Church. The Bible was recognized as the sole standard of faith, and its interpretation was left to reason, "penetrated and animated" by the Christian idea. Only two sacraments were admitted, baptism and the Lord's Supper. In matters of ritual each congregation was left free to carry into practice its own views. The organization of the new Church was almost the same as that of the Presbyterian dissenting churches of Scotland. Each congregation was to choose its own pastor and elders. Affairs of a general interest were intrusted to the management of a general council to meet every five years, but the decisions of this council were to be ratified by a majority of the congregations before they became valid. The confession of sins, the hierarchy of the clergy, and the celibacy of the priests were abolished and the authority of the Pope was not recognized. On the subject of purgatory nothing was declared either for or against it. The constitution of the new Church was thus a Protestant one, but in some respects the German Catholics went even further than the majority of Protestants in a liberal direction, inasmuch as they claimed for all, complete religious liberty and declared their religion to be capable of development and modification with the progress of the human mind.

The Church established on this basis had at first, as has already been stated, great success. The most eminent men of the liberal party regarded the movement with sympathy, or at least with interest. Gervinus expressed his belief that great benefits might result from it. Many Protestants, dissatisfied with the subjection of their religion to state supervision, joined the body, which, at the end of 1845, counted 298 congregations. But it was not long before the spirit of opposition began to show itself. The majority of the governments in Germany at the instigation both of the Protestant and the Roman Catholic clergy began to use repressive measures against the new body. Prussia contented itself with regulating the exercise of their worship; but some of the other states went farther. At Baden the adherents of the sect were deprived of their political rights. Austria took the course of banishing them from her dominions. But persecution from without did less hurt than the divisions within the body. Almost immediately after the meeting of the council at Leipsic a congregation had been formed at Berlin which refused to abide by its decisions. Czerski and Ronge, the two originators of the sect, became the leaders of two opposing parties within it, one of which, that headed by Czerski, clung to the traditions and doctrines of the Roman Catholic Church, rejecting only the supremacy of the Pope and the union between Church and State; while the other sought for more freedom, converted religion into a sort of popular philosophy and began to mix up with it questions of politics, exhibiting strong democratic tendencies. These were most plainly manifested during the revolutionary epoch of 1848. The schism between the two parties was then complete. One section of the congregations of German Catholics professed to have only religious ends in view, while another section openly pronounced itself in favor of socialistic principles.

From the year 1850, however, there were several attempts to re-establish the unity of the body. An effort was made to reintroduce harmony by widening the basis of union. Instead of founding a religion, a council held at Gotha in June 1850, proposed the formation of a religious association or confederation into which all free Protestant and even Jewish congregations were to be admitted. Legislation in the different states had become more tolerant and the carrying out of the scheme of the council of Gotha seemed to be at least practicable. But the result proved otherwise. The association consisted of too heterogeneous elements. While some of the members receding further and further from orthodoxy proclaimed simple deism as their religion and abolished baptism and the Lord's Supper, others on the contrary lost themselves in an exaggerated mysticism. According to the most recent statistics there are still about 100 congregations of German Catholics in Germany; but their numbers only amounted to about 6,200 in 1895.

German East Africa, the largest German colonial possession, extending from lat. 1° to about 11° 41′ S., and from lon. 29° to 40° 40′ E. It has a coast line of 620 miles, and lies between British East Africa, Indian Ocean, Portuguese East Africa, Rhodesia, Congo Free State, and the British Sudan. The area is 384,000 square miles. The German empire is represented by an imperial governor, who appoints a council of five in each of nine communes. There is a military force of 232 Germans and 2,000 natives. The region produces almost every kind of tropical fruit, fibres, sugar, tea, etc. In 1901 over 1,600 tons of copra were exported. The chief seaports are: Dar-es-Salaam (pop. 13,000); Bagamoyo (pop. 14,000); Saadani, Pangani, Kilwa (pop. 10,000 each), and several smaller towns. A railroad from Tanga is open for traffic to Muhesa and Korogme, 54 miles. There are nine telegraph stations in the coast towns. The trade is chiefly with Zanzibar and Germany. Pop. (1901) 6,750,000 natives, 15,347 foreigners, mostly Arabs, Syrians, and Loanese. See GERMANY—THE COLONIES.

German Empire. See GERMANY.

German Evangelical Protestant Church, in the United States, a religious body, liberal in doctrinal belief, having no confession of faith. Its ministers are associated in district unions. There are 52 churches having a membership of 36,156.

German Evangelical Synod of North America, a religious body, accepting the symbolical books of the Lutheran and Reformed churches, representing in the United States the State Church of Prussia, which is a union of the Lutheran and Reformed bodies. It celebrated, 12 Oct. 1890, the semi-centennial anniversary of its organization in the United States. In 1900 there were 909 ministers, 1,129 churches, and 203,574 members.

German Ivy *(Gynasys cordifolia or Senecio scandens)*, a creeping plant of the *Com-*

positæ family, with fleshy light-green leaves. It is commonly grown as a house plant.

German Language and Literature. See GERMANY—HISTORY OF LANGUAGE; HISTORY OF LITERATURE.

German Measles. This disease is acute, very contagious, and of unknown causation. It differs from measles in the mildness of its onset and symptoms, in the quicker appearance of the rash after the first signs of illness, and the more rose-red tint of the developed rash. It is distinguished from scarlet fever by its mildness of onset, the patchy character of the rash, without diffuse redness, and the shorter duration. The disease develops in 10 or 12 days after exposure, lasts about 3 to 5 days, and is followed by a moderate branny desquamation. Complicating bronchitis, pneumonia, gastro-intestinal catarrhs, and kidney disturbance may occur, but are infrequent.

German Ocean. See NORTH SEA.

German Silver, a white alloy for tableware, consisting of nickel, copper and zinc in various proportions. The best quality consists of four parts copper, two parts nickel, and two parts zinc, but this quality is the most difficult to work. For some purposes the proportion of copper is slightly increased, and for articles which are to be cast instead of stamped or hammered about 2 per cent of lead is added. To make a good malleable alloy, the three metals of which it is composed should all be of the best quality. It is harder and tougher than brass, and takes a fine polish. In color it is sufficiently near silver to make it valuable for plating with that metal. This, together with its hardness in resisting wear, has caused a great demand for German silver for certain wares made in Birmingham and Sheffield.

Spoons and forks of this alloy are made in immense numbers. Such articles as salvers, dish-covers, jugs, teapots and the like are also largely made of it, but these objects, or at least some of them, are still more largely made of a greatly inferior alloy, because much softer. German silver has a coppery odor and is readily attacked by acid liquids, such as vinegar, which coat it with verdigris. Spoons and forks made of this alloy should therefore either be plated with silver or carefully kept clean. Of late years, through care in preparing a suitable alloy, large objects, such as the bodies of jugs and coffee-pots, can be formed of sheet German silver by "spinning" it on the lathe, instead of by stamping or by the slow process of hammering. Formerly it was only a soft alloy that could be so treated. For some time past there has been a tendency to substitute for electroplate—that is, German silver plated with real silver—white alloys having nickel for their basis. These, however, are but varieties of German silver known under different names, such as silveroid, argentoid, navoline, and nickeline. Some of them contain small quantities of tin, cadmium, and other metals. Mountings for ship-cabins, bar-fixtures, forks and spoons, and other similar articles have been manufactured on a considerable scale from these new alloys. See ELECTROPLATE; METALS.

German Southwest Africa, a German protectorate in West Africa, coast extending from Cape Frio to Walfisch Bay, inland to lon. 20° E.; area, estimated, 322,450 square miles. Coast infertile and desolate; inland are richer tracts. Damaraland is the name of the north district, Namaqualand and Luderitzland lying to the south. Damaraland is occupied by the Southwest African Company, an Anglo-German syndicate, which was formed in London in 1892, and obtained from Berlin a concession to search for and work the minerals of the district, including the copper mines of Otavi, but outside of the district worked and occupied by the German Southwestern Africa Colonial Company, which district consists chiefly of the coast lands. The German government, owing to complaints that too great favor had been shown to the Anglo-German Company, decided to give preference to German settlers, and to reserve certain parts of the country for them for 10 years. The country is apparently rich in copper and in agricultural resources, though undeveloped. The seat of administration is at Great Windhoek, 170 miles inland from Walfisch Bay. The German government decided in 1897 to commence the building of a railway from the coast to the interior. Pop. (1900) 221,000. See GERMANY—THE COLONIES.

German Theology. See GERMANY—HISTORY OF RELIGION.

Germander, jĕr-man'dĕr (*Teucrium*, a large and widely distributed genus of labiate herbs, of which all the European species are of old medicinal repute on account of their aromatic bitter and stomachic properties. The species are numerous. The wall germander or true germander (*T. chamædrys*), often found on ruined walls, has probably been introduced from Europe. Wood germander or wood sage (*T. scorodonia*) is a very common British plant, in dry bushy or rocky places. It is very bitter and slightly aromatic. It is used in the Island of Jersey as a substitute for hops. Water germander (*T. scordium*), in wet meadows, has a smell like garlic. Cat or sea thyme (*T. marum*), of southern Europe, like catmint and valerian root, has great attractiveness for cats. It is still sometimes used in the preparation of sneezing powders. The American species (*T. canadense*) is also known as wood sage.

Germa'nia, a country of ancient Europe See GERMANY.

German'icus Caesar, Roman general: b. 15 B.C.; d. Epidaphnæ, near Antioch, 9 Oct. 19 A.D. He was the son of Nero Claudius Drusus, and of Antonia, daughter of Mark Antony and niece of Augustus. By desire of Augustus he was adopted in the year 4 A.D. by Tiberius, whom he accompanied in the war against the Pannonians, Dalmatians, and Germans. In the year 12 he was consul, and next year was appointed to the command of the eight legions on the Rhine. He was at Lugdunum Batavorum when news came of the death of the Emperor Augustus and of the mutiny for more pay and shorter service among the soldiers in Germany and Illyricum. Germanicus hastened to the camp and quelled the tumult by his personal popularity; and at once led his soldiers against the enemy. Crossing the Rhine below Wesel, he attacked and routed the Marsi, and next year marched to meet the redoubtable Arminius (q.v.), the conqueror of Varus and his legionaries, whose bones had lain unburied for six years in the Teutoburg Forest. With solemn rites his soldiers buried these sad relics of disaster, then advanced against the foe, who, retiring into a difficult country, managed to save himself, and was not subdued till the year after, when Germanicus again carried a part of his army up the Ems in ships, crossed to the Weser, and completely overthrew Arminius in two desperate battles. Tiberius, jealous of the glory and popularity of Germanicus, recalled him from Germany in the year 17, and sent him to settle affairs in the East, at the same time appointing as viceroy of Syria, in order secretly to counteract him, the haughty and envious Cn. Calpurnius Piso. Germanicus died, probably by poison. His wife, Agrippina, and two of her sons were put to death by order of Tiberius; the third son, Caligula, was spared. Of the three daughters who survived their father, Agrippina was as noted for vice as her mother for virtue.

Germanium, jer-mā'nĭ-um, a metallic chemical element discovered in 1886 by Dr. Winkler in a silver ore (argyrodite); symbol, Ge; atomic weight, 72.3. It has a melting-point about 1,650° F. (900° C.); is oxidized when heated in air; crystallizes in octahedra; has a perfectly metallic lustre, and is of a grayish-white color. As gallium had been named from France, the new metal was named after Germany. Fifteen years before its discovery its existence was prophesied by Mendeleeff as required to fill the gap in the periodic table between silicon and tin.

Germans in the United States, The. See GERMANY—THE GERMANS IN THE UNITED STATES.

Germantown, Pa., a former village, since 1854 the 22d ward of Philadelphia. Considerable historical interest is attached to the place. It was settled by the Germans, under a grant from William Penn, in 1684, and on 4 Oct. 1777 a battle took place between the armies under Washington and the English under Howe. See GERMANTOWN, BATTLE OF.

Germantown, Battle of, 4 Oct. 1777. Howe having captured Philadelphia, stationed his army across the Germantown road north of the city and east of the Schuylkill: the left wing with its supports on the river, the right "in the air" to the east. He shortly detached part of it to reduce the forts which blocked the Delaware below the city; and Washington planned the capture of the weakened army, starting after dark on the evening of 3 October. His right under Sullivan and accompanied by himself, with six brigades, was to move down the main street and crush the British left; the Pennsylvania militia to march along the river and take it in flank; the left under Greene was to divide, three brigades under himself taking the British right in front and flank, while two others were to move to the east and come up in its rear. This would drive it back upon the left and both on the river, and it was hoped would compel surrender. A mile or so north of the British centre on Mount Airy, were a battalion of light infantry and a battery; in a field just left was a regiment under Col. Musgrave; a little south on the main road was the massive stone house of former Chief Justice Chew. At sunrise a heavy fog came up and left all darker than ever. The British advance bodies were overwhelmed by the Americans, and the battery captured; but Musgrave took shelter in Chew's house, and after an unsuccessful attempt at breaching it with the light guns, the Americans left a brigade to besiege it and pushed on. Despite this delay and the warning to the British, both their wings soon began to give way before the American onset. But in the fog, the heavy firing at Chew's house drew Gen. Stephen with his brigade, on Greene's right, too far west, thinking the main fight was there; and Wayne on Sullivan's left had turned considerably east and came in front of Stephen, who took him for the enemy and attacked him in the rear. Wayne's men were driven against the next left of Sullivan's remaining brigades, a panic started, and a general retreat began. The British took the offensive, and reinforced by Cornwallis from Philadelphia, pressed the Americans hard; but the latter soon regained composure and retired in good order, though one regiment of Greene's was surrounded and captured. The Americans, however, brought away several captured cannon, and all their own and their wounded. Their loss in killed and wounded was 673, the British 535. Stephen was accused of having drunk too much on the night march, court-martialed, and dismissed from the army. Despite the failure of the plan, the ultimate results were very great. The audacity of the Americans in attacking the British so soon after the defeat of the Brandywine, and the fighting qualities displayed, were a large factor in determining the French alliance.

CONTENTS

DEPARTMENT OF

GERMAN HISTORY AND DEVELOPMENT.

GERMANY:

HISTORY AND MODERN DEVELOPMENT.

1. **Germany.**—*Geography* — Germany, or the German Empire (Deutsches Reich, emperor Deutscher Kaiser, 208,830 square miles), the third in size of the European states and the most central of the powers of Europe, covers the territory between the Alps and the North and Baltic Seas, between 56° and 47½° N. and 6° and 23° E. It is bounded, E. by Russia, S.E. and S. by Austria and Switzerland, W. by France, Luxemburg, Belgium, and the Netherlands, N. by Denmark.

Physiographically, the German territory consists of three main divisions: The Alpine region, the "Mittelgebirge" (Central Ranges), and the North German Lowland.

The highest elevations are in the South, where the Northern Limestone Alps enter on Bavarian territory (Zugspitz, 9,660 feet). At their base a plateau covered with glacial drift, about 2,000 feet high, interspersed with many lakes (Bodensee, Starnberger, Chiemsee) stretches north as far as the Danube, drained by the tributaries of this river which bounds it along a large fault line.

The Mittelgebirge is an old mountainous country of Appalachian type, whose ranges are controlled by two directions of tectonic movements: The Rhenish, running S.W.-N.E., and the Hercynian System, running S.E.-N.W. To the former belong (see map), beginning in the South: The Swabian Jura, Erzgebirge, Black Forest-Odenwald-Spessart, Taunus, Westerwald on the right, and Vogesen-Hardt, Hunsrück, and Eifel, left of the Rhine; to the latter: the Bohemian Forest, Thuringian Forest, Teutoburger Forest, the Weser mountains, and Sudeten; the horseshoe-shape of the Fichtelgebirge and the parallelogram of the Harz present a combination of the two. Intersecting each other in many places, these ranges produce a chessboard-like dissection of the country which has not been without influence on the political dissection of central Germany into many small states.

The North is a large lowland, narrow at the West and widening toward the East where it joins the great Russian lowland. It is dissected by two heights of land extending, respectively, from Silesia along the middle course of the Elbe and across that river between the lower courses of Elbe and Weser to the North Sea, and from Eastern Prussia along the Baltic coast into Slesvig-Holstein. The latter culminates near Dantzig in the Turmberg (1,000 ft.) and is dotted with innumerable lakes ("Seenplatten" of Prussia, Pomerania, and Mecklenburg); the former consists mostly of glacial sands (Flaming, Lüneburger Heide) and is of little interest economically or scenically.

Rivers.— The courses of the rivers are adjusted to these topographic conditions flowing partly in one, partly in the other, direction. Thus the Rhine flows first N.N.E., then W.S.W., then N.W. The Danube, first, N.E. and then S.E.; the rivers of the lowland; Weser, Elbe, Oder, alternate between a more westerly or northwesterly direction where they follow the general slope of the Hercynian system predominating in the East, and a northerly course where they cut through the heights of land. The Main is perhaps the best illustration of the complicated topography of central Western Germany; Neckar, Moselle, and Lahn dissect, the former, the terraced country east of the Black Forest; the latter two, the old peneplain through which the lower Rhine has cut its gorge. The largest tributaries of the lowland rivers on the right repeat the zigzag of the main watercourses so exactly that they almost establish connections between the corresponding reaches of the latter: Weser-Aller-Elbe, Elbe-Havel-Spree-Oder, Oder-Warthe-Netze-Vistula. An extensive canal system utilizes these conditions for commercial purposes, thus reconstructing the watercourses of the glacial period when at different stages of the advance and retreat of the ice sheet the waters collected at its southern margin and flowed westward or northwestward along it to join the ocean in the present lower courses of the Weser and Elbe. The tributaries on the left generally continue the S.-N. reaches of the main rivers, and during the eastward expansion of the nation often gained strategic importance, such as the Saale-Elbe line in the struggles with the Slavs. The Vistula belongs to Germany only in its lower course; E. of it the Pregel and Memel are coastal rivers of great commercial importance; so is the Ems in the extreme northwest; the Eider in Slesvig, by means of a small canal, once connected the Baltic with the North Sea until it was superseded by the large Kaiser Wilhelm canal. Of the large rivers the Rhine is the only one which, owing to its Alpine origin, affords good shipping all the year round. The others generally suffer from lack of water during the dry season, and only by extensive river regulation has it been possible to satisfy the needs of modern river transportation.

Harbors.—The seaports suffer from similar disadvantages. The Baltic has good river harbors (Königsberg, Dantzig, Stettin) or fiords (Kiel), but their location on an inland sea, though recently improved through the Kaiser Wilhelm canal, puts them at disadvantage. Those on the open North Sea have to combat with the dangers of shallow water on a sinking coast ("Watten"), and Hamburg and Bremen owe their importance more to the energy of their merchants than to natural advantages. Wilhelmshafen, the naval port on the Jade bay, is an entirely artificial creation. The chain of


WESTERN
GERMANY
SCALE OF MILES.
Population of places is indicated
by different lettering, thus
200,000 and over .... BERLIN
100,000 to 200,000 .... Bremen
50,000 to 100,000 .... Spandau
10,000 to 50,000 .... Sulzbach
Smaller Places .... Zähringen
Railroads
Canals
BALTIC SEA
Kiel Bay
WEST AND EAST FRISIAN ISLANDS
ZUIDER ZEE
HANOVER
BERLIN
Charlottenburg
Hamburg
Bremen
OLDENBURG
MAGDEBURG
Brunswick
Dortmund
Elberfeld-Barmen
DUSSELDORF
COLOGNE
Aix la Chapelle
HESSEN
FRANKFURT
Mannheim
Stuttgart
WURTEMBERG
NURNBERG
MUNCHEN
LEIPZIG
DRESDEN
CHEMNITZ
Halle
STETTIN
POMERANIA
PRAGUE
AUSTRIA
BOHEMIA
HUNGARY
LORRAINE
LUXEMBURG
Strassburg
Nancy
Basel
ZURICH
BELGIUM
BERLIN and Vicinity
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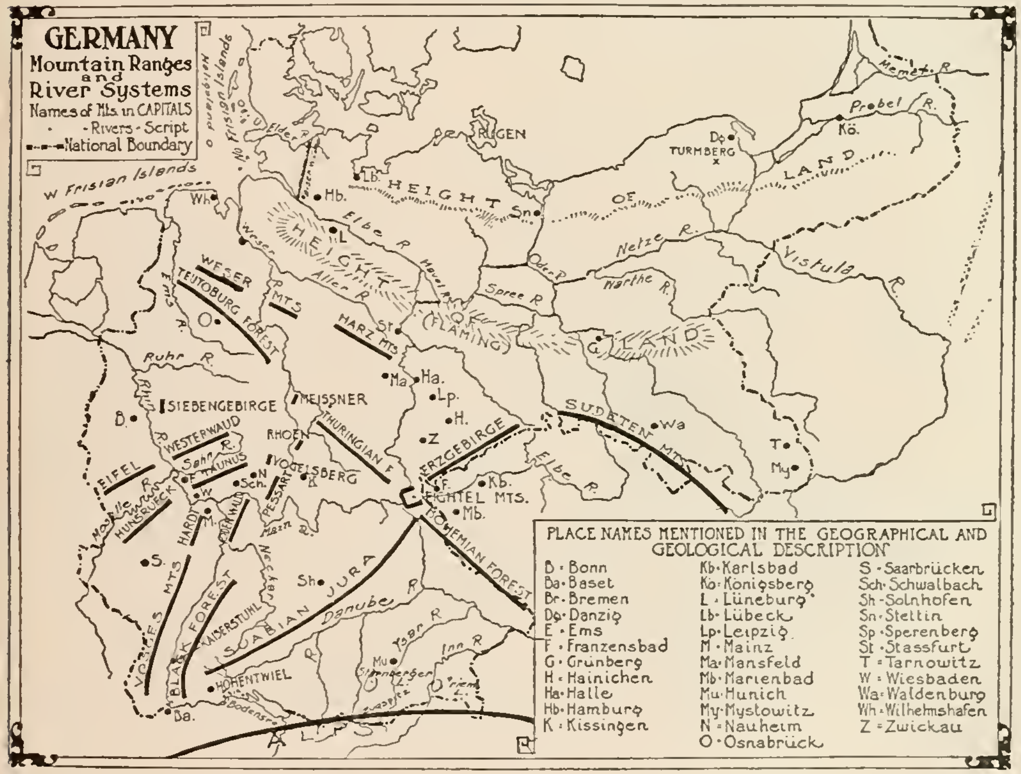
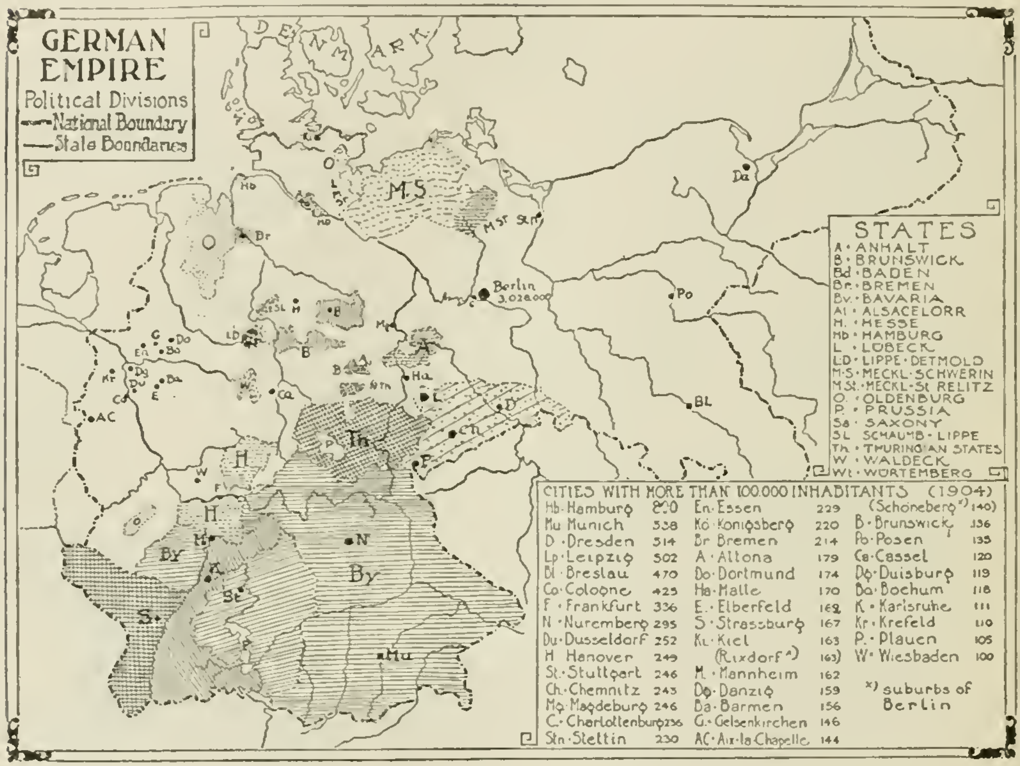
the Frisian Islands represents the old coastline, Heligoland being the only genuine island in that region. On the Baltic coast, Rügen is the largest and most picturesque of the German islands.

Climate.— Being open to the mild westerly winds, Germany has a milder climate than would be expected from its latitude. There is little difference between the North and South, as in the latter higher elevation counterbalances the southerly location. The mean annual of Hamburg is 48° F., of Leipzig, 47°; of Munich, 45°. A greater contrast exists between the East and West, the lowland sharing already the continental climate of Russia with colder winters and warmer summers. The latter allow the vine to reach here its most northerly location on the earth, at Grüneberg on the Oder, in lat. 52° N. The valley of the upper Rhine is the only part of Germany where low elevation and low latitude are combined: here we find, therefore, the warmest parts of the empire, where Indian corn is cultivated and chestnut forests abound.



States.— Politically, the German empire is a union of 26 states under the leadership of an emperor. Twenty-two are monarchies: four kingdoms (Prussia, Bavaria, Saxony, Württemberg), six grand-duchies (Baden, Hesse-Darmstadt, Oldenburg, Saxe-Weimer-Eisenach, Mecklenburg-Schwerin, Mecklenburg-Strelitz), five duchies (Anhalt, Saxe-Altenburg, Saxe-Meiningen, Saxe-Coburg-Gotha, Brunswick), seven principalities (Waldeck, two Schwartzburg, two Lippe, two Reuss), each under its own king, grand-duke, duke, or prince, and with an upper and lower house (except Mecklenburg which has not yet a constitution); besides these there are three republics: Hamburg, Bremen, and Lübeck, the old Hansa towns with their territories, and one "Reichsland" (imperial territory): Alsace-Lorraine, regained from France in 1871, and, for lack of a hereditary prince, placed directly under the imperial government, with a governor appointed by the emperor. Prussia alone occupies about two thirds of the whole empire, practically all of northern Germany, with exception of a few of the smaller states interspersed between her provinces. Since 1871 the king of Prussia holds the office of German Emperor, made hereditary in the Hohenzollern dynasty, and Berlin thus is the seat of both the Prussian and the federal government. The latter consists of the emperor and two houses, similar to the state governments, but the members of the lower house are elected by direct and secret vote, while the modes of the state elections are quite intricate. The upper houses of the states and the empire consist of representatives of the governments.

Population.— Exclusive of Berlin, Germany had, in 1905, 40 cities with over 100,000 inhabitants, mostly industrial centres and state capitals (see map). The majority of the population (60,000,000) are of Germanic origin, especially in the older countries west of the Saale-Elbe line. East of this line lives a more colonial race, with a large admixture of slavic blood. Among and beyond them there are 3,000,000 Poles in the formerly Polish provinces of Prussia; in the East 140,000 Masurians, 106,000 Lithuanians, 100,000 Cassubians; on the upper Spree 90,000 Wends; 220,000 French in Alsace-Lorraine; 11,000 Walloons along the Belgian, and 140,000 Danes near the Danish line. Although no more than one tenth of the whole population, these foreign elements are not insignificant because most of them have their mother country back of them, and the problem is still more complicated by the overlapping of the German race into foreign territory on the N. E., S. E., and S.



Geology.—The oldest parts of Germany, geologically, are the metamorphic rocks of the Bohemian Forest-Erzgebirge-Sudeten region, the Thuringian and Black Forests, the Vosges, etc. Of paleozoic rocks, Algonkian and Cambrian schists and quartzites occur in the S. W. Erzgebirge (Vogtland), the S.E. Thuringian Forest (Frankenwald), and Eichtelgebirge. Silurian schists, limestones, and sandstones occur above them in these three ranges, and the eastern Sudeten, while the Rhenish Slate Mountains (Eifel), are the classical locality of the German Devonian, and the Harz includes portions of all paleozoic formations. Igneous rocks (diabases) and mineral veins intersect them.

Between the lower and upper Carboniferous this whole area of paleozoic rocks was folded into a mountain system of Alpine height, extending from Belgium to the Sudeten ("Variscian Mountains" of Suess, or Paleozoic Alps). Eruptions of volcanic matter accompanied the mountain making forming the granite massifs of the Erzgebirge, Black Forest, etc. In the valleys between the ranges and in the low country at their base the deposition of the carboniferous formation took place. The German Carboniferous belongs to the terrestrial facies of the period, the lower part (Culm) being shales and sandstones of litoral origin with occasional coal seams (Hainichen, Saxony); the upper includes the productive coal fields. They extend with little interruption from Belgium along the northern slope of the Rhenish Devonian into Westphalia (Ruhr Basin), and with the fields around Saarbrücken farther south, in Saxony (Zwickau), and Silesia (Waldenburg, Myslowitz), are the most important sources of coal supply in central Europe.

The Permain consists of two epochs: Rotliegendes and Zechstein. During the Rotliegende the area remained land, the Paleozoic Alps were worn down to Mittelgebirg heights,

EASTERN GERMANY
SCALE OF MILES
0 10 20 30 40 50 60 70 80
Population of places is indicated by different lettering, thus:
200,000 and over BERLIN
100,000 to 200,000 Danzig
10,000 to 50,000 Gulau
Smaller Places
Railroads
Canals
Copyright 1904, by The American Company
BRESLAU and Vicinity.
BALTIC SEA
GULF OF DANZIG
EAST PRUSSIA
WEST PRUSSIA
POMERANIA
BRANDENBURG
POSEN
SILESIA
SAXONY
BOHEMIA
MORAVIA
AUSTRIA-HUNGARY
GALICIA
POLAND
LOMZA
PLOCK
KALISZ
PIOTRKOW
RADOM
KIELCE
WARSAW
LODZ
BERLIN
STETTIN
DRESDEN
PRAGUE
BRESLAU
VIENNA
Danzig
Posen
Brunn

and their deposits filled the depressions with sands and conglomerates of a reddish color; hence the name. Occasionally coal beds occur between them. Volcanic activity continued in some places (porphyrites and pitchstones of Saxony). In the Zechstein epoch the ocean advanced again, leaving its deposits on the northern edge of the Mittelgebirge, especially around the Harz and in northern Thuringa. Among them are the famous copper-bearing shales of Mansfeld, the Zechstein proper (shallow water limestone), and the immense salt beds of the upper Zechstein epoch (Stassfurt, Sperenberg) with their large supplies of gypsum and «araum» salts.

The Triassic period consisted of three epochs in Germany. In the first a shallow sea covered especially western Germany, forming the reddish sandstones (Buntsandstein) which cover miles and miles from Basel to Osnabrück, the W. slope of the Eifel, the region around Tarnowitz in Silesia, and form the cliffs of Heligoland. This sea deepened in the second epoch producing a shell limestone (Muschelkalk), but in the third (Keuper, pron. coiper) was cut off from the main ocean and formed gay colored marls and sandstones with occasional coal seams. (Lettenkohle). The uppermost stage of the Keuper, the Rhaetic, shows the beginning of another transgression of the ocean, that of the Jurassic period.

About the Alpine facies of the Triassic, see ALPS.

The Jurassic ocean overflooded all of central Europe, with only the tops of the mountains standing out as isles. It reached a great deal higher up on their sides than its present distribution would indicate, since the highest deposits were probably eroded in subsequent periods. At present we find its deposits in South Germany on both slopes of the Black Forest and Vosges, and especially in the range of the Swabian-Franconian Jura, where the lithographic stones of Solnhofen belong to its upper epoch. It also occurs in the N. foothills of the Mittelgebirge, near the Elbe in Saxony, in Silesia, and evidently underlies the whole lowland, cropping out frequently from under the younger deposits.

Likewise a zone of Cretaceous hills skirts the northern border of the Jurassic ranges, with many isolated occurrences in the lowland. The second part of the Cretaceous again witnessed a large advance of the ocean, its deposits often lying on rocks several periods older in places which had never been submerged since; on archaic and paleozoic rocks in Saxony, on Carboniferous in Westphalia, etc. The white chalk cliffs of Rügen, and the Pläner sandstone of Saxon Switzerland are the best known examples of German Cretaceous.

The Tertiary was again a period of great geological disturbances: Mountain folding, volcanic eruptions, and changes of shore-lines. During the Eocene, almost all Germany was land; but in the Oligocene a shallow sea extended over the lowland as far as Bonn, Leipzig, and Silesia. Local oscillations favored the formation of coal beds, to which soft coal measures (Halle and Leipzig) owe their origin. From the South the sea entered the rift valley formed by the breaking in two of the Black Forest-Vosges massif, the present Upper Rhine Valley. Toward the end of the Miocene, the folding of the Alps began and gradually shut off this bay from the ocean; it became brackish and finally a freshwater lake drained by the later Rhine (Mainzer Becken). All through the Mittelgebirg region, volcanic eruptions accompanied these tectonic processes; the volcanoes and volcanic rocks of the Eifel, Siebengebirge, Westerwald, Vogelsgebirge, Meissner, Rhön, northern Bohemia, and the eastern Sudeten, together with the hot springs which have created a belt of famous watering places along this line (Ems, Schwalbach, Wiesbaden, Nauheim, Kissingen, Franzensbad, Karlsbad, Marienbad, etc.), in the South the Kaiserstuhl, the Hegau volcanoes (Hohentwiel) and those of the Suabian Jura date from this period. During the Pliocene practically the whole of Germany was land again, and ready for the invasion of the Pleistocene ice sheet.

In the Pleistocene six glacial and five interglacial stages have been distinguished of which, however, only the second (the Kansan of America) and third (corresponding to the Wisconsin) deserve special mention. At the time of its largest extension the Scandinavian glacier reached the northern foot of the Mittelgebirge from the lower Rhine southeastward into Silesia. The terminal moraines are well developed along this line and the whole lowland is covered with till and strewn with erratic boulders. Another inland glacier stretched northward from the Alps, covering the Bavarian plateau with its moraine material. The Black and Bohemian Forests and the Sudeten (Riesengebirge) had local glaciers of smaller size.

Palæontology.—The geological description indicates the old faunas and floras. Special mention deserve:

Devonian: Eifel limestones: Brachiopods, crinoids, corals.

The Rotliegende of Chemnitz: cycads, conifers, especially treeferns; of the Saar valley and the Plauen Grund (Dresden): Stegocephales (larvæ and adults).

Zechstein shales of Mansfeld: Ganoid fishes.

Buntsandstein rocks have few fossils but contain footprints of various animals (Thuringia, Franconia).

Muschelkalk limestone (Thuringia, Württemberg) are packed full with fossils, few species, many specimens: molluscs, besides brachiopods, ammonites, crinoids. Terebratula vulgaris is very common, the stalks of Encrinus form whole beds. Ceratites nodosus, practically confined to Germany, is common everywhere.

Keuper sandstones of Württemberg: well-preserved amphibia and reptilia; gigantic Mastodonsaurus, Capitosaurus; huge Belodon, Zanclodon. Famous is a slab with 24 specimens of Aëtosaurus (Stuttgart Museum).

The Jurassic rocks, especially of Swabia and Franconia, show a marvelous wealth of beautifully preserved fossils of all kinds: sponges, corals, jelly-fish, sea-urchins, crinoids, brachiopods, molluscs (ammonites and belemnites especially), crustaceans, insects, many fishes (ganoids especially), and above all the reptiles: Ichthyosaurus, Plesiosaurus, Teleosaurus, the Pterosaures, the unique Campsognathus, finally the two specimens of Archæopteryx so far known. Holzmaden (Württemberg), Solnhofen and Eichstätt (Bavaria) are the famous localities. The finds fill the collections of Banz, Stuttgart, Munich, Berlin. Tübingen has a slab (15x24 feet) with 24 Pentacrinus (some measure three feet across).

The flora of the Wealden formation (N.W. Germany) looks like jurassic.

Suddenly the dicotyledons appear in the upper Cretaceous beds.

The Tertiary climate was warm, the flora had a tropical or subtropical character. During the Oligocæne epoch corals could grow. The dense forests and swamps resembled those of Florida and Louisiana of to-day, although plants of a former more Indo-Australian flora survived: Conifers (sequoias, cypresses), evergreen oaks, gardenias, fig trees, cinnamon trees, palms, magnolias, laurels, but also poplars, alders. Several oscillations during the Oligocæne and Miocæne favored the formation of extensive soft coal measures. The amber (E. Prussia), the fossil resin of pines and especially one spruce (Picea Engleri) contains a rich insect fauna related to those of N. America and E. Asia of to-day.

The Miocæne flora much resembled the modern N. American and Japanese floras: sequoias, bamboo, palms, laurels, camphor, and cinnamon trees, fig trees, evergreen oaks, chestnuts, magnolias, myrtles, acacias, mimosas; but also poplars, maples, elms, walnuts, hazel nuts, willows, birches. The fauna likewise shows many specimens found now only in warm countries: elephants, Mastodon, Dinotherium, Rhinoceros, Hippopotamus, tapirs, antilopes, monkeys, together with wild boars, deer, large and small carnivores, and the ancestral forms of the horse.

In the Pliocæne epoch the climate became temperate, animals and plants resembled those of modern N. America.

The ice masses of the Pleistocæne advanced and many animals and plants were exterminated, some, however, adapted themselves. The narrow belt finally left between the northern and southern ice sheets had an arctic fauna and flora that had come in from the north. The glacial and interglacial periods caused plants and animals to migrate back and forth. Survivors of the Tertiary were: Hippopotamus, hairy elephants, the mammoth, hairy rhinocerosses; arctic forms: the musk-ox, reindeer, lemming; others: horses, deer, fallow deer, elks, the aurochs, the urus, wild boars, bears, tigers, hyenas. The ice retreated, a wide plateauland or rolling country was exposed. Animals and plants found to-day in the steppe of S.E. Russia and S.W. Siberia came in and mixed with the others: jerboas, bobacs, marmots, altaic gophers, voles, calling-hares, ermines, the Saiga antilope, wild horses, bustards.

Many arctic animals and plants could not stand the change and followed the retreating ice northward or climbed the mountains. Thus the fauna and flora of the Alps and many lower mountains (Schneekoppe, Brocken) contain arctic specimens.

Soon a denser covering with vegetation developed, immigrations from all sides occurred, a new fauna and flora resulted. Lack of connection with a region where the old Tertiary forms had survived prevented restocking. Thus we find fewer species and less variety than in N. America or E. Asia, and only the Tertiary forms of the three countries are much alike.

Old Germania was moist and cool, had extensive swamps and perhaps 75 per cent of her area covered with dense forests.

Flora.— The flora is that common to northern Europe. Germany lies entirely within the northern forest zone of phytogeography and is pre-eminently a wooded country. Even to-day forests abound (26 per cent of the area; France, 16 per cent; Great Britain, 3 per cent). Man has taken care of the woods, dried out or drained swamps, regulated rivers, planted fields, and thus caused great changes. Little "primeval forest" is left. (N. and N.E., Bohemian Forest.)

The flora comprises about 2,200 phanerogames, 60 vascular cryptogames; 6 coniferous forest trees: fir, spruce, pine, larch, juniper, yew, 40 deciduous forest trees, 20 shrubs.

An alpine flora (one third of the alpine plants) is found in the Bavarian Alps and spreads along the rivers onto the high plateau. The Sudeten mountains (with some arctic forms missing in the Alps) and the tops of other high mountains (Brocken) are isolated centres of alpine plants.

The southern mountainous region (so-called Hercynic flora) is characterized by the fir (Abies alba) and shows a varied flora, the valleys having the Baltic, the mountain slopes a subalpine character. Vine culture is possible only here.

The Baltic flora occupies the northern lowland.

The forest line on the mountain slopes is at about 4,000 feet (Brocken, 3,400; Vosges, 4,264). Above is a zone of trailing trees and shrubs up to about 4,500 feet: Mountain pine (*Pinus montana*), dwarfed willows and junipers, rhododendron (in the Alps); above this the true alpine region with its peculiar flora. The highest peaks have only cryptogames (lichens, mosses). The alpine region in Bavaria begins at 5,500 feet, spruces go up to 5,900, larch trees to 6,200. Generally, heights above 3,500 feet are unfavorable to tree growth and covered with grasses and often heather. In the Alps the region above timber-line is pasture with many flowers (gentians). Many species which are missing in the arctics probably represent alpine plants of the Tertiary (Edelweiss).

The deciduous forests are diminished by secular changes (natural rotation?): the spruce *(Picea excelsa)* is everywhere gaining ground at the expense of the red beech which, as is almost certain, once crowded out oaks, pines, and birches (known to have happened in Denmark). In W. Prussia pines replace oaks and birches.

To-day, deciduous forests occupy only the lower mountain slopes, above are coniferous forests. The Spessart only has retained its old oak and beech forest to the top. The large Buntsandstein area in S. W. Germany not good for agriculture supports magnificent forests.

The pine is typical for the northern lowlands and forms forests even on the sand plains. The spruce has spread from the south all over the country. The larch forms groves in the Alps but is not confined to them. The Swiss Stonepine (*Pinus cembra*) occurs in a few places in the Bavarian Alps. The yew once common has almost disappeared and is found only in E. and W. Prussia, and occasionally in the mountains. The juniper is a tall tree in the E., smaller and rarer in the W., missing in E. Friesland; a shrub in the mountains and in the heath.

Deciduous forests are usually mixed, beech forests, however, common. The northern limit for the beech is south of Königsberg. In the N. the oak is most characteristic (two kinds); it is the national tree celebrated by songs, poems, and myths. Maples, elms, hornbeams, birches, ashes, mountain-ashes, poplars, aspens, wild apples and pears, hawthornes, service trees form the mixed forests which contain no trees with showy flowers, except wild fruit trees, have little underbrush and no climbing vines, except hop, clematis, and ivy. The autumn coloration is not remarkable. The beauty of the mountain forests lies in the mixture of light deciduous and dark coniferous woods, interspersed here and there with meadows or heath patches.

The linden marks former Slavic regions. The chestnut (Mediterranean flora) thrives along the Rhine. The evergreen holly (Mediterranean) is confined to W. Germany. The evergreen box avoids the cold east.

Introduced trees: American horsechestnuts quite common, especially in the cities; American locust trees belong to the flora now and form woods in Anhalt; Oriental cherries, plums, prunes, apricots; and walnut trees are common fruit trees. Along the highways tall Lombardy poplars are seen, but also apple, cherry, and plum trees.

Meadows occupy marshy districts along the shores, and together with woods, the flood plains of rivers, and form patches in the mountains and in the Alps. They are a dense growth of grasses (20–30 species) intermingled with a great variety of flowering herbs (meadow saffrons in the fall); natural or cultivated, always indicating moist soil.

On sandy soil birches and pines may grow or the heath develops (heather and vaccinium) (N.W. Germany, tops of mountains, high plateaus of S. Germany).

Bogs and swamps cover large areas of the lowland and of the southern plateaus. They are the coldest parts of the country and retain arctic plants. Rushes, sedges, reeds, sphagnum mosses and the insectivorous sundew, Utricularia, and Pinguicula form their flora.

Along the shores a salt flora develops with fleshy leaves and stalks. It is occasionally found inland (near Halle).

Sand dunes have special grasses and thistles.

Elodea canadensis introduced in female plants only has multiplied so that it often blocks navigation in rivers and canals.

Red poppies, blue bachelors' buttons, and purple corncockles adorn the grain fields. Many plants, especially weeds, are spread by man, railways, and modern traffic, and foreign plants are mixed in with the native flora.

Difference in climate: fruit trees bloom in Memel about four weeks later than on the Rhine.

Fauna.— Old Germania had a rich woodland fauna. Directly and indirectly man has caused many changes. Many animals were exterminated, others were too much disturbed in their habits and disappeared. The creation by farming of an artificial steppe («Kultursteppe») invited others. Some were protected, other useful or injurious ones introduced.

Mammals.— The urus became extinct probably in the 17th century. The last bison (aurochs) was killed in E. Prussia in 1755. The elk is now confined to a few preserves in E. Prussia. Wild boars much reduced in number survive only by protection. Bears have not been seen since 1835 (Bavaria). The wolf is now only found along the western mountainous border and in the large eastern forests. The lynx, common in the 17th century, seems to have disappeared (last ones: Harz mountains, 1818; E. Prussia, 1861; Wollin, 1875). Wild cats are scarce. The beaver has narrowed down its habitat to a few quiet places (Elbe near Dessau). The black rat (*Mus rattus*) which spread during the 12th century (from Asia?) is crowded out by the brown rat (*Mus decumanus*) which migrated in from Asia in the 17th century.

The snowhare in the Alps is an arctic relic. The hare, the most popular game, has many enemies, but is still common (game laws). Rabbits have been introduced and occasionally run wild. They are bred here and there, but are not popular.

Red deer are the pride of the woods, the ambition of the huntsmen, the subject of songs and poems. They and the smaller roe deer give the best venison (game laws.) The fallow deer introduced in the 16th century, is usually kept in game parks.

Other mammals are: fox, two martens, fitchet, ermine, weasel, otter, badger, a mink called «Nörz» (*Putorius lutreolus*, very rare in N.E. Germany, reaching here its western limit of distribution); the insectivores: hedgehog, mole, six shrews; the souslik (western limit in Silesia), the hamster (a steppe form which is comfortable in the fields).

The mammalian fauna comprises about 65 species, 16 per cent. of the mammals of the paræartic region.

The *avifauna* has about 225 species. The many singing birds and water-birds are characteristic. Among the former are: finches, bullfinches, skylarks, nightingales, thrushes, orioles; among the latter: rails, coots, cranes, herons, bitterns, storks, the spoonbill, swans, geese, brants, many ducks, mergansers, pelicans (very rare), cormorants, many gulls, sternas, greebes and loons, auks, murres. Flamingoes (Mediterranean) have been met with on the Rhine.

The cuckoo (nesting parasitism like the American cowbird) is the only member of a family of about 200 mostly tropical species.

The lammergeier, the largest bird-of-prey of the old world, seems now exterminated in the German Alps. Three of the Mediterranean vultures occur rarely. The golden eagle has become very scarce, the imperial eagle sometimes penetrates in Germany. The osprey is common, the sea-eagle is found. Gledes, sparrowhawks, hawks, kites, buzzards, falcons are the birds-of-prey. The capercailzie and the heathgrouse are interesting (game laws). The large bustard, a steppe animal, is found especially in Saxony.

Many birds of passage breed in Germany and leave in the fall; northern birds spend the winter and go north in spring. From the E. birds of the Pontic fauna often penetrate into Germany, sometimes repeatedly until they establish themselves as new members of the fauna. Pallas' sandgrouse (Syrrhaptes paradoxus) has several times arrived in large flocks. The large bustard, some larks, quail and partridges, the house-sparrow seem to have come in that way, and like the "Kultursteppe." The small bustard, the bee-eater (Merops), still breed in S. and E. Europe but penetrate occasionally in Germany. They may be about to immigrate. The S.W. gate into the Rhine valley is often used by Mediterranean birds.

In autumn most of the migrating birds fly to the Rhine valley and then south to the Rhône. On Heligoland where many migrating birds take a little rest 396 different species have been observed. The black guillemot breeds here.

Thirteen *Reptiles* belong to the fauna. One tortoise occurs in ponds east of the Elbe. Three lizards (including the blindworm), the ringed snake, and the poisonous adder are common, the smooth snake is common in certain regions. Other lizards and snakes reach the S.W. so that here all twelve of them occur; among them is the venomous asp (Metz) and the deadly ammodyte viper.

The *Amphibia* have twelve batrachians and six urodeles. The nurse-frog and the Swiss newt reach into the Rhine valley, the black salamander is alpine.

A great variety of freshwater *fishes* (64 species) is characteristic, and is due to the double drainage Atlantic and Pontic). Smelt, salmon, eel, sturgeon are missing in the Danube, hucho, Acipenser ruthenus in the Rhine. The alpine lakes and those of the N. E. have many specific fishes, especially Salmonides which have become landlocked. The most important food-fishes are perch, pike-perch, carp, dace, roach, tench, bream, pike, eel, lamprey; those of the German seas: mackerel, cod, halibut, plaice, flounder, sole, herring, sprat. The piscifauna is diminishing as the industrial development progresses (withdrawal and pollution of the waters.)

The land and fresh water *molluscs* number 240, the genus Helix alone 40. Helix pomatia is the edible snail (snail farms in Swabia). The pearl mussel occurs in some districts. The Pontic Dreissena polymorpha has spread by migration and transportation through vessels into the larger rivers and is now spreading into their tributaries.

Marine food mussels are: the edible mussel, scallops, oyster (Ostrea edulis, an expensive luxury). Oyster beds are confined to the North Sea.

The *insect* fauna is numerous (6,000 beetles, 3,500 butterflies and moths), many are injurious, many useful. Immigrations can be traced from the S.W. and the E. (Praying mantis (Rhine), Cicada orni (S. W.), death's head moth, Sphinx nerii, migratory locusts). The potato beetle has appeared here and there, the American Phylloxera has done enormous damage.

The great many Carabidæ are characteristic. The cockchafer (periodicity four years) is a serious pest. The gypsy moth (E. and Bavaria), the processionary moths (N.W. and N.E.) are others.

Of the *Crustaceans* the common crayfish is widespread and a much-relished titbit.

We can distinguish three faunal districts: (1) the alpine region (chamois, snowhare, marmot, snowgrouse, chough, many insects and molluscs); (2) the mountainous regions with a western and eastern section; (3) the lowlands again with a western and eastern section.

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2. Germany — Political History. The place of origin of the Germans is doubtful, and even the theory, based on similarities of language, that they formed part of one great Indo-European race is no longer tenable. One race may readily impose its language on another, as the Germans on their Slavic neighbors.

Quite early we find German tribes in conflict with the Romans. Marius (in 101–2 B. C.) gained victories over bands of Cimbrians and Teutons that had penetrated to Provence and Northern Italy. Cæsar, after a struggle with the German Ariovistus, established the Rhine as a Roman boundary. Augustus undertook an invasion of Germany and his stepsons, Tiberius and Drusus — also, later, the son of Drusus, Germanicus — penetrated far into the land and built camps and fortifications, of which the remains are still to be seen. But the Cheruscan Arminius (or Hermann) at the head of a coalition of tribes defeated the Roman general Varus in the Teutoburg Forest (9 A. D.) and liberated Germany. Augustus began the *Limes* or great fortified wall which, under his successors, was extended across the whole frontier. The Germans were not always unfriendly and a considerable trade sprang up.

From being, in the days of Tacitus, a great number of semi-nomad tribes, the Germans coalesced into larger bodies called "stems" or "nations," among which the chief were the Goths, Vandals, Saxons, Burgundians, and Franks (q.v.). The Goths were the first to accept Christianity — in the Arian form, indeed, — and were represented by their own bishop at the council of Nicea. Throughout the 3d and 4th centuries the Germans made themselves more and more felt in the affairs of the Roman Empire, and thousands were allowed to settle on Roman soil. The advent of the wild hordes of the Huns (q.v.), who first crossed the Volga about 375 A. D., started the "wandering of the nations" and brought about the disintegration of the Western Empire and the rise of new kingdoms. Of these the only one that proved permanent was the kingdom of the Franks. Its survival is ascribed to the facts that it never lost touch with Germany, and that it adopted the Roman Catholic form of Christianity, thus finding support in the clergy of its conquered provinces.

Under the Merovingian Clovis and his sons an end was put to the remnant of Roman rule in Gaul. Provinces were wrested from the Visigoths (q.v.) to the south; while, to the east the Allemanians (q.v.) and Burgundians (q.v.) were subjugated. Though the race of the Merovingians (q.v.) steadily degenerated, the affairs of the new kingdom were well administered by the chief officials, the mayors of the palace, who contrived to make their own position hereditary and who handled the kings like puppets. Several mayors in turn distinguished themselves by quelling revolts, but the most brilliant achievement of all was the driving back of the Saracens by Charles Martel (q.v.). The battle near Poictiers (732 A. D.) was one of the world's great combats. The Saracen war is notable, too, as marking the beginning of the feudal system (q.v.). The first fiefs were lands of the Church, confiscated and parceled out by Charles Martel with the understanding that the persons thus favored should provide themselves with horses and perform military service.

Pepin, son of Charles Martel, put an end to the fiction of Merovingian kingship (752 A. D.) by imprisoning the last of the line and causing himself to be proclaimed king. This he did with the sanction of Pope Zacchary, who declared the Frankish crown hereditary, anointed Pepin's sons, and pronounced a curse on those who should choose a king from any other line. Charles, known as "the great," then brought the work of consolidating the kingdom to its culmination. He conquered the last free German tribes, notably the Saxons, with whom he warred for 30 years. He interfered in Italy, overthrowing the Lombard kingdom, and he conquered the wild Avars in the present Austria. He came forward as the champion of Pope Leo III, who had traveled to Germany to ask aid against a faction of the Romans. Charles conducted a sort of trial over the Pope's enemies, finally banishing them from Rome. Leo, in return, surprised Charles as he knelt in Saint Peter's by crowning him as successor to the old Roman emperors (800 A. D.). Charles, who had already subdivided the greater party of Germany into administrative districts, now centralized the government still more by requiring a new oath of allegiance and by sending out envoys with power to examine into the actions of all officials. It was a flourishing period not only politically, but also in learning, literature, and art. Unfortunately Charles's son, Louis the Pious, proved unequal to the task of governing. He allowed the clergy to override him and did humiliating penance for alleged faults; he quarreled with his sons about their rights to the succession and became involved in civil war, which kept up after his death and only ended with the treaty of Verdun, in 843. (See PEACE TREATIES.) This treaty divided civilized Europe into three parts, one nearly corresponding to modern France, another to modern Germany, and the third being a strip between the other two, extending from the North Sea far down into Italy. After the death of Lothar and of one of the latter's sons this middle strip (Alsace Lorraine) was divided between Germany and France (Treaty of Mersen, (q. v.) 870), but remained a bone of contention down to our own day. Lothar's other son retained Italy.

From 885 to 888 the dominions of Charles the Great were reunited under his great grandson, Charles the Fat. Unable to cope with the invading Norsemen Charles the Fat was deposed and five independent kingdoms arose: Germany, France, Italy, Upper and Lower Burgundy. Germany itself narrowly escaped further subdivision, but the danger was averted by the election of Conrad of Franconia, chosen possibly because he was related to the Carolingian house. So slight was the political cohesion that Conrad went to war with the heads of each of the great duchies in turn — Lorraine, Saxony, Swabia, and Bavaria — and that he felt compelled on his deathbed to urge the election of Henry of Saxony simply because that prince had been the most powerful of his opponents and could, it was hoped, hold the discordant elements together. It was a good choice. Henry proved a great organizer, training an army, building fortresses, and overcoming the wild Hungarians and other Slavic tribes. He left Germany so consolidated that, at the coronation of his son and successor, Otto I, the heads of the duchies — Lorraine, Franconia, Swabia, and Bavaria — did feudal, almost menial, service as cup-bearer, steward, chamberlain, and marshal. Later, indeed, Otto had to put down rebellions on the part of all these dukes, and he came to rely on the ecclesiastical princes as the staunchest supporters of his throne. He inaugurated the policy, which proved unfortunate in the end, of endowing the clergy with great landed possessions. The benefit to him was that at every vacancy, as the bishops had no lawful descendants, these lands reverted to the crown and could again be used to reward faithful service. Grants made to the nobles, on the contrary, came to be looked upon as hereditary family possessions, which, being let out in return for feudal service, assured the owners of large bands of faithful retainers. These local powers, especially the great dukes, were very often arrayed against the crown.

Otto kept not merely the German, but also the Roman, church in subjection. Drawn into Italian affairs by an appeal from the heiress to that kingdom, he put her enemies to flight, married the heiress, Adelaide, and himself assumed the titles of "King of the Lombards" and "King of the Italians." He restored the empire of Charlemagne with the title of "Holy Roman Empire of the German Nation," and, for misconduct, deposed the very Pope (John XII) who had crowned him emperor. Unfortunately these Italian interests drew Otto's successors away from their duties as German rulers. Again and again, with German armies, they descended upon Italy; each felt it a vital necessity to be crowned with the imperial crown at Rome. One consequence of their repeated absences was the loss of the supremacy over the Slavic nations on the German borders.

Otto's ecclesiastical policy was imitated by his son and grandson and led to a gigantic conflict with the papacy. It was a question, ultimately, as to who should control the elections of the German bishops. If the Pope, then he had simply to adjudge the rich German sees to his partisans; the emperor lost the supporters of his throne and the lands might practically as well have belonged outright to Rome. It seemed a life and death struggle, which accounts for its long continuance and for the venom displayed on both sides. There were wonderfully dramatic moments, like the penance at Canossa of Henry IV (1077), who amid winter snows appeared barefoot on three successive days before the Tuscan castle in which sat Pope Gregory VII, refusing him absolution, or the capture, in Rome itself, by Henry V, of Pope Paschal II and all his cardinals. This so-called investiture quarrel ended in 1122 with the Concordat of Worms, a compromise by which there were to be two investitures, one with the temporal estates by the emperors, the other with the spiritual power by the Pope. It had taken 50 years to arrive at this simple solution of the matter. See INVESTITURE.

New conflicts with the papacy broke out under succeeding rulers. Frederick Barbarossa warred for years with the semi-independent Lombard cities which were upheld by Pope Alexander III. Defeated at Legnano (1176) he was obliged to conclude the Peace of Venice with the Pope (1177), and that of Constance (1183) with the Lombard Cities. See PEACE TREATIES.

The fact that Barbarossa's son, Henry VI, acquired Sicily by marriage, made the enmity of the Popes and the emperors implacable. The papal possessions seemed to be held in a vice. It was this jealousy and fear that led to the papal determination to destroy the house of Hohenstaufen, root and branch. Other pretexts were never wanting. Frederick II was placed under the papal ban for delaying to accomplish his crusading vow, and again for starting when forbidden. Crusades were preached against the emperor himself, who retaliated by capturing a whole ship-load of prelates on their way to a council at Rome. It was a Titan struggle, the Sicilian kingdom being always the real bone of contention. The papacy conquered, with the aid of Charles of Anjou, who was promised the rule over Sicily. The last scion of the Hohenstaufen line, after losing the battle of Tagliacozzo (1268), was beheaded in the market-place at Naples.

Meanwhile the continued absence of the lawful rulers from Germany, and also the gifts of land and of privileges with which they had tried to win the support of the German nobles in the Italian campaigns, had led to the rise of many small and almost independent states. Frederick Barbarossa had still been strong enough to put down his most powerful vassal, Henry the Lion, and divide up his lands. Frederick II's death (1250) brought anarchy; and when, after an interregnum, Rudolph of Hapsburg was made king it was practically a confederation over which he ruled.

Yet, strange to say, the age of the Hohenstaufens marks a great advance in civilization and well-being. It was the age of the crusades (q.v.) and of chivalry (q.v.), an age that marked an era in commerce, in learning and literature, and in luxurious living. It is from this time that some of the great cathedrals date. Germany's boundaries, too, were pushed to the east and north by colonization and occasionally by war.

The 14th and 15th century kings left little impression on the history of Germany. They were men of no great force and they advocated no great principle. Henry VII and Louis of Bavaria renewed the old struggles in Italy but with no lasting results. The quarrel of Louis with Pope John XXII, indeed, is memorable for the literary productions that it called forth. The success of the *Defensor Pacis* of Marsilius of Padua was phenomenal. Never had the papacy been so assailed.

Charles IV was a man of no high aims, and his reign is chiefly remarkable for his promulgation of the so-called Golden Bull (q.v.) in favor of the seven electors. The earlier kings of Germany had been chosen by the whole body of the princes. At the election of Rudolph of Hapsburg, however, seven,— the three archbishops (Mainz, Treves, and Cologne) and the dukes of Saxony and Bavaria, the Margrave of Brandenburg, and the Count Palatine — had been especially prominent. Bavaria's vote, indeed, was adjudged later to Bohemia. This electoral college became very powerful, exacting promises from the successful candidates and even deposing an emperor. The Golden Bull (1356) fixed the elaborate ceremonial of elections and the functions, rights, and prerogatives of each of the seven electors. They were accorded almost sovereign rights.

Equally remarkable with the growth of the duchies and electorates was the development of the free towns. We find them banding together into commercial leagues and exercising real political power, such as setting their own king on the throne of Denmark. The Hanseatic League had its own fleet and its settlements in foreign lands. It enjoyed monopolies of trade and built great halls or warehouses that excite admiration to-day.

Another important organization was the Teutonic Order, a band of knights who had undertaken the conversion of wild Prussian tribes and had ended by building up a great state with the Marienburg for its centre. The order became rich and powerful and was visited by the greatest princes. It degenerated at last and became involved in a long war with Poland. By the Peace of Thorn (1466) the part of its territory known as West Prussia passed into Polish hands, while even the portion that was left became a Polish dependency.

Throughout the 15th century the cohesion of the different parts of Germany was slight. The interests of its rulers lay elsewhere: in Hungary, Bohemia, Italy, or Luxemburg. Emperor Wenceslaus was deposed for staying away as much as eight years at a time. Sigismund made his first appearance four years after his election. Frederick III once retired in a fit of anger and did not come near a diet for 27 years. Yet the chief courts of justice followed the king's person! No wonder a secret tribunal, the Veme, could become the chief upholder of law and order and even venture to summon the king himself. Like the Hausa and the Teutonic Order the Veme had its flourishing days and then sank into disrepute; the end of the 15th century marks the decline of all three institutions.

After 1437 Hapsburgs, many of them inefficient, held the imperial throne in almost unbroken succession. After the Councils of Constance and Basel Frederick III, by a concordat or agreement with the Pope, renounced practically all the benefits that Germany had obtained. Frederick is noted for the fact that the great Renaissance movement began under his reign. His son, Maximilian, was a regular product of the Renaissance, versatile, talented, but lacking in balance. Maximilian was personally active in a scientific, literary, and artistic way, and was full of political projects, some of which were almost too wild for belief, aiming as they did at making him world-ruler. He was, for instance, to combine the offices of Pope and emperor in his own person, and to succeed Perkin Warbeck as king of England.

In Maximilian's reign, independent of him yet a product of the Renaissance spirit, falls the beginning of the German Reformation. The invention of printing (about 1450) had provided a channel for the rapid dissemination of ideas, and pungent satires like Erasmus' 'Praise of Folly,' Brant's 'Ship of Fools,' and the anonymous 'Letters of Obscure Men' had mercilessly assailed abuses in the Church. Inflammatory writings of various kinds had made the peasants familiar with the idea of vengeance on the clergy and nobles, in whose favor they were overtaxed; while payments for the support of the papal court at Rome were becoming decidedly unpopular. Altogether, the ground was well prepared when the monk Martin Luther (q.v) launched his demand for a discussion of the matter of papal indulgences, a demand that drew down an avalanche on his own head and that altered the whole course of German history.

Luther had soon found that the indulgence-preacher, Tetzel, was merely the instrument of higher personages and was not altogether to blame for his extravagant utterances. He then joined issue directly with Pope Leo X, who had authorized the indulgences, and with the Archbishop of Mainz, who was to benefit largely by them. Luther's sovereign prince, the elector of Saxony, though a professed Roman Catholic to the end, came forward as the reformer's protector, and Luther, in response to his own demand for a fair hearing, was summoned to meet the Roman cardinal, Cajetanus, at Augsburg. The meeting proved fruitless, as did one with the legate Miltitz, who had been sent to Saxony to bribe the elector with the gift of the golden rose. A disputation with the theologian Eck, at Leipsic (1519), only served to clarify Luther's own ideas and to widen the breach with Rome. In three great writings he attacked the Pope and the doctrines of the Church, drawing down upon himself the papal ban. But the bull of excommunication was publicly burnt by Luther at Wittenberg. The new emperor, Charles V, felt compelled, by a recent agreement with his princes not to condemn any one unheard, to summon Luther to his first German diet (Worms, 1521). By this time, if we can believe the Roman legate himself, nine-tenths of the German people were more or less in favor of Luther. Crowds gathered all along his route. His final word at Worms was: "I neither can nor will recant anything, for it is neither safe nor right to act against one's conscience. God help me. Amen." He left as a convicted heretic, an edict signed by a majority of the princes declaring him in the ban of the empire. His life was in danger, but by order of the friendly elector of Saxony he was attacked by seeming brigands and spirited away to the Wartburg, where he employed his time in preparing a translation of the Bible. Germany meanwhile was in a ferment and the number of polemical publications became enormous. Luther himself, by 1523, had published a hundred writings. Radical elements, men who claimed to be following Luther's own teachings, soon caused disturbances and drew him from his seclusion. His successful effort at restoring order in Wittenberg was one of the causes that prevented his arrest. His rôle in the great peasant revolt that broke out in 1524 was not so admirable. His incendiary eloquence had been taken by the masses as an invitation to iconoclasm. Discontent against the nobles, fanned by long oppression, had blazed up fiercely and 300,000 peasants rose in revolt, sacking castles and monasteries in all directions. Luther preached against them as "brands of hell," and urged every man to strike them dead. The revolt was quelled and horrible vengeance taken, but Luther, naturally, lost many adherents, and the course of the reformation was changed. Reliance had now to be placed on the princes rather than on the people. The Edict of Worms was never carried out, though still considered in force as late as 1530. Charles V was hampered by political considerations and by his wars with Francis of France and the Pope. His enmity to the latter once led him to remark that "Martin Luther might, after all, prove a useful man." Luther was able at his leisure to organize his new church; and the diet of Spires, in 1526, unanimously passed a decree which practically allowed the Lutherian princes to conduct the religious affairs of their lands as pleased themselves.

The reversal of this decree, in 1529, by a simple majority vote, drew forth the "Protest" from which the "Protestant" party takes its name. Charles V had meanwhile gained the advantage both of the papacy and of France (treaties of Cambray and Barcelona) and his adherents were feeling very aggressive. They wished to force the issue, and they succeeded. The "Protest" was a technical one against the right of the diet to reverse the former unanimous edict. Charles himself earnestly sought to bring the schism to a peaceful end. He invited discussion and summoned conferences, acting not at all like the tyrant that many writers have made him out. He staved off war for 17 years, and then entered into it more on political than on religious grounds. Several Protestant princes fought on his side. This war with the Smalkald League, of which Elector John Frederick of Saxony and Margrave Philip of Hesse were heads, ended in the defeat and capture of those princes and in their long captivity. The electoral dignity in Saxony passed to the other branch of the house, the head of which, Maurice, had helped the emperor. But Maurice in turn, dissatisfied because Charles did not fully keep his promises, and alarmed at the emperor's attempt to have his son, Philip II of Spain, declared successor to the throne, headed a revolt which reduced Charles to great straits. A temporary peace was concluded at Passau (1552), but the final settlement was delayed by the disunity of the Protestant princes, the Margrave of Culmbach and Maurice of Saxony fighting on opposite sides. Maurice was killed at Sievershausen (1553).

Finally at Augsburg (1555) a general peace was concluded between the Protestant and Catholic princes; but by Ferdinand, not by Charles V — the latter preferring to abdicate rather than to make the needed concessions. The basis of the peace was free choice on the part of each lord of the land of the form of faith to be tolerated. There were, unfortunately, ambiguous clauses that led to later conflicts.

For the next 20 years Protestantism had the upper hand; but while the Roman Catholic party was strengthening itself by internal reforms, the Protestants, through dogmatic disputes, were becoming greatly weakened. Saxony (Lutheran) and the Palatinate (Calvinist) allowed their private enmities to ruin their cause as a whole. The Jesuits, marvelously trained for such work, made it their chief purpose to combat Protestantism. They secured the majority of votes in one bishopric after another, and even in the imperial diets and in the law courts.

A revolt of the Bohemians (Protestant) against the house of Hapsburg precipitated a European war. The acceptance of the Bohemian crown by Frederick V of the Palatinate was a challenge on political as well as on religious grounds: for the other German states could never suffer one of their number to hold two of the seven electoral votes. The Pope, the king of Spain, the elector of Bavaria, even the Protestant elector of Saxony rallied to the Hapsburgs. Frederick proved but a winter king and, before a year was over, was decisively defeated on the White Hill near Prague. New allies came to the fore in time: Bethlen Gabor, prince of Transylvania; Mansfeld, the Savoy condottiere; Christian of Brunswick; the margrave of Baden Durlach, and, last but not least (1530), Gustavus Adolphus of Sweden. The emperor, Ferdinand II, would have succumbed to Gustavus Adolphus, who won a great victory at Breitenfeld and made a triumphal progress as far as Nuremberg, had he not, by enormous concessions, succeeded in inducing the mysterious Wallenstein, who was living in forced retirement, to re-enter his service. Wallenstein, endowed with dictatorial, almost royal rights, raised a huge army, compelled Gustavus Adolphus to withdraw from Nuremberg, and, finally, engaged him in a battle at Lutzau, near Leipsic, that cost the Swedish conqueror his life. Later, indeed, doubts arose in many quarters as to Wallenstein's ultimate purpose. As far as we can judge now, it was to dictate a peace to Germany even at the risk of having to intimidate the emperor. Just at what stage his dealings with the Swedes and Saxons became treasonable is hard to establish, but treasonable they were at the last. An order was given for his arrest, living or dead; and some of his own officers joined in a deliberate plot to kill him. His room was invaded, he himself stabbed in the breast (1634).

The war now entered a new phase. It was no longer merely a question of religious interests, for Catholic France joined in on the side of the Protestants. The struggle finally became one merely for compensation and costs. For four years it went on simultaneously with peace negotiations (at Osnabruck and Munster in Westphalia) which ended in an agreement as to mutual religious toleration and in a readjustment of the map of Europe. Unfortunately the boundary between Germany and France was established by an ambiguous formula and, later, led again to war (1688–97).

The most important development in the period following on the peace of Westphalia was the rise of the Brandenburg-Prussian monarchy. See Prussia. After the Great Elector (1640–1688) had consolidated his possessions, his son, Frederick III, was allowed to assume the royal title as compensation for aid furnished the Hapsburg emperor in the Spanish Succession War. The Spanish throne, vacant by the death of the childless Carlos II, was claimed by Emperor Leopold for his son Charles (VI), and by Louis XIV for his grandson, the duc d'Anjou. Against Louis XIV was arrayed the grand alliance, consisting of England, Holland, Austria, and the majority of the German states. With Louis were the electors of Cologne and of Bavaria. The war, which lasted 13 years, showed an almost unbroken series of victories — Blenheim, Turin, Ramilies, Malplaquet, and others — for the Grand Alliance. Yet by the treaty of Baden (1714) the German states gained absolutely nothing, England and Austria having already secured their own advantages by the treaties of Utrecht and Rastadt.

Meanwhile in Prussia (see Prussia) the first king, Frederick I, had been succeeded by the great organizer, Frederick William I, who remodeled the administration, brought the army to the highest pitch of efficiency, and placed the finances on a good basis. It was these reforms that enabled Frederick the Great to play a commanding rôle in European history. Scarcely had Frederick come to the throne (1740) when he made a descent on the Austrian province of Silesia, advancing old claims of his house, not altogether unwarranted, to a portion of the territory. Received with open arms by the inhabitants of Breslau, who had chafed under the Austrian rule, he won the battles of Mollwitz and Chotusitz, and compelled the Archduchess Maria Theresa to conclude the Peace of Breslau (1742) which left Silesia in his hands. Austria and England continued the war with France. Austria's growing strength and prestige, and especially the fact that, in 1744, she concluded a treaty with Saxony, determined Frederick to re-enter the arena. He did so ostensibly in support of the new emperor, Charles VII of Bavaria, the only man not a Hapsburg chosen to that position in 300 years. In the Bohemian campaign of 1745 Frederick suffered severe reverses, but at Hohenfriedberg, at Sohr, and at Kesselsdorf he gained important victories and was able to obtain at Dresden the same terms as in the Peace of Breslau, compelling Saxony, besides, to pay an indemnity. Charles VII having died, Maria Theresa's husband was now elected emperor, and took the name of Francis I.

Eleven years later Frederick, learning through secret channels that Maria Theresa, the Czarina Elizabeth, and Augustus of Saxony-Poland were plotting the dismemberment of Prussia, concluded the Convention of Westminster with England and prepared for a new war (1756). France, where Madame de Pompadour was now all powerful, joined the two empresses. Madame de Pompadour boasted that the Treaty of Versailles (May, 1750) was her work. It was followed by a second, offensive, treaty signed at the same place. See Peace Treaties. The odds against Frederick in this Seven Years War were very great, for though England sent him money and though she maintained an army of Hanoverians, she sent him no direct reinforcements. The allied forces often outnumbered his own by two and three to one, yet in the teeth of such superiority he gained some of his most splendid victories: Rossbach, Leuthen, Zorndorf, Liegnitz, and Torgau. There came a time, indeed, when even victories were of small avail, for there was no way of filling the ranks. The death of the Czarina Elizabeth (1762) did more for Frederick than many battles and even neutralized the effect of the desertion of England, which country, under the new Bute ministry, suddenly left him in the lurch and tried to compel him to make peace. The new Czar, Peter the Third, became Frederick's ally but was deposed before his troops could be of much assistance. France, however, had also withdrawn from the struggle and concluded the preliminary Peace of Fontainbleau with England. Maria Theresa saw the helplessness of continuing alone the task she had been unable to accomplish when aided by powerful allies, and sent an envoy to treat for peace. After seven weeks of negotiation an agreement was signed at the castle of Hubertsburg (1763) which in every respect was a return to the condition of things before the war.

Later Maria Theresa and her son, the Emperor Joseph, joined with Frederick and with Catherine of Russia in dismembering Poland — a step which the demoralization of the Poles invited if it did not excuse. Though Frederick the Great's share was but one-third the size of that of either of his allies, it was doubtless of greater proportionate value, as it comprised West Prussia, the land that had once belonged to the Teutonic Order, and rounded out his domains. Austria and Prussia once more went to war (1778–9), this time with regard to the Bavarian succession, claimed by Joseph. The acquisition of a German electorate would have assured the preponderance of Austria in all the affairs of the empire and would have been a fatal blow to Prussia. Frederick and his brother Henry took the field in person, but no battle of importance took place and the war was stopped by the intervention of France and Russia. Frederick devoted his last years to organizing a league of German princes for mutual protection against Austria. It was a powerful weapon, for three of the members were electors and might readily be in a position to frustrate the choice of a Hapsburg as emperor.

Frederick's policy of opposing Austria with the aid of other German states was not carried further by his successor, Frederick William II. Indeed the latter sided with Austria in an attempt to intimidate the French revolutionists, and joined with the Emperor Leopold II in the declaration of Pillnitz (1792). Frederick William himself took the field. The blatant manifesto of his chief commander, the Duke of Brunswick, roused the French to fury and encouraged them to win the battles of Valmy and Jemmappes (1792).

Frederick William's attention was diverted from France by further partitions of Poland (1793 and 1795) which gave him a vast territory; but the new provinces were badly administered and proved a source of weakness rather than of strength. Prussia had greatly lost her prestige even before Frederick William consented to the disgraceful Peace of Basel (1795), which secretly bound Prussia to non-interference even though France should annex the left bank of the Rhine. Austria was left to continue alone the struggle that had been begun in common, but in 1797 concluded the Treaty of Campo Formio, which contained secret clauses about the left bank of the Rhine similar to those signed by Prussia.

The Holy Roman Empire, as it was still called, was in an incredible state of disintegration. At the Congress of Rastadt (1798) the French envoys openly came out with their demand for Rhenish territory, and the dispossessed princes clamored for compensation elsewhere in Germany. A witty publicist thereupon drew up the last will and testament of the old empire. Austria renewed the war, indeed, but was defeated at Marengo and Hohenlinden and, by the Peace of Lunéville (1801), was obliged to take active part in the dismemberment of Germany. An executive council of the Diet, called the Imperial Deputation, passed a decree (1803) which practically annihilated more than 200 German states and divided up 50,000 square miles of territory. The compensations were arbitrarily apportioned so as to serve French interests, Napoleon Bonaparte's idea being to strengthen the South German states and create a "Third Germany" to be under his own influence. He treated Germany as conquered territory, sending his troops to occupy Hanover, carrying off and putting to death the duke of Enghien, who thought himself safe on Baden soil, and causing a bookseller of Nuremberg to be shot for selling a harmless publication which bewailed the general state of affairs.

The murder of the duke of Enghien was one of the occurrences that roused Alexander of Russia to form a third coalition which was joined by Austria and England, but not by Prussia. The Napoleonic victories at Ulm and Austerlitz (1804) routed this coalition, and by the Peace of Pressburg (1805) Austria was divested of 28,000 square miles of territory and 3,500,000 inhabitants; while Würtemberg and Bavaria, which had aided Napoleon, were raised to the dignity of kingdoms. They formed the nucleus of the Rhine Confederation, which now formally repudiated the jurisdiction of the Holy Roman Empire. This caused Francis I to abdicate the throne (1806), though he had carefully provided for the future, in 1804, by having the Hapsburg possessions declared an empire by themselves.

Prussia was now goaded into war with Napoleon by violation of her territory and by double-dealing with regard to Hanover. But never had a seemingly strong state shown more abject weakness; never was military organization more faulty. The defeats of Jena and Auerstädt (1806) were overwhelming and the fortresses with which the land was studded fell like houses of cards. A brief rally at Eylau, where the Prussians were joined by Russian forces, was followed by the defeat of Friedland which frightened Alexander into signing a truce. By the Treaty of Tilsit (1807), Prussia was humbled in the dust and was shorn of half of her provinces. They went to form the kingdoms of Westphalia for Jerome Bonaparte, and the duchy of Warsaw for the king of Saxony.

Then began a time of moral and physical regeneration. In every department arose earnest workers: Stein and Hardenberg, Scharnhorst and Gneisenau, Jahn and Arndt, Fichte and Schleiermacher. Austria, too, arose from her lethargy, but struck her blow at Napoleon too soon and collapsed after Wagram (1809). Napoleon made Prussia join him in his invasion of Russia, but his disasters gave the Prussians their longed-for opportunity. General Yorck, in command of a Prussian auxiliary force, renounced his allegiance to France, and even the phlegmatic Frederick William III was finally carried away. Landwehr and Landsturm were called out; England, Russia, and Austria came to Prussia's aid and the war of liberation began (1813). Napoleon returned from Paris with a new army and gained the battles of Lützen and Bautzen. But Blücher showed indomitable energy. After a series of defeats and one more victory Napoleon was penned in in Leipsic, and only escaped after an ultra-bloody three days' battle. He was eventually followed into France and was forced to surrender. His return from Elba and his defeat at Waterloo are too familiar to be more than mentioned. See WATERLOO, BATTLE OF.

The Congress of Vienna left Germany in a very unsatisfactory condition, as a loose confederation with Austria at the head, and with a Diet that was to meet at Frankfort. There was no central army, no treasury. The only means of coercion was federal execution, the deputing of one state to punish another.

The policy of the reactionary Austrian minister, Metternich, dominated the next 30 years. He made it his life-work to prevent the German states from introducing constitutional government. He saw conspiracies everywhere and became the bitter enemy of the Burschenschaften and Turnvereine, comparatively innocent student organizations which held meetings, like the Wartburg and Hambach festivals (1817 and 1832), where there were inflammatory demonstrations. The murder of the Russian agent Kotzebue by the Jena student Karl Sand enabled Metternich to thoroughly frighten Russia and Prussia, which had formed with Austrian a "Holy Alliance." Draconian decrees were passed, and a sort of revolutionary inquisition was established at Mainz (1819). The Burschenschaften were dissolved, but the discontent of the students simmered on until 1848.

The hope of Germany, as we know now, lay in the supremacy of the strongest state. It was a great step forward when, between 1828 and 1842, Prussia managed to enroll in her Customs Union all the other German states except Austria. Commercial hegemony then paved the way for political leadership. One deterrent was the imperviousness of the Prussian king to liberal ideas Frederick William IV steadfastly refused to give his subjects a written constitution, though at times using language that implied sympathy with the popular demands. In 1848 the happenings in France unchained the spirit of revolt all over Germany. There were bloody uprisings in Berlin and Vienna, and a national parliament met at Frankfort. The crown of a new empire was offered to Frederick William IV, but he spurned it as a crown plucked from the gutter and reeking like carrion. He got the better of the Prussian revolutionary parliament, but felt obliged to grant a constitution which, as he wrote to a friend, was liberal enough to make his own stomach ache. It is the constitution still in vogue in Prussia. The Frankfort parliament was finally dispersed by force of arms, and Prussia endeavored to form a "Union" of which she should be head (1849). At Olmutz (1850), at the peremptory summons of Austria, she desisted, and consented to a simple restoration of the old confederation, with its diet, as before, at Frankfort. To this diet the Prussian delegate was Otto von Bismarck who, for 10 years, made it his special task to combat Austrian pretensions. Later he attacked the problem by strengthening the Prussian state, being called by King William to be prime minister, and so put through a great increase in the Prussian army. This was done by technically unconstitutional means and in the teeth of violent opposition from the parliament, which was not appeased until the utility of the new measures had been proved beyond a doubt in the victories over Denmark (1864) and over Austria (1866). The Danish war had been undertaken in common with Austria because of Danish efforts to incorporate the province of Schleswig-Holstein; the conflict with Austria had arisen with regard to the disposal of the spoils. Austria, supported by the minor German states, had threatened federal execution. Prussia had accepted the challenge and declared her intention of founding a new confederation which the other states were to be compelled to join. After the swift overthrow of Saxony, Hesse, Hanover, and Nassau, and after the great victory over Austria at Königgratz, this plan was easily put into execution. Prussia became the head of the North German Confederation, from which Austria was excluded. By the mediation of the French emperor, Napoleon III, it was stipulated that the South German states might form their own organization, which they never did. Prussia was allowed to annex much of her conquered territory.

Napoleon's own prestige demanded that France, too, should have some annexations to show. He begged for the Rhenish provinces, he tried to buy Luxemburg. But Bismarck was inexorable. Hatred of Prussia became a dominant passion with the French, and when, in 1870, a pretext was found in the candidacy of a Hohenzollern to the vacant throne of Spain, the nation rushed joyously into war. When the candidacy was withdrawn the chamber sent an insulting demand that the king of Prussia should promise that it should never be renewed. Bismarck's publication of a terse version of the incident aroused intense excitement in Germany; but it was the French who began hostilities. Their total want of preparation and the wonderful organization of the Germans, for which Moltke was largely responsible, brought about the long series of French defeats and resulted in the capture of the two main armies, as well as of the emperor's own person (Metz and Sedan). After the successful siege of Paris the war closed with the treaty of Frankfort (May 10, 1871). Already on 18 January, by invitation of all the states, King William of Prussia had assumed the crown as German emperor.

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Ernest F. Henderson,
Author of 'Short History of Germany.'

3. **Germany—Political History (from 1871-1906).** The date of birth of the new German Empire, 18 Jan. 1871, marks the successful termination of the efforts of the German people, continued ever since the downfall of Napoleon, to reconstruct national unity; it marks also the beginning, for this Empire, of an era of deliberate consolidation within, as well as of a gradual, since 1890 however, more vigorous, expansion, less territorially than industrially, commercially, and culturally, into nearly every part of the globe. None of the other great powers has enjoyed, during the 35 years past, the blessing of a more peaceful development. During this period the population of the Empire increased from 1870–1890 by 8½ millions (from 41 to 49½ millions) and, in a much higher ratio, from 1890–1906 (January) by 11½ millions (from 49½ to 61 millions). From an inferior position the Empire rose to be second only to the United States in the production of iron and steel, second only to England in merchant marine tonnage and foreign commerce, and holds undisputed first rank in the excellence of ocean steamship building, in war materials, and first rank in volume also of the output of chemicals, of sugar, of printed books and music. Nor have the higher cultural affairs been allowed to lag behind in development: Germany still leads the world in the provision for and organization as well as the methods of learned and scientific research, in university and general school organization, in the cultivation of art and music. Since the country is not favored by great natural resources, it is obvious that man's will and intellect have overcome difficulties, triumphed over the material forces, and made the most of the situation. It is also evident that it required unusual wisdom and conscious effort in the policy of the nation, domestic as well as foreign, to bring about and safeguard this extraordinary development. The lack of perspective, of course, does not permit of a definitive estimate of this period, yet a review of it, in its more important aspects, clearly reveals the outlines of the main currents of historical development. Two periods are easily discerned; the one from 1870 to the resignation or dismissal from office of the first imperial chancellor in 1890; it is dominated by the personality and the leadership of him whose creation the new body politic may be said to be, Bismarck (q. v.). The second period, still in process, succeeds the first; it is outspokenly characterized by Emperor William the Second's (q. v.) personality. These two men are both leaders and types (the most pronounced, naturally) of the minds and men ruling and shaping modern Germany, they embody her spirit and energy much beyond the average measure. The men of the first, the Bismarckian, period quite logically entered upon the task of consolidating, and filling out, within the outer framework of the national structure. Germany, it was obvious, would have to be maintained principally, according to old political wisdom, by what had built her up, her military organization, defensive as well as offensive. The nation realized this fully, in fact nowhere is the army such a popular and, in the best sense, a democratic institution as with the Germans. The development of the army, in numbers, efficiency, technique, and organization, has been the paramount national concern, uniting, with the exception of the Socialists, all parties, north and south, Prussians and Bavarians, and the rest. When, in 1886, a great portion of the Liberals blunderingly opposed, for party reasons, measures calculated to increase the efficiency of the army organization, an appeal to the people in the new elections swept the extreme Liberalists into impotence. Pacificist arguments have evidenced no influence with a people so exposed, naturally, to foreign invasion.

Federal legislation covers a vastly greater area in the German Empire than in the United States. The execution of the Federal laws, however, is, different from the United States, entrusted to the judges of the States. Only the Imperial Supreme Court (Reichsgericht) at Leipzig, strictly speaking, is composed of Federal judges appointed by the emperor on nomination by the Federal Council (Bundesrat). German institutions resemble French ones in the fact of a stricter separation of administrative and of legal functions; they resemble Anglo-Saxon ones in the application of self-government principles. So, e. g., the 'Landgemeindeordnung,' an act of 1891 organizing rural communities in Prussia, is a continuation of the policy of administrative decentralization so successfully inaugurated by Stein in the Städteordnung. Gradually the legislative jurisdiction of the Empire was extended, after the Reichstag, in 1873, on an original motion by the National Liberal Lasker, had adopted the constitutional principle of Federal competency in all matters of legislation. Criminal and civil procedure were made uniform for the Empire and a uniform system of courts was established. Furthermore, a series of laws regulating and meeting new conditions in the rapid economic development of the country were framed and enacted as Federal laws, acts concerning trade organization, banking, merchant marine, patents, etc.

The adoption of the criminal and the commercial codes, the acts regulating citizenship, copyright, etc., mark important steps in the unification and consolidation of the German States. The culmination of this process was the introduction, as the result of many years of juristic codification, of the Imperial Civil Code ('Bürgerliches Gesetzbuch), in 1900. Roman civil and the territorial laws are thereby superseded by a law of distinctly more Germanic character. A unique legislative development is contained in the body of laws relating to workingmen and their conditions enacted since 1883 (Sozialgesetzgebung); partly as the result of the spread of socialistic agitation among industrial workingmen, an agitation which led, indirectly, to several attempts to assassinate Emperor William I. (in 1878 and in 1883), partly in recognition of the obligation of state and society to protect and assist the economically weak in their struggle for existence. Besides these labor laws, e. g., protecting children and women, and establishing courts for settling minor industrial disputes, a series of insurance and pension laws for the laboring classes came into existence, insuring (in 1900) about nine millions of working people against sickness, 17 millions against industrial accidents, and securing for 13 millions pensions in case of permanent infirmity, and at the age of 70. In the same year the Empire's and the employers' share in the payment of premiums amounted together to 200 millions of marks. An Imperial Insurance Office (Reichsversichrungsamt) and numerous branch offices carry on the immense executive business of this legislation. It is true the Socialist vote, in spite of all that, has steadily increased, numbering, in 1903, more than three millions, but it is also true that the intransigent radical character of the movement is slowly but surely decreasing.

It is evident that Bismarck (cf. his 'Memoirs') was to some extent influenced, if not carried away, by doctrines of Liberalism, when he entered into the conflict with the Catholic Church (Kulturkampf). Since the Vatican Council had adopted the dogma of papal infallibility, Liberals and Liberal Catholics (these latter ones headed by the learned Bavarian Ignaz Döllinger) had been thrown into a state of uneasiness, since, by origin and application, the dogma was clearly anti-German and obviating German political consolidation. It is a fact, however, that principally these hierarchical tendencies urged Bismarck to the direct attack on the Church by a number of restrictive and disciplinary laws (Maigesetze) excluding the Jesuits and similar congregations from Germany, and pronouncing a number of principles of State authority over ecclesiastic affairs. By combining the Catholics with the separatist and anti-imperial tendencies of the Guelphs, Poles, Alsatians, and part of the Bavarians, the Center Party, in consequence of these laws, was organized, principally by Windthorst (q.v.) into the strongest party of opposition to the imperial and consolidating policy of Bismarck. When, in 1878, Leo XIII. succeeded Pius IX., and William I. feared for a dangerous loss of religious spirit among his Catholic subjects, peace between State and Church was obtained by compromises and gradual abolition of the most offensive and disquieting church laws. Yet the State retained a number of valuable conquests, e. g., relating to so-called mixed marriages, school supervision, etc., and succeeded in strengthening materially the patriotic devotion of Catholics to the Empire and its future, and weakening the fierceness of partisan strife which was the curse of German political life for centuries. But if we believe with Treitschke that men make history, too much importance can hardly be given to the uplifting and unifying effect of those personalities with whose names the founding of the Empire is associated, Moltke, Roon, and more than these, William I. and Bismarck

William I. and Bismarck.— William I., king and emperor, through his very personality, gave the Germans, in an age of liberal and republican tendencies, a new and genuine love and respect for monarchial institutions, which, since his death, have been rather strengthened by domestic and foreign experiences. This strong and dignified man was again, in the fullest sense, what his ancestor, Frederick the Great, had been, but on a firmer, a nonautocratic basis, the first servant of the State. A modern German writer calls him a patriarchal educator of the German people, "a plain German, honest, sincere, just, benevolent, sensible, unselfish, God-fearing. In him was embodied heroic gallantry, a strongly national and lofty sense of honor, faithful and laborious fulfillment of duty in the service of his country." And yet the greatest has not been told without an appreciation of his unusual ability to select and his loyalty toward the great men, whom he was blessed to encounter in his life, especially toward the greatest of them all, Bismarck. He, in a higher sense even than Luther or Frederick the Great, will stand in German history as the national hero, the representative German, to speak with Carlyle and Emerson. He united where Luther was forced to disunite, and he embodied, in his person and his works, both the conservative and the liberal elements, the traditional and the modern views, from the harmonious union of which emanates that healthful realism or practical idealism that makes nations prosper. Bismarck, more than any other German, has won for the Germans a national consciousness and pride which with other nations are a long inheritance. The verdict of the great conductor, von Bülow, that Beethoven's 'Eroica' had at last found its hero in the welder of German national existence is accepted as the verdict of his people. The sculptor Lederer, in the colossal statue of Bismarck erected by the city-republic of Hamburg to its friend and benefactor, represents him as a modern and idealized Roland, in whom the mediæval Hansa towns personified their civic liberties and independence. So the people's imagination, like the artist's, is simplifying the character of the first chancellor into an heroic type of colossal outline: the creator as well as the conservator and guardian spirit of his nation's greatness and might. Bismarck was, unlike Napoleon, a religious man; he felt himself to be a soldier of God in the service of his king and his people. His loyalty toward his monarch springs from this source, also his keen appreciation and respect for the subtler feelings of his people, which the political doctrinaire never takes into account. He never interfered with these feelings needlessly, that is, unless a higher duty, the ideal of national unity and power, was involved. His critics, incompetent ones, who have no sympathy with his soul nor his ideals, see him merely as the man of blood and iron, who, however, was possessed of the tenderest feelings toward his wife and family, and whose heart beat with horror and was full of responsibility at the thought of war and its effects. The Napoleonic "hybris" which trampled underfoot everything in the way of its self-aggrandizement was not in Bismarck. While Napoleon's work was shattered, most of it, Bismarck's will stand as long as true patriotism shapes the destiny of his creation.

Bismarck opposed unnecessary centralization and red tape; the smaller States in the federation and their rulers could rely on him as their stanchest friend as long as they were loyally and actively engaged in the affairs of the whole empire. Unlike Napoleon, after the state of saturation, on national lines, was reached with the foundation of the Empire, he never conspired to annex, or force into the federation against their will, smaller States, like Belgium, Holland, Switzerland. He resisted also all agitation for a similar union of German Austria to the Empire. His whole life was spent in uniting and consolidating the unity of his people. Even when grudgingly aloof from the affairs of state after his dismissal, he advised and cautioned his nation from the fullness of his experience. In his memoirs he left the Germans a treasure of history and political wisdom in classical German. The sociologist and sometime Austrian minister, Albert Schäffle, speaks in his memoirs of a meeting with Bismarck who consulted him regarding the plans of the workingman's insurance laws, as follows: «The most interesting feature of this interview I feel to be the perception, how Bismarck took in at a glance, with the intuition of a genius, the situation and all its circumstances, even the remotest, bearing on the immediate success, nor did he neglect those facts that at present seemed to be irrelevant but were bound to be of importance later on. Then I understood the secret of his great success and of his power, but also the reason for his many changes of tactics and temporary retreats in his political career.»

Bismarck succeeded, after 1871, in preserving the peace for the Empire. Twice the country was on the brink of war with France, in 1875 and in 1887 (Boulanger); both times his calm conduct and his firmness in carrying through defensive measures, averted the war. When Russia, in 1879, after her diplomatic defeat at the Berlin peace congress, in her Balkan policy, threatened an alliance with France, he entered with Austria into the «Zweibund,» which became the «Dreibund» by Italy entering the alliance in 1883. Especially the relations of the Empire to Austria have become more and more friendly and close, from geographical, racial, and economic reasons. Bismarck had worked toward this ever since 1866 with steadfastness and clearness of vision. The recent troubles of Russia with its resulting new grouping of powers still leaves the German Empire in i. itary predominance on the Continent, even without Italy staying in the triple alliance.

When William the Second succeeded his unfortunate father in 1888 it soon became apparent that he, as Bismarck had prophesied, would be his own chancellor. It was the temperament and the whole high-strung individuality of the young ruler that made impossible the co-operation of two so masterful minds. Yet, with some oscillations due to the nervousness besetting public life after this sudden change, the traditional policy within and without was carried on on Bismarckian lines. In foreign relations William II. continued to cultivate the friendship and close defensive alliance with Austria-Hungary. He succeeded also in changing the attitude of the influential Danish court and of the Danish nation into one of friendliness, and with singular tenacity he gained friendship and influence with the Sultan for a far-sighted policy of cultural expansion in Asia Minor, Mesopotamia, and Syria. The military equipment of the nation was constantly developed. The success, since, of the Turkish, Chilean, and Japanese pupils of Prussian drill and strategy, has given abundant proof of its efficiency and up-to-dateness.

But the young emperor, and the younger generations with him, could not nor would content themselves with simply preserving what their ancestors had won for them; they pushed since 1890 with business energy into what is known as «Weltpolitik.» In the struggle for existence the fittest, nation or individual, will survive. The German nation holding such a high and unique rank among peoples, a model and a prototype for other civilized peoples, is determined to take its share of the white man's burden so-called, and to play its melody in the symphony of human culture in every part of the globe. Its paramount position in some of the highest concerns, its efficiency, honesty, and energy are so many valuable assets also of humanity, for the loss of which the world would be greatly impoverished. This is the spirit agitating young Germany and its emperor and leading them on to their destiny.

There can be no doubt that since William II.'s accession Germany's progress has been phenomenal, and it is also probable that with Bismarck's influence still omnipotent this progress would not have been so great. What was the immediate occasion, not though the cause, of Bismarck's resignation, the conflict of opinion about the policy to be pursued in regard to the Socialists, demonstrated the young emperor to have definite ideas of his own. The law against the Socialists was, in spite of Bismarck's wish, not renewed. There is no discrimination, any more, under the law, against Social Democrats. The wisdom of this measure will be appreciated only in times to come, since the numerical development of the Socialist party seems, at present, to speak against it. More immediately successful were the emperor's efforts to win over the Catholic Germans for a vigorous and patriotic participation in the national affairs. In this connection may be mentioned the extremely intimate relations the emperor entertains with Cardinal Prince Bishop Kopp and Cardinal Archbishop Fischer, of Breslau and Cologne, respectively. In fact, it may be said that the emperor's fervent patriotism, his optimism and energy, his Americanism one might say in this respect, has done immeasurable good in neutralizing that sectional strife and the spirit of partisanship so dear to the German heart. Whether Conservative or

Liberal, Catholic or Protestant, Jew or Gentile, all are carried along by their sovereign's lofty idealism, his sense of impartiality, that makes only one supreme demand: unflinching, active devotion to the nation's greatness.

There is no real break in the Bismarckian tradition of economic policy. Bismarck, at first rather favorable to free trade, for reasons of industrial development as well as for financial or fiscal purposes entered, in 1879, on a protective policy extending to grain, wood, iron, wine, tobacco, coal oil, coffee, etc. Under William II. this policy was continued but, since 1893, partly neutralized by a system of reciprocity treaties which favored especially the exporting industries. The farming interests of the nation (*Agrariertum*) were aroused by these, however, and the urgent necessity of protecting the bone and sinew of the population, the source of its military and, indirectly, also its industrial strength, its farmers, finally culminated in an elaborate revision of the tariff, prepared with extreme care and scientific acumen in the new *Zolltarif* of 1904. No doubt that this new tariff which raises the duties especially on food stuffs of every description, but also on industrial products, was brought about by the agrarian movement and by the protective tariff legislation of the United States with its almost prohibitive duties. The German tariff, though, provides for differential duties on the basis of which a number of countries (Russia, Austria, Sweden, etc.) have already come to trade arrangements with the Empire, thereby assuring a steady advance in the enormous export trade of Germany.

Gradually, although reluctantly, Bismarck had yielded, from 1884 on, to the increasing demands of the commercial interests of Germany for the acquisition of colonies. German Southwest Africa, German East Africa, Kamerun, Togo, German New Guinea, the Bismarck, and some smaller archipelagoes were acquired up to 1890. Part of East Africa (Zanzibar, Uganda, Witu) were exchanged in 1890 for Helgoland, an inadequate compensation for Germany. Since them most of the Samoa Islands have become German territory, in 1898 and in 1899 the Caroline Islands were bought from Spain in the great liquidation of her colonial possessions. Also in 1898 Kiautschou was leased from the Chinese government to serve as a German Hongkong for trade development with China. Coercive actions had to be undertaken, e. g., against Hayti and Venezuela in 1902, the latter in concert with Italy and England. The last few years in German South Africa necessitated elaborate measures for putting down the Herero rebellion, but this brought about also a renewed interest in the development of the only German colony fit for permanent settlement of white people.

While all these measures and events were, to some extent, prepared and initiated by Bismarck, there are yet two problems to be mentioned, which owe to William II. most of their solution so far attained, namely, the reform of the higher (secondary) school system in Prussia and the development of the German navy to such adequate proportions as befit Germany's position as the second country in foreign trade and in ocean transportation and the third as a colonial power. Both questions are, not directly but indirectly, related to another.

The school system of Prussia (the other States do not differ materially) has demonstrated its supremacy for the training of scholars of all sorts, of experts in every science, of officers, military and civil, of engineers and merchants, to a degree that admits of no questioning of its results. But, so it seems to the emperor and many others, its success in making its pupils for all intents and purposes good Germans, wherever they might be, and to fill them with the pride of a nation which yields to none in patriotism and devotion to its own highest interests, is more than doubtful. The deplorable and, from the German point of view, indecent and degrading easiness with which Germans renounce allegiance to their people and its political and cultural mission, clearly points to a defect in the schools. The demand is that they have to be national throughout, while preserving their excellent facilities for training along special lines. This nationalizing of the schools, i. e., to require from them what the American school system is doing so successfully for its own purposes, is carried into the lower schools (*Volksschule*) with no great difficulty. But in the higher schools the obstinacy of pedagogues only reluctantly yields to the pressure of the emperor who in this undoubtedly represents the best interests of the country. Especially the so-called humanistic schools (Gymnasien) gave little assurance of the recognition of German, German literature, and German history as the studies of paramount importance and interest for all German schools, higher and lower. A conference called together and addressed in this sense by the emperor in 1890 led to a compromise which preserved, practically, all the privileges of the Gymnasium while at the same time endangering its efficiency for mental training so well established. A second conference resulted in what must be considered a satisfactory arrangement. It was admitted that the principal aim of the higher schools must be to educate young Germans able to cope with the questions and conditions confronting them, not young Romans or young Greeks, if the latter were at all possible. Each of the three forms of higher schools (Gymnasium, with Greek and Latin, Realggymnasium with Latin, modern languages, and mathematics, Oberrealschulen with modern languages, mathematics, and the sciences as central studies of mind discipline) grant the same privileges as to admission to the universities. A wholesome competition of the three kinds of schools may now be expected. It is quite in consonance with this policy that the emperor endeavored to raise the standing, in the social estimation, of the men of practical affairs, business, industries, technology, to the level of military or civil officers or professional men. The great technical universities (Polytechniken) were given the privilege of granting degrees of Doctor of Engineering and they are also represented now in the Upper House of the Prussian Diet. Prussia in this set the pace for the other German States.

The German navy as it is to-day, by no means the largest, but perhaps one of the most efficient, modern, and well equipped for naval warfare, is almost exclusively the work of William II.'s initiative and untiring agitation. The nation, at first, was quite unwilling to enter on a scheme of extensive naval construction. Grad-

WILLIAM II., EMPEROR OF GERMANY,
IN ADMIRAL'S UNIFORM.

ually only the enthusiasm of the young men was able to win over the cautious older generations. Recent developments, though, beginning with the Spanish war of the United States, the Boer war, and most of all the Japanese-Russian sea-fights, have brought about the determination of the German nation to build a navy so strong as to be independent of any one's good will and mercy in the protection of its own interests, colonial and commercial. The recent Delcassé incident with its revelations has confirmed this determination. Immediately after the Moroccan difficulties had disclosed the intentions of England and France against Germany, the Reichstag, for the first time in its history, voted unanimously and without much debate the adoption of the naval budget of the government. William II. has his nation, the socialistic iconoclasts excepted, behind him in this greatest national problem.

William II. has been conspicuous before the eyes of the entire world ever since he came to the throne in 1888, a comparatively young man of 29, and the world is not likely to lose its interest in his personality. It has been emphasized how intimately he is identified with the great immanent tendencies at work in the German nation. As President Roosevelt may be called a type, not the only one, but the most characteristic of the modern American generation, of the American young man, so William II. is typical and characteristic of the modern German. From this fact comes the best assurance of historical eminence, which, otherwise, in the case of a living person, would be nothing but vague calculation, which might or might not come true. But William II. leads his nation, heads it, directs it, as a born leader, as the first and most loyal patriot, the most indefatigable worker for Germany's future. His civil governor, Professor Hinzpeter, observed in the boy and youth an extraordinary and strongly marked individuality, a masterful, sovereign character in the true sense of the word, in whom conservative and progressive elements and inclinations were indissolubly blended. Never, though, has he overstepped the privileges given him by the constitution, which cannot be said of all the rulers of to-day, but these privileges, great as they are, he has made use of and uses to their very limits. He holds office, he rules and reigns by what appears to him as a divine commission. His deep religiosity, so tolerant toward every form of belief, his avowed Christianity, makes him conceive of his duties as a ruler such as perhaps no other living sovereign or president. In one of his speeches (he is perhaps the greatest living impromptu orator on serious matters) he expressed himself thus as to his duties: «The royal office with its burden of duties, its never-ending, ever-enduring cares and labors, with its awful responsibility toward the Creator alone, wherefrom no man, no minister, no house of representatives, no people can relieve the sovereign.»

There is in this monarch a most remarkable mixture, or better an harmonious amalgamation, for there is no split in his character, of romantic and idealistic ingredients with the most modern ones of a nervous energy, a strong optimism, and a bent toward an active, strenuous life, devoted to practical realistic ends. In this he represents, like Bismarck, the extreme counterpart of that contemplative, pedantic type of Germans so prevalent and so efficient in its way since the great cultural renaissance after 1700. His range of interests, his information on many subjects, is truly astonishing, his mental alertness likewise, and all who have had the opportunity to speak and come into personal touch with him testify to his unusual personal magnetism, which overpowers even his severe critics. This man, who is the very incarnation of royal demeanor and dignity at all official occasions, delights in good fellowship when he is not under functional restrictions. In spite of impetuousness, and what sometimes seems to be an erratic nervousness, every close observer sees in him a singular steadfastness and tenacity in pursuing his political ends. What some critics, German ones especially, have called his «Zickzackkurs,» has never dimmed his vision of nor changed his resolution to obtain his final aim. Aside from his religiousness and his pious devotion to the spirit of his ancestry one must mention also his pure and happy family life among his conservative traits that go far in explaining the health and vigor of this truly strenuous life.

A few words remain to be said about the development of political doctrine in this period. Heinrich von Treitschke is the great and passionate political writer of the constructive period of the Empire, of the Bismarckian era; next to him in importance is Gustav Freytag. They cannot be identified with any party platform, the former being more conservative, the latter more liberal in his fundamental views. Among the present political writers are found Franz Mehring, the Socialist, and Maximilian Harden, essentially a negative mind and critic, a professional «kicker.» Among the constructive critics we find conspicuous Hans Delbrück, professor of history in Berlin University, Carl Jentsch, a former priest, and Friedrich Naumann, formerly a Protestant minister. The Pangermans (Alldeutsche) represent what in English-speaking countries are the Pan-Anglo-Saxon world saviors.

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Germany, Rulers, Emperors, and Kings of. Up to the treaty of Verdun (843 A.D.) we can not speak of a king or emperor of Germany. Charlemagne was "King of the Franks" and "Emperor of the Romans." But as he was the first to unite all the elements that later made up Germany, he rightly heads our list.

NAME	Dynasty	Date of Reign
Charles the Great or Charlemagne	Carolingian	768–814
Louis the Pious (emperor)	Carolingian	814–840
Lothair (emperor)	Carolingian	840–843
Louis the German (first real king of Germany)	Carolingian	843–876
Charles III. the Fat (king and emperor)	Carolingian	876–888
Arnulf (king and emperor)	Carolingian (illegitimate)	887–899
Louis the Child	Carolingian (illegitimate)	899–911
Conrad I	Franconian	911–918
Henry I. the Fowler	Saxony	919–936
Otto I. the Great	Saxony	936–973
Otto II	Saxony	973–983
Otto III	Saxony	983–1002
Henry II. the Holy	Saxony	1002–1024
Conrad II. the Salian	Franconian	1024–1039
Henry III	Franconian	1039–1056
Henry IV. (whose reign was interrupted by the four following)	Franconian	1056–1106
Rudolph of Swabia	....	1077–1081
Herman of Luxemburg	....	1081–1087
Conrad (son of Henry IV.)	....	1093–1098
Henry (son of Henry IV.)	....	1105–1106
Henry V. (same as above)	Franconian	1106–1125
Lothair the Saxon	Saxony	1125–1137
Conrad III	Hohenstaufen	1138–1152
Frederick I. Barbarossa	Hohenstaufen	1152–1190
Henry VI	Hohenstaufen	1190–1197
Philip of Swabia / Otto IV. } Jointly	Hohenstaufen	1197–1208
Otto IV. (alone)	Guelph	
Frederick II. (whose reign was interrupted by the following)	Hohenstaufen	1208–1215
	....	1215–1250
Henry (Landgrave of Thuringia) merely nominal	....	1246–1247
William of Holland (chosen by the ecclesiastical electors merely nominal	....	1247–1256
Richard, Duke of Cornwall, England, merely nominal	....	1257–1272
Alphonso of Castile, merely nominal*	....	....
Rudolph	Hapsburg	1273–1291
Adolphus	Nassau	1292–1298
Albert I. of Austria	Hapsburg	1298–1308
Henry VII	Luxemburg	1308–1313
Louis IV. } Were contenders.	Bavaria	1314–1447
Frederick the Fair } Were contenders.	Austria	1314–1330
Charles IV	Luxemburg	1347–1378
Gunther, Count of Schwarzburg (rival king)	....	1349
Wencelaus (deposed)	Luxemburg	1378–1410
Rupert, Count Palatine	Bavaria	1400–1410
Sigismund of Brandenburg	Luxemburg	1410–1437
Jobst of Moravia (pretender)	....	1410–1411
Albert II	House of Austria Hapsburg	1437–1439
Frederick III	Hapsburg	1440–1493
Maximilian I	Hapsburg	1493–1519
Charles V.	Hapsburg	1520–1556
Ferdinand I	Hapsburg	1556–1564
Maximilian II	Hapsburg	1564–1576
Rudolph II	Hapsburg	1576–1612
Matthias	Hapsburg	1612–1619
Ferdinand II	Hapsburg	1619–1637
Ferdinand III	Hapsburg	1637–1658
Leopold I	Hapsburg	1658–1705
Joseph I	Hapsburg	1705–1711
Charles VI	Hapsburg	1711–1740
Charles VII	Bavaria	1742–1745
Francis I	Hapsb'g-Lorraine	1745–1765
Joseph II	Hapsb'g-Lorraine	1765–1790
Leopold II	Hapsb'g-Lorraine	1790–1792
Francis II	Hapsb'g-Lorraine	1792–1806
William I**	Hohenzollern	1871–1888
Frederick	Hohenzollern	1888
William II	Hohenzollern	1888–

* The period from 1250 to 1272 is generally called an interregnum.

** Between the end of the "Holy Roman Empire" (1806) and the beginning of the new German empire (1871) fall the German Confederation (1815–1866) and the North German Confederation (1867–1871).

Consult: Henderson, 'A Short History of Germany' (2 vols., N. Y. 1902). At the head of each chapter will be found further references.

4. Germany — History of the German Language. The Modern German Language, as written, spoken on the stage and also, with certain provincial variations, in the ordinary intercourse of the educated classes of the German Empire and of parts of Austria and Switzerland, is a literary language which has arisen by a process of selection and refinement from the popular dialects formerly used in their respective territories and preserved even now in the natural speech of the uneducated and, to some extent, in dialectic literature. At the beginning of historical tradition these dialects, in their entirety, had certain important characteristics which justify their classification under the common head of German. They were distinguished from, though closely related to, the Frisian and the Anglo-Saxon, and together with them they constituted the West Germanic branch of the Germanic family of languages, the other branches of which were the East Germanic, comprising Gothic, Vandalian, Burgundian, and the North Germanic, or Scandinavian, comprising Swedish, Danish, Norwegian, Icelandic. From the beginning, two main groups may be distinguished: High German and Low German, the former spoken in the hilly and mountainous midland and South, the latter in the low and level North. High German differs from Low German and from all the other Germanic dialects chiefly by the so-called High German shifting of consonants, which probably took place between A.D. 500 and 700. By this process original *d* changed to *t;* original *t*, initial and after consonants (or doubled) to *z* or *tz* (pronounced *ts*), after vowels to a sound similar to *s*, which much later became identical with *s;* original *p*, initial and after consonants (or doubled), to *pf*, after vowels to *ff*, *f;* original *k*, initial and after consonants (or doubled) in the extreme South only, to *kch*, later *ch*, after vowels to *ch*. A similar change, sometimes classified here, original *th* to *d*, began much later, but spread over the entire High and Low German territory. In consequence of these changes High German differs in its consonants more widely from Modern English than do the Low German dialects. Examples:

English.	Low German	High German.
day	*dag*	*tag*
tide	*tid*	*zeit*
plant	*plante*	*pflanze*
water	*water*	*wasser*
pipe	*pipe*	*pfeife*
corn	*korn*	(*chorn*, *Alemannian*)
make	*maken*	*machen*
that	*dat*	*das*

One of the chief divisions of Low German, Low Franconian, gradually separated from the other German dialects and developed a literary language of its own, which in its modern form is called Dutch or Hollandish. Hence «Low German» is sometimes used in the more restricted sense excluding Low Franconian. The dialects thus designated were for a long time used extensively for literary purposes, but gradually High German gained ground, and by the end of the 16th century Low German had almost ceased to be written, the people of the North adopted the common High German literary language for all higher purposes, and the use of the Low German dialects, in their modern form also called Plattdeutsch, was restricted to more intimate intercourse and to consciously dialectic literature. The modern literary language has drawn upon Low German for contributions to its vocabulary, notably terms relating to the sea, navigation, and transmarine commerce, but in the main it is based upon High German dialects. The latter form two groups: Middle German and Upper German. Middle German comprises Franconian (not including the Low Franconian mentioned above) and Thuringian, Upper Saxon, and Silesian. Upper German comprises Alemannian with its subdivisions Swiss and Swabian, and Bavarian, which includes Austrian.

At first all the dialects ranked practically alike, every writer using the speech of his own region. There was, indeed, at first no name of national significance applied to the whole group of dialects; the word *deutsch*, which later came to mean «German,» denoted originally "popular," and was used mainly of the language of the people as distinguished from Latin, which was the language of church, school, and, to some extent, of government. This indicates the beginning of a struggle for pre-eminence between German and Latin which continued for many centuries and which may be characterized by a few especially important facts and dates. Religious writings in poetry and prose are found in German as early as the 8th century, but for a long time the majority of them continued in Latin. About 1230 we find the first code of laws in German, the Low German Sachsenspiegel, also the first history in German, a chronicle of the world (in Low German), and the first legal documents; but for many years afterward Latin continued to be used alongside of the vernacular for all such purposes. The Reformation gave a great impetus to the use of German for all literary purposes, but even in 1570 70 per cent of all the books printed in Germany were in Latin, and as late as 1691 more than 50 per cent. In the winter of 1687-1688 Christian Thomasius gave at Leipzig the first lectures in German in any German university. Even works of poetry were up to the 17th century mostly in Latin. By the end of the 18th century the use of Latin had become generally limited to a few branches of learning, chiefly philology and jurisprudence.

It is customary to divide the history of the German language in three periods. The first of these, from the beginnings to about 1150 (Old High German, Old Low German), was characterized by full inflectional and derivative suffixes, showing a great variety of vowels: *singan*, *singu*, *singit*, *sungun*, *sungīn*, *gasungan*, *salbōta*, *lebēta*, *zunga*, *zungūn*, *guotēr*, *guotaz*, etc. From the beginning a tendency to weaken these endings is noticeable and by the end of the period their vowels had, with slight exceptions, been reduced to the indifferent *e:* *singen*, *singe*, *singet*, *sungen*, *süngen*, *gesungen*, *salbete*, *lebete*, *zunge*, *zungen*, *guoter*, *guotez*, etc. Another important change affected the stem vowels, namely, vowel assimilation or "Umlaut:" when the suffix contained an *i* or *j*, *a* changed to *e*, e. g. *gust*, pl. *gesti* (later *geste*, now written *Gäste*); *ū* changed to *ü* (written *iu*), e. g. *hūt* (now *Haut*), pl. *hūti*, *hiute* (now *Häute*); *uo* changed to *üe*, e. g. *vuoz* (now *Fuss*), pl. *vuozi*, *vüeze* (now *Füsse*), etc. The change from *a* to *e* took place in the 8th century; the others do not appear in writing until the end of the period. The period was further characterized by crudity of vocabulary and of syntax, the latter due chiefly to the fact that the grammatical means of subordination, viz. relatives, conjunctions, and a characteristic word order, while already in existence, were not yet fully developed. Translations from Latin clearly show the inadequacy of the language to render easily sentences of complex periodic structure. During the period also a considerable number of words were adopted from the Latin. The oldest stratum of these was due to the first contact with the Romans, from whom the Germans learned some of the fundamental arts of civilization. Hence terms referring to commercial intercourse like *Pfund* (Lat. *pondo*), *Münze* (Lat. *moneta*), *Strasse* (Lat. [via] strata), *Zoll* (Lat. teloneum, Low Lat. *toloneum*), *Meile* (Lat. *milia* [*passuum*]), etc.; the names for the months, *Januar*, *Februar*, *März*, etc., which supplanted the native *Wintermonat*, *Hornung*, *Lenzmonat*, etc.; terms relating to building, *Mauer* (Lat. *murus*), *Pfeiler* (Late Lat. *pilarius*), *Keller* (Late Lat. *cellarium*), *Kammer* (Lat. *camera*), *Ziegel* (Lat. *tegula*), etc.; terms of agriculture, horticulture, and especially viniculture, *Pflanze* (Lat. *planta*), *Sichel* (Lat. *secula*), *Pflaume* (Lat. *prunum*), *Wein* (Lat. *vinum*), *Winzer* (Lat. *vinitor*), *Essig* (Lat. *acetum*), etc.; terms relating to cookery and eating, *Koch* (Lat. *coquus*), *Schüssel* (Lat. *scutella*), *Tisch* (Lat. *discus*), *Kessel* (Lat. *catinus*), *Becken* (Low Latin *bac-*

cinus), Kohl (Lat *caulis*), *Pfeffer* (Lat. piper), etc. The second stratum includes the terms relating to the Christian church, the oldest of them of Greek origin, e. g. *Kirche* (Gr. *kyriake*), *Pfaffe* (Gr. papas), the majority from the Latin, e. g. *Messe* (Lat. *missa*), *Kreuz* (Lat. *crucem*), *predigen* (Lat. *praedicare*), *kasteien* (Lat. *castigare*), etc.; also terms relating to school and the art of writing, e. g. *Schule* (Lat. *schola*), *Tinte* (Lat. *tincta*), etc. Sometimes Latin influence is seen in the make-up of a compound of native elements, e. g. in *Gevatter* = Lat. *compater*, *Gewissen* = Lat. *conscientia*. Most of the words of these oldest strata have been thoroughly assimilated in form and meaning, and few have ever been given up again.

The second period, from about 1150 to about 1500 (Middle High German, Middle Low German), was characterized by smoothness and melody of sounds, simplicity of grammatical forms, flexibility and variety of construction, and great richness of vocabulary. This was particularly true of the language of Middle High German poetry during the 13th Century, which was not inferior to any medieval language as a means of poetic expression. It showed in all parts of the High German territory such a uniform poetic diction and technique, that scholars for some time assumed for this period the existence of a common literary language ranking above the dialects. This is now generally regarded as overstating the case; the poets traveling much from place to place probably learned to avoid words of distinctly local color and range, but in regard to pronunciation greater variety must have prevailed than the unreliable spelling of later manuscripts and the uniformized spelling of modern text editions suggest. The language of the prose literature of the time, homilies, chronicles, philosophical works, shared in this improvement over that of the preceding period. If the impetus given to literature by the Crusades, by the bloom of chivalry, and by other contemporary events and conditions had continued, it is likely that a common literary language ranking superior to the dialects would before long have developed; but the impetus was of short duration and in the middle of the 14th century we find, together with the decay of chivalry and literature, a rapid deterioration of the language and a great increase of dialect differences. For this reason the time from about 1350 to about 1500 is sometimes reckoned as a transition period. The contact with French knighthood during the Crusades and the predominating social and literary influence of the French during the whole period of chivalry led to the introduction of many French words. Some of them, being technical terms, were given up again with the things they represented; others are still in common use, e. g. *Abenteuer* (Fr. *aventure*), *Lanze* (Fr. *lance*), *Palast* (Fr. *palais*), *prüfen* (Old Fr. *pruef*), *preisen* (Fr. *priser*). German thus gained even two important and prolific suffixes: the Old French verbs in *-ier* (Modern Fr. *-er*) were adopted with the infinitive form *-ieren*, e. g. *parlieren* (Old Fr. *parlier*, Modern Fr. *parler*), and this suffix then spread to other verbs of foreign and later to such of native origin, e. g. *komponieren* (Lat. *componere*), *halbieren*, *irrlichtelieren*; the French suffix *-ie* (Lat. *-ia*), Middle High German *-ie*, gave by regular phonetic change Modern German *-ei*, e. g. *Melodei* (but also, under a re-assertion of French influence, *Melodie*), hence *Büberei*, *Druckerei*, etc.

The third period, from about 1500 to the present day (New High German, New Low German), is characterized by the creation of a common literary language and its superimposition upon the dialects. The latter continued to develop and diverge, and an inhabitant of the extreme South would now probably find it difficult, if not impossible, to communicate with one from the North if each could understand only his own dialect. The common language was composed of elements contributed by the dialects, but its spread was not brought about by the assimilation of dialects, but by the substitution of the common language for the dialects for one purpose after another, by one class of the people after another, in one region after another. The beginnings of this common language may be traced back to the middle of the 14th century, by which time German had generally taken the place of Latin in public documents. From 1347 for almost a hundred years the chancery of the Empire was located at Prague, in the borderland between Upper and Middle Germany. The documents issued from here were written in a language in which Bavarian-Austrian and Upper Saxon elements were blended, which was comparatively readily understood in other parts of the country, and which the chanceries of the various German states found therefore easy to imitate. The chancery of the Elector of Saxony was among the first to approximate to the language of the Imperial chancery; others followed and thus a larger and larger part of the country came to make use of a comparatively uniform language for the business of government. The extension of the use of this common language to general literature and finally to all the higher forms of intercourse was largely due to the enormous popularity and deep influence of Luther's writings. The great reformer deliberately and avowedly chose as his medium the language of the Saxon chancery, and he was therefore not, as he has been often called, the creator of the modern German literary language; but while his standard served him well enough in matters of linguistic form, the chancery language, owing to the limited range of subjects treated in public documents, could offer him little help as regards words and idioms. Luther had a remarkable natural command of language, but he also proceeded with the utmost care and spared no pains to learn from the mouths of the people and through his correspondence with men in all parts of the country the most widely understood and yet vigorous and effective forms of expression. Thus the form as well as the substance of Luther's numerous writings caused them to find a ready reception and enormous sale throughout the country, and his prominence in the most important affairs and the most stirring events of the period gave a peculiar authority to the form of his utterances.

The principal formal characteristics of the new common language were as follows:

(1) The diphthongs *uo*, *üe*, and *ie* of the Middle High German are regularly contracted into *ū*, *ü*, and *ī* (the latter continuing, however, to be spelt *ie*): *guot*, *güete*, *liebe* became *gūt*, *güte*,

lībe (spelt *liebe*). This change was originally a Middle German characteristic.

(2) The long vowels *ī, ū, and ü* (spelt *iu*) of the Middle High German are regularly diphthongized into *ai* (written *ei*), *au*, and *oi* (spelt *eu*): *mīn* and *hūs* became *main* (spelt *mein*) and *haus* (the English *mine* and *house* have gone through similar changes), and *hüte* (spelt *hiute*) became *hoite* (spelt *heute*). This change was originally a Bavarian-Austrian characteristic.

(3) The diphthongs *ei* and *ou* are regularly changed to *ai* (continuing, however, to be spelt *ei*) and *au*: *kein* and *boum* became *kain* (spelt *kein*) and *baum*. This was also first a Bavarian-Austrian characteristic.

(4) In the combinations *sb, sm-, sn- sw-, sp-, st-*, the initial sound has regularly changed to the sound represented now by *sch*, though in the last two combinations *s* continues to be written: Middle High German *slange, smelzen, snīden, swimmen, sprechen, sterne* appear as *schlange, schmelzen, schneiden, schwimmen, schprechen* (written *sprechen*), *schtern* (written *stern*).

(5) A later change, which came about during the period itself, consists in the lengthening of most short stem vowels in open syllables; by analogy many in closed syllables have followed suit. New High German *sā-gen, fāh-ren, nēh-men, Vā-ter, Hōf, Wēg*, etc., had originally short stem vowels. On the other hand many originally long vowels and diphthongs followed by more than one consonant have been shortened, hence, *brachte, Mutter, Jammer*.

(6) By the end of the 17th century the old differences between the stem vowels of the preterit singular and preterit plural of strong verbs had been wiped out: *sang-sungen* had become *sang-sangen*; the only exception remaining is *ward-wurden*.

(7) The influence of Latin exercised through the traditions of the chancery language on the one hand, and through the clerical and humanistic training of Luther and his followers on the other, resulted in a cumbersome and greatly involved sentence structure, from which Luther's style in his most popular works, notably his translation of the Bible, is happily free, but which in the writings of others, notably in more or less technical works, has been carried to such excess that it has seriously interfered with the acquisition and spread of the German language among foreigners, and only in modern times has the style of the best writers become reasonably free from this defect. The influence of Latin showed itself further in the vocabulary, not only in the borrowing of Latin terms, but also, as in the first period, in the coining of German compounds on Latin models. During the 17th century, chiefly as a result of the Thirty Years' War, the language became so corrupt with Latin and French words that it was scarcely recognizable. A reaction, however, set in, societies were formed by scholars, writers, and patrons of letters for the purification and refinement of the language, and these conscious efforts for improvement have continued with more or less persistence to the present time, so that the language of the best writers of our day is freer from unnecessary foreign words than that of Lessing, Goethe, and Schiller. Indeed Modern German is, especially compared with English, a very homogeneous language, which shows itself not only in the small number of foreign words, but also in the thoroughness with which most of these have been naturalized in pronunciation and inflection.

In spite of the great influence of Luther and other favorable circumstances it must not be supposed that the introduction of the new literary language did not meet with more or less conscious and unconscious resistance. The South was slower than the North to accept it: being largely catholic, it looked askance at the « Lutheran » language. The political independence of the Swiss made them ambitious to raise their native Alemannian to the position of a literary language. Not until the middle of the 18th century had all resistance practically ceased, and the German-speaking countries possessed and were conscious of possessing a common literary language. The provincial characteristics which still remain, especially in Austria and Switzerland, are slight in comparison with the unity that has been attained. Moreover the common language has not only supplanted the dialects in literature, government, school, and church, but also in the ordinary intercourse at least of the educated; on the other hand it is still constantly drawing upon the dialects to replenish and rejuvenate its stock of words.

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5. **Germany — History of Literature.** German literature which, as far as its documents are preserved, extends over a period of 15 centuries, may be considered in more than one way a history of the very soul of the German people, reflecting its ideals and innermost aspirations in the productions of the poets and writers of the various centuries, and showing at the same time the development and growth of these ideals and aspirations in their influence upon the people as a whole. « Literature,» says Goethe, «is the fragment of all fragments, the least of what happened and was spoken was put in writing, and of that which was written the least has been preserved.»

There are many reasons for assuming the existence of a richly developed poetry among the Germanic tribes long before we meet any records of it in writing. The nature of this poetry was, without question, that of the poetic productions of most primitive peoples, inasmuch as it originated with their religious cults, their festivities and games, and showed the elements of lyric, epic, and dramatic poetry in their original combination. With this opinion accord the accounts given by Tacitus of old Germanic poetry, according to which its character was partly religious, partly heroic. Later sources assure us of the existence of nuptial poems, funeral hymns, love-songs, and dramatic plays. There was scarcely a manifestation of old Germanic life which was not accompanied and permeated by poetry. But with the exceptions of a number of charms and incantations, such as the *Merseburger Zaubersprüche*, little of this oldest poetry has been handed down to us. Its metrical form was the alliterative verse, as is shown not only by these charms, but also by numerous ancient riddles, proverbs, and the richly developed gnomology of the various Germanic tribes.

The alliterative verse, whose origin was presumably contemporary with the development of the Germanic word-accent, was the metrical form also of the old heroic poetry that flourished chiefly during the time of the migrations, the truly heroic period in the history of the Germanic tribes. The heroic song was cultivated by a special class of rhapsodists whom we find mentioned among the Goths, the Franconians, the Anglo-Saxons, etc. Their lays are almost entirely lost to us, but from the Beowulf and the later Nibelungenlied and the Gudrun, all of which originated among these rhapsodists, we may still form an idea of the greatness of their poetic productions. A fragmentary relic of this early period, though not recorded in writing until about 800, is the *Hildebrandslied*, the highly dramatic account in alliterative verse of the fight between Hildebrand and Hadubrand, father and son.

The chief reason why so much of the oldest German poetry was lost or suppressed must be ascribed to the Church. The introduction of Christianity in Germany meant the decline of popular national poetry as well as the rise of new ideals resulting from the acquaintance with Christian religious life and ancient civilization. Unfortunately it was not the civilization of classic antiquity, but that of the decaying Roman empire with which the youthful German people were brought into contact.

The earliest German written literature was produced by the clergy, and its chief character, therefore, is learned and religious. As the oldest document of this kind may be mentioned the translation of the Bible into the Gothic language by Wulfila (✝ 381), of which, however, only fragments are preserved. They are of the greatest value not only from a linguistic point of view, but also as a document of the intellectual character of the Goths, whose name quite unjustly became synonymous with "barbarous."

Among the earliest products of Christian poetry in Germany may be mentioned the 'Heliand,' an epic poem in alliterative verse of the 9th century, possessing considerable literary merit in its representation of the story of Christ as the story of a powerful Germanic king. The Heliand was written in Old Saxon, a dialect agreeing in its consonant system with English and Dutch, but differing from Old High German, which was destined to form the basis of the future literary language of Germany. It was due chiefly to the patriotic efforts of Charlemagne, who collected the old Germanic heroic songs and began the writing of a German grammar, that a certain unity in the literary use of the various Old High German dialects was attempted even at this early period, the Franconian dialect attaining, of course, a certain preponderance in this literary language.

Of less poetic value than the Heliand, though displaying the marks of serious literary industry and patriotic sentiment, is the 'Evangelienbuch' by Otfried (ca. 868), a monk in the monastery of Weissenburg. He was the first to employ the rhyme in his work; the structure of his lines still show, however, the rhythmic characteristics of the old alliterative verse.

Otfried's complaint in the Latin dedication of his book to Archbishop Liutbert about the lack of grammatical rules in his mother tongue makes it quite evident that even then a chasm existed between clerical learning and native German speech and poetry. The learned disregard for the poetry of the people, the opposition between artificial and popular poetry, seems to have continued during the 10th and part of the 11th centuries, although in the monastery of St. Gall we find a laudable exception. Here lived the greatest of the early German grammarians, Notker (✝ 1022), and here the monk Ekkehard I (✝ 973) turned into Latin hexameters one of the famous old Germanic hero-songs, the song of 'Walther and Hildegunde.'

Popular German poetry did, however, not cease to exist during this period; it was cultivated by the Spielleute or traveling minstrels, a class of poets less dignified than the old German rhapsodists, but equally influential. They were the first to seize upon a subject-matter which a period, fond of fabulous tales of adventure, as was the age of the Crusades produced in great abundance. Thus a number of epic poems originated of which the charming 'König Rother' is the most important. In the meantime the clergy, who always had a strong antipathy against the minstrels and the worldly spirit of their poetry, turned their literary efforts also in the direction of the epic, choosing their subjects partly from the stories of the Bible, partly from history. But the exclusive literary predominance of the clergy soon had to make room for chivalry which gradually assumed the leadership in matters of literature.

The conditions from which chivalrous society developed in Germany during the 12th century were essentially the same as in England and France. Hence the similarity, too, of ideals: chivalrous valor and virtues, culminating in the "service of ladies." But although we are still able to follow the paths by which these ideals entered Germany from France, their literary expression in Germany is not merely imitative of French models. It is an acknowledged fact that the great German court epics of Hartmann von der Aue ('Erec,' 'Gregorius,' 'Iwein'), of Gottfried von Strassburg ('Tristan und Isolde'), and, above all, of Wolfram von Eschenbach ('Parzival,' 'Willehalm,' 'Titurel') are more than mere translations from the original French versions of these tales, most of which belong to the Arthur legend. In Wolfram von Eschenbach's mind the story of the Holy Grail assumed, in fact, a depth of feeling and thought which makes his 'Parzival' one of the greatest poems of the Middle Ages. The same is true of the 'Minnesong.' This may be seen especially in the songs of Walther von der Vogelweide, one of the greatest lyrists of all times, who proclaimed the divine mission of the poet both in the social and political spheres of human affairs. The beauty and grace of his 'Minnesongs' (love-poems), and the depth and power of thought, the humor and the patriotic and religious pathos of his 'Sprüche' (didactic poems) were admired long after the dissociation and decline of the court-society had taken place as the result of economic conditions no less than of inherent elements of unnatural and immoral artificiality.

By introducing into his poetry the healthy sentiment of the folksong Walther von der Vogelweide attempted to stem the degeneration of the Minnesong into artificial unnaturalness, against which the women of the time themselves seem to have occasionally protested. A similar patriotic protest against the popularity in fashionable court circles of Franco-Celtic literary models and subjects seems to have led to the final shaping into epic-poems of the old Germanic hero-legends such as underlie the 'Nibelungenlied,' the 'Gudrun,' and a number of minor poems. Though disguised in these epics as ladies and knights of the 13th century, the characters of the old hero-legend still disclose their original gigantic proportions, and the force of their passions, the grandeur of their struggles, and the primitive depth and simplicity of their feelings contrast strongly with the fantastic picture of court-life portrayed in the contemporary court-epics.

The period of classical productions during the latter part of the 12th and the beginning of the 13th centuries was followed by a period of poetic dearth in which great literary activity was, however, not wanting. The place of the chivalrous Minnesingers is taken by the so-called Mastersingers, mostly honorable citizens and tradesmen, fond of cultivating the didactic, the mystic, and abstruse in their songs. A similar decline we notice in epic literature. At the same time we may, however, observe the beginnings of new forms of literary expression, such as prose, the drama, and folk-song, all of which were developed especially during the 15th and 16th centuries.

During the classical period of Middle High German literature a general uniformity in the language of poetry had been sought and, to a certain degree, attained by the best writers. It was essential that a like uniformity, displacing the various dialects, should be established for the literary use of German prose which, from the 13th century on, had been employed more and more in sermons, mystical writings, and in chronicles. According to the testimony of Luther (1483–1546) he found the form of German prose, which became so powerful an instrument in his hands, in the language used by the imperial Saxon chanceries. It was Luther's genius and great personality which assured this Saxon dialect the future literary predominance over the other High German dialects. For the language of his classical translation of the Bible and his powerful church-hymns soon became the authority for the grammarians and the best writers.

The origin of the German drama must be traced to the simple dramatic representations, given by the Church at Easter, Christmas, etc., the old Germanic plays having gradually died out. How popular these performances soon became may be seen from the great number of Easter, Christmas, and Passion plays, of Carnival plays and farces which have come down to us. It is the dramatic form gradually developed in these plays which we find also in the dramas of Hans Sachs, the foremost German dramatist and mastersinger of the 16th century. An enthusiastic admirer of Luther and his work, Hans Sachs (1494–1576) did inestimable service to the cause of Reformation by popularizing its ethical ideas in his numerous dramas, farces, and poems.

The most perfect poetic productions of the 15th and 16th centuries are, however, the 'Volkslieder' (folksongs), the direct and artless expression in verse of inimitable beauty and simplicity of the very soul of the people, who were then still feeling and thinking as a whole, and were as yet undivided into the learned and the unlearned. The discovery later by Herder of the truth, the ethical force, and the beauty in which human nature reveals itself in these songs, contributed greatly to the rejuvenation of German life and literature during the 18th century and afterward.

Great as the influence of the Renaissance was on the intellectual life of Germany during the 16th century, the indebtedness to this influence of the really great writers, of men like Luther, Hans Sachs, and even Johann Fischart, was after all comparatively small. The attempt to reform German literature after the model of the ancients was, however, made during the 17th century by Martin Opitz (1597–1639). The principal features of this attempt the effects of which are noticeable even in the classical literature of the 18th century, were the breaking with the life and the literary traditions of the past, and the beginning of an entirely new literary development. While in matters of metrics Opitz's reform was fully justified, this reform meant, nevertheless, mere imitation and the introduction of a literature of the learned for the learned. The people as a whole were forgotten, if not disregarded; the writing of poetry became, as with the Neo-Latinists of the 16th century, a conscious labor, the result of reasoning and calculation instead of the product of the free play of inspired imagination.

Neither Opitz nor his more gifted immediate followers produced poetry of more than ordinary value. In their endeavor to surpass the former and by their imitation of contemporary Italian and Spanish models the writers of the next generation, known as the Second Silesian School, ended in bombast and filthy sensuality. Much of the pitiable condition into which German literature fell during the 17th century was, of course, due also to the degenerating effects upon the intellectual, political, and social life of Germany produced by the Thirty Years' War.

It was due to the efforts of numerous noble and patriotic men during the 18th century that German literature as well as German life underwent a great regeneration. The rejuvenation of the German nation and of mankind in general was, in fact, the ultimate aim in the efforts of all the great thinkers and poets of this period, and nowhere can we follow this process better than in their writings.

Long before Rousseau's panacea, "back to nature," became the watchword in literature, we notice in these writings the endeavor to find, independently of the ancients, nature, truth, and reality. Poets like A. von Haller (1708–77) and F. von Hagedorn (1708–54) discover the rich inner world of man as the only great object of poetry. And in C. F. Gellert (1715-69) the preclassic period produced a writer of extraordinary popularity. A harmonious personality who discarded traditional learning, he exerted a liberating influence on his time by poinging to the human heart as the source of true life.

Hand in hand with these attempts of the poets proceeds the work of criticism in ascertaining the nature of the beautiful and thereby the nature of what constitutes true humanity. It is characteristic of German poetry since Opitz that the creative activity of the poets is accompanied by a conscious reflection concerning the nature of poetry: thus it came about that Lessing, Herder, Schiller, and Goethe were also great critics.

The discovery by the Swiss critics, Bodmer and Breitinger, of the imagination as the true source of poetry prepared the way for the first great poet of this period, F. G. Klopstock (1724-1803). The influence which the latter, through his 'Messias' and his 'Oden' exerted upon the intellectual, the moral, and the political life of his people was extraordinary. In him the old Germanic conception of the poet seemed revived; he regarded his calling as that of a priest and a prophet, and his highest ideal was that of true humanity.

Yet Klopstock's principal work, the 'Messias,' was, with regard to the subject-matter and its treatment, a mistake. It was the task of Lessing (1729-81) to establish the laws of poetry, particularly those of the epic and of the drama. This he did in the 'Laokoön' and in the 'Hamburgische Dramaturgie.' A fearless critic and searcher for truth, he was also the first great German dramatist of this period The characters of his famous plays, *Minna von Barnhelm* and *Emilia Galotti*, breathe real life, embodying at the same time the poet's new and manly conception of human life. And through his theological writings, his 'Erziehung des Menschengeschlechts,' and his drama 'Nathan der Weise,' he exerted a reformatory influence not only upon theology, but also upon the religious life and conduct of his country.

In Lessing's path as a critic followed J. G. Herder (1744-1803), one of the most remarkable geniuses of this period. Correcting and supplementing Lessing's discoveries in his early writings, Herder soon became a critical pathfinder who pointed out with prophetic instinct the course which the intellectual development of Germany was to take. To him is due above all the momentous discovery of the true nature of popular poetry and, moreover, a conception of history such as no previous historian had thought of.

With Herder began the so-called "Storm and Stress" period, the revolution in German intellectual life, whose ultimate aim it was to break with previous traditions and to attempt the regeneration of human nature, the beginning of a new life from the innate eternal sources of the soul. The result of this remarkable movement was the classical German literature of the 18th century, the chief representatives of which are Goethe (1749-1832) and Schiller (1759-1805). Goethe's earliest works ('Götz von Berlichingen,' 'Werther,' his early lyric poetry and the oldest scenes of 'Faust') as well as Schiller's first dramas ('Die Räuber,' 'Fiesco,' 'Kabale und Liebe') show us the spirit of the literary revolution in its whole force and depth. In the works of the mature period of both poets, with Goethe's 'Iphigenie,' 'Tasso,' 'Hermann und Dorothea,' 'Wilhelm Meister,' etc., and with Schiller's 'Don Carlos,' 'Wallenstein,' 'Wilhelm Tell,' and his æsthetic essays, German literature reaches its highest perfection both as to form and contents. It is the ideal of humanity which lives in the best works of these poets and lends them an imperishable charm. Poetry is no longer an imitation of the ancients, but the highest human creative power which, independent of science and religion, strives to solve the riddle of the world and of man. In the creation of this new ideal of humanity the example of the ancients was, no doubt, most helpful, but it was, after all, essentially a product of the German mind, to which the great thinkers, Kant, Fichte, Schelling, and Hegel contributed their share also.

That this fact was gradually recognized, and that, in place of the abstract cosmopolitanism to which Goethe and Schiller inclined, the conception of nationality was established, was due to the Romantic School, which, in the main, was a continuation of the Storm and Stress period, particularly of Herder's ideas and discoveries. Although the members of this school (A. W. Schlegel, Fr. Schlegel, L. Tieck, and Novalis) were lacking as poets, in plastic creative power, frequently losing themselves in fantastic dreams, their influence upon art, music, science, and even on politics and religious life was extraordinarily great. To them belongs the credit of having discovered the beauty and greatness of Germanic antiquity, the investigation of which was undertaken by the Brothers Grimm, by Ludwig Uhland, and many of their successors. At the same time the political humiliation of Germany by Napoleon I. had no small effect upon the awakening of national consciousness, as is clearly shown by the patriotic poetry of E. M. Arndt, Th. Körner, M. von Schenkendorf, Fr. Rückert, and others who roused the nation from its political lethargy and despair.

The wars of liberation were followed by a period of political stagnation during which the contradiction between the ideal world that had been created by the poets and thinkers and the wretched reality of the social and political conditions was felt most keenly. Against these conditions, which also form the background in the work of the great humorist, Jean Paul Richter, arose, at the beginning of the third decade of the 19th century, a group of writers called Young Germany. Its leaders, L. Wienbarg, H. Heine and Karl Gutzkow were arrayed chiefly against the spirit of degenerate romanticism, claiming at the same time greater political freedom and the concession of the principle of realism in literature. The political struggles which, during the subsequent decade, completely occupied German intellectual life are reflected also in the patriotic poetry of the time. Inspired by Goethe's lyrics and the revived folksong, lyric poetry had flourished greatly in Germany. Its chief representatives were L. Uhland, Ed. Mörike, H. Heine, N. Lenau, and Jos. von Eichendorff. Several of these masters, like Uhland and Heine, now took a hand in the political movement, and the younger poets like

F. Freiligrath, H. von Fallersleben, G. Herwegh, Em. Geibel, and others joined their ranks.

The disappointment following the failure of the national hopes after 1848 had to affect literature also. There was, to be sure, during this period no lack of eminent talent — I only mention the dramatists, Fr. Hebbel and Otto Ludwig, the novelists, V. Scheffel, G. Freytag, G. Keller, and Paul Heyse, and the lyric poet, E. Geibel — but poetry had ceased to play the leading rôle in the intellectual life of Germany. Music, the plastic arts, and especially the natural sciences had taken its place. Even the great events which finally led to the unification of Germany did not bring with them the expected revival of poetry, but rather a visible decline.

Dissatisfied with this state of affairs, and influenced by foreign authors, such as Zola and Ibsen, a group of young men attempted in the early eighties to reform German literature along the lines of realism and to win back for it its lost prestige in the estimation of the nation. Much in this movement was abstract theorizing and fruitless æsthetic experimentation by men whom Goethe would have called "forced talents." But the interest of the nation in contemporary literature has been reawakened by gifted writers like D. von Liliencron, H. Sudermann, G. Hauptmann, Ricarda Huch, Clara Viebig, and others, and to-day an industrious activity prevails especially in the fields of the drama and the novel. The crude and sometimes revolting realism of the early productions of this recent literary movement has been followed by a return to the ideal dreamland of romanticism, and many are the signs that Germany is about to enter upon a new great era of national literature.

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6. Germany — History of Science and Philosophy. The German nation has often been called a people of "thinkers." That had perhaps in the past sometimes a slighting implication, as if the Germans lived in a world of dreams and were unfit for success in the practical world of reality; only the last decades have removed completely such a tacit meaning, since the German Empire has proved itself not less strong in its achievements in commerce and industry and politics than in the fields of science and scholarship. Yet, on the whole, it was at all times a sincere acknowledgment of that German contribution to the progress of human civilisation which has been most original and most lasting. German earnestness and thoroughness, German love of truth and of freedom, have blended, at least since the days of Leibnitz, into a productiveness of knowledge which is not paralleled in the world.

1. The most valuable contribution of the earliest times was the historiography done in the German cloisters. Their "annals" were faithful work and Einhardt's 'Life of Charlemagne' (written 820) is a noble piece of history writing. But the scholarly thought was still essentially imitative. When in the 9th century the Benedictine Rhabanus Maurus in the cloisters of Fulda wrote his encyclopedia 'De Universo,' in 20 books, setting forth the status of German knowledge in the time of Charlemagne, it was on the whole a repetition of that which Isidor of Sevilla had brought together in the 7th century. All thought about nature was controlled by the ancients. And when in the 11th century a new European movement of thought was growing, the great scholastic effort to harmonize belief and reason, France, Italy, and England gave the signal. Yet Germans as, for instance, Hugo, Count of Blankenburg, took an important part, and Albert von Ballstädt, called Albertus Magnus (1193–1280), was one of the deepest and most brilliant scholastic thinkers, whose knowledge of natural science, too, was far superior to his age. Theologians and philosophers of repute, like Thomas von Strassburg, followed in the 14th century, and certainly no thinker of the 15th century equalled the cardinal Nicolaus von Cusa (1401–1461), who combined scholasticism and Platonism, mathematics and theology. In the meantime Germany had founded its famous seats of higher learning, the universities, which have been always at the same time schools for the professional training of clergymen, teachers, doctors and lawyers and centres of productive scholarship. (See GERMANY, UNIVERSITY SYSTEM IN.) Through the 13th century the university of Paris was the point of crystallisation for scholasticism; in 1348 the first German university was founded in Prague, soon after that the university of Vienna, and Western Germany followed immediately with Heidelberg (1385) and Cologne (1388). The political disturbances in Boehmen brought about a secession in Prague, and its emigrating scholars founded the university of Leipzig (1409). These new centres of scholarly influence increased the independence of German scholasticism of the dogmas of Paris, and in the declining period of mediæval thought the German systems of nominalistic philosophy played an important rôle.

The opposition to the hairsplitting rationalism of scholastic thought came from two movements which better expressed the German instincts: mysticism (q.v.) and humanism (q.v.). Mystical speculation became influential from the beginning of the 14th century; in an immediate personal unity with God there was sought a deeper knowledge than that of church and university. Meister Eckhart's pantheistic mysticism, a Christian neoplatonism, stands with such daring independence against the doctrines of the hierarchy that it must be acknowledged as the first original German philosophy, in spite of its unsystematic character. The mystical schools develop themselves, especially in the western Germany, through the 15th and 16th centuries and emphasize now the theological interests or even the practical religion (Thomas à Kempis, 'Imitation of Christ'), now the naturalistic interests. The mystical study of nature was most strongly influenced by the physician Paracelsus (1493–1541). His aim was a fundamental reform of medicine, which had still the stamp of Galen and Avicenna. But to understand man's body the microcosmos must be understood as image of the macrocosmos and thus natural science, astronomy, and theology become the basis of medicine. His numerous writings influenced, through all Europe, medicine, alchemy, and theosophy. The last great mystic was Jacob Boehme (1575–1624), whose speculations concerning God's relation to the world and its evils became influential through the following centuries.

Far more systematic and scholarly was the opposition which arose against scholasticism from the humanistic side. The European renaissance which flourished from the 14th to the 16th century found nowhere a more enthusiastic echo than in Germany. The best minds entered into its service and here, too, the movement took a threefold form: it created the historical æsthetic interest in the literary treasures of classical antiquity, it opened the eyes to nature, and it liberated from the mediæval onesidedness of christianized Aristotelianism. The time thus demanded philology, natural science, and independent philosophy. The great philological movement was carried by Germans like Johann Wessel, Rudolph Agricola, Johann Reuchlin (1455–1521), whose handbooks and editions stimulated the study of Latin and Greek throughout Germany, and who at the same time inaugurated the study of the Hebrew language in Western Europe; Erasmus of Rotterdam (1457–1537), the most eminent scholar and the most witty writer of his time, who published the first edition of the Greek New Testament, and whose writings fill 24 folio volumes; and above all the "teacher of Germany," Philipp Melanchthon (1497–1560). Famous as theologian and diplomatist, he desired to be in first line philologist and expounder of the classics. For 40 years he taught in Wittenberg. His 'Loci Communes' appeared in 60 editions during his lifetime.

The return to nature and the striving for scientific knowledge is expressed in great scholars like the mathematicians and astronomers Nicholas von Cusa, Georg Peurbach, Regiomontanus (1436–1476), famous for his 'Ephemerides ab Anno'; Martin Stöfler, and epoch-making Copernicus (1472–1543), whose discovery that the planets moved around the sun was worked out in 'De Orbium Celestium Revolutionibus.' The movement culminated in Johann Keppler (1571–1630), who discovered that the planetary orbits are elliptic and that the squares of the periods of revolution of any two planets are to each other as the cubes of their mean distances from the sun.

Humanism thus brought to Germany ample results in the fields of philology and natural science, but seemed without such results in that field in which the other countries gained most by the renaissance: philosophy. The German philosophical humanistic reaction against mediævalism (q.v.) and scholasticism (q.v.) was inhibited by the religious movement which absorbed Germany's metaphysical energies — Protestantism (q.v.). The Protestant religion, no doubt, ultimately reinforces knowledge and scholarship. Its appeal to the sources, its attack on authority, liberates the spirit of criticism and research. The great progress of Germany's scholarship in all fields in the 19th century is markedly the work of the Protestant parts of Germany and, in a much less degree, of the Catholic regions. German philosophy, more than any other branch of knowledge, shows this Protestant character from Leibnitz to Kant and Fichte and Hegel. But in the days of the new awaking, when Italy and France and Holland and England produced great philosophical systems, Protestantism necessarily inhibited the metaphysical movement in Germany.

Scholasticism had been a union of church theology with rationalistic philosophy, an effort to bring the religious belief into harmony with reason. The Reformation agreed, of course, with the new humanistic antagonism against those scholastic systems, but not in the interest of an independent philosophy, rather in the interest of an independent theology — independent alike of the church and of abstract logic, faithful only to the individual religious instinct and to the revelation of the Scriptures. Martin Luther, with his mystical tendency, had no sympathy with the logical definitions of human thought and no trust in the power of merely human intellect. The humanists who in the first decades of the 16th century defeated the scholastic world and who fought for literary-æsthetic ideals and platonistic philosophy, soon felt that the Lutheran movement was unfriendly to the cherished arguments. It is true, Zwingli stood nearer to philosophy, and Melanchthon became a most influential teacher of philosophical doctrines; his philosophical writings, not only the commentaries to ancient philosophers, remained the best books of Protestant Germany for a century. Yet Melanchthon, too, was more original as theologian than as philosopher. The theological discussions filled the time and reached the masses, and the humanistic movement, which fascinated the few, was necessarily the loser in Germany. The increase of religious strife was accompanied by a decrease in independent interests of thought throughout the land. The lowest point was reached when the Thirty Years' War destroyed the power and prosperity of the commonwealth; the moral and intellectual energies of Germany seemed paralyzed and German universities and German scholarly interest had never so little dignity and authority in the world as through the first two-thirds of the 17th century. Naturalists and philosophers like J. E. Sturm or Joachim Jungius stood under the influence of the great French thinkers, and even the famous jurist Samuel Pufendorf (1632–1694), the first German teacher of natural law, is under foreign leadership. Indeed, the neighboring countries had incomparably better conditions for scholarly activity than the devastated land of Germany, and while they did their utmost to reinforce the spirit of productive scholarship through the founding of academies and the high social position of the scholars, Germany had no academies and no protectors of knowledge; university life itself became vulgar and barbaric.

The new spirit had thus to come from foreign lands. The French language and literature and philosophy entered at first the courts of Germany and soon after its universities; the humanistic neo-classical interests were replaced by the more "modern" efforts which had been developing in the neighboring country since the days of Descartes. The universal thinker who stands at the threshold of a new and better time is Leibnitz.

2. Gottfried Wilhelm von Leibnitz (1646–1716), a man of the great world, brought German thought in contact with the advanced scientific spirit of France, Holland, and England. Through his influence the Berlin Academy was founded in 1700 with the aim to create a place for the real advancement of knowledge at a time when the universities felt, on the whole, satisfied with handing down the scholarly traditions. He created the most elegant instrument of natural science: the differential calculus, which he published (1684) in his essay 'Nova methodus pro maximis et minimis.' But still more important was his metaphysical system. It shared with Descartes and Spinoza the rationalistic belief in the power of transcending experience through reason, but Descartes' sharp separation of mind and body and Spinoza's monism were left behind by Leibnitz's 'monadology.' His monads, held together by pre-established harmony, represent a continuous series of simple substances which are without windows, each containing the whole world as perceptions, but each apperceiving only a varying part of them. His system fulfills in an original way the purpose of every great philosophy: to justify and to harmonize both the causal, mechanical, and the teleological idealistic knowledge of the time. And thus Germany had finally, as the last of the European nations, a real philosopher who was to introduce the enlightenment of the 18th century.

While Leibnitz brought the modern interests to the German courts and academies, the universities, too, reflected the progressive time. Halle, founded in 1694, and Göttingen, founded in 1737, became the new centres of an activity which had no sympathy with the doctrines of authority, either the theological ones of the church or the classicistic ones of the humanists. An independent free thought, working with mathematics and logic and empirical observation, was the demand of the time in every field. The jurist Thomasius (1655–1728) became the leader of the academic movement of protest against all narrowness and prejudice, fighting alike against the mediæval methods of legal and equivocal prosecution, against the superstitions of orthodox theology, and against the artificiality of classical learning. He was the first to emancipate German university instruction from the traditional Latin and to publish a literary critical magazine in the German language. After conflicts with Leipzig he became one of the founders of Halle, and his spirit of modern intellectualistic enlightenment came to be characteristic of the place. To be sure, on theological grounds the opposition against orthodoxy did not move so much toward theoretical rationalism, but took at first the turn toward practical religiosity. The great pietistic anticlerical movement which Spener (1635–1705) started, influenced by English puritanism, was continued in Halle by Francke (1663–1727), to whom true Christianity was not an object of science but a living duty; and yet even the insistence on the Bible as the only true source of religion meant here, as two centuries before in Luther, in first line not a binding of the free intellect, but a liberalizing and modernizing opposition against the orthodox spirit of the past. The full development of theological criticism in Halle belongs rather to the influence of Semler (1725–1791), whose historical interpretations of the Bible open the way for the new rationalistic theology.

The most influential separation from church authority, however, on all fields of human thought came through Halle's fertile philosopher, Christian Wolff (1679–1754. His system was no great original construction — it was essentially Leibnizian philosophy — but it gained its new strength and power by being really a system. Dogmatic rationalism herein reached its most self-conscious expression and Wolff's didactic treatment of ontology, cosmology, psychology, theology, ethics, economics, and politics soon penetrated the whole protestant scholarship of Germany. Theology and metaphysics, morality and jurisprudence had to become "natural" and "rational"; the ideals of mathematical knowledge and social happiness determined the whole period. The Leibnitz-Wolffian movement was not without opponents like Crusius and Rüdiger, and yet the adherents carried the day. Among Wolff's pupils, besides interesting philosophers like Bilfinger and Lambert, Baumgarten (1714–1762) must be mentioned as the founder of German "æsthetics," a name which he invented. The scholarly rationalistic philosophy yielded quickly to its natural tendency to subserve the practical purposes of human virtue and happiness, to be reached by the emancipation of the individual from every authority but its own reason, and with this practical aim came the tendency to popularisation. It was a movement to which Frederick the Great lent himself from the Prussian throne, and authors like Moses Mendelssohn and Reimarus, Nicolai and Engel, Tetens and Moritz spread it throughout Germany. Here also is the place for the important scholarly writings of the poet Lessing (1729–1781), who stimulated theoretical æsthetics as well as philosophy of religion and philosophy of history.

While thus the new philosophical and theological spirit of the 18th century radiated from Halle, it was the university of Göttingen in which the new scientific and philological impulses started, till finally the light came from Königsberg. In Göttingen taught the next to Linnaeus most eminent biologist of the time, Albrecht von Haller (1708–1777), famous for his botanical books, but still more influential by his medical studies. He introduced the physiological experiment, and his demonstrations of what he called sensibility and irritability of nerves and muscles, became the starting point for biological theories which controlled the medical discussions of Europe down to the time of cellular pathology. Among those who took part in these physiological, pathological, and therapeutical controversies of the 18th century Frank, Weikard, Röschlaub, Pfaff, and others belong to Germany; and especially the group of those who defended that branch of Haller's system which had found its development in France under the name of vitalism: Blumenbach, Reil, and Hufeland. Blumenbach (1752–1840) who interprets the organic world by his "nisus formativus," became the founder of anthropology: the doctrine of the five human races is his. He was also the first to lecture on comparative anatomy. Reil considers life as a galvanic process, and with Hufeland the doctrine of animalism becomes practical medicine. Side branches of this vitalistic movement are mesmerism and homœopathy, whose founders, Mesmer (1734–1815) and Hahnemann (1755–1843), are German physicians.

While biological studies flourished in Göttingen through Haller and Blumenbach, mathematical and physcial, historical, juristic, and philological scholarship also found there the most brilliant representation. Lichtenberg (1741–1799) had there his model laboratory for physics and his theories of electricty became victorious. Tobias Mayer (1723–1762) worked out there his famous catalogue of zodiacal stars and Kaestner (1719–1800) attracted the mathematicians. All three stand as foremost representatives of the inorganic sciences of the time; yet Euler (1707–1783), whom Frederick the Great called to Berlin, was perhaps more original in his numerous works dealing with mechanics and dioptrics, integral calculus and astronomy. Chemistry which began to demolish the old phlogiston theory was largely enriched by the comprehensive analyses of Scheele (1742–1786), by Klaproth and others, and Richter (1762–1807) became the founder of chemical stoechiometry.

The classical philology of the 18th century also took, in Germany, a new turn. It was the time of the great literary movement in which every mind was directed toward the beauty of art. The new aim for the student of antiquity was to join the interest in classical fine arts with the interest in the writings and to approach the literature of antiquity with the attitude of æsthetic appreciation. Gesner (1691–1761) had revived the Greek studies throughout Germany; his Göttingen successor, Heyne (1729–1812), who edited Virgil, Homer, and Pindar, and explained Greek mythology, did much to give classical studies the æsthetic interest. The whole revival was known as the neohumanistic movement. The greatest exponent was Heyne's pupil, F. A. Wolf (1759–1817), whose 'Prolegomena in Homerum' were epoch-making. With Wolf, the one-sided æsthetic attitude goes over into an enthusiastic interest for the whole of Greek life, its religion and art, its politics and history. The study of antiquity became for him a system of twenty-four different disciplines.

3. While thus the spirit of enlightenment in philosophy and natural sciences, in jurisprudence and theology, and the æsthetic spirit in literature, history, and philology gave interest and value to the intellectual life of Germany, the greatest emanation of the German genius had prepared itself. In the year 1781 appeared the first of the three great critiques of Immanuel Kant (1724–1804). Kant's critique of pure reason, critique of practical reason and critique of judgment, represent the most essential progress of human thought since Plato and Aristotle. The preceding rationalism which sought knowledge of metaphysical reality through reason, and the preceding empiricism which sought knowledge from the impressions on the senses, were equally superseded by Kant's "criticism," which proves that knowledge does not mean a reproduction of an independent reality, but a reconstruction of objective data by the subjective categories of perception and understanding. Knowledge is thus not concerned with a metaphysical reality; but we belong to the world of reality as free subjects of will who are determined not by the causality of phenomena, but by duties. This gigantic reorganization of human knowledge and morality inspired the leaders of German culture; in Schiller it came into live contact with the great literary movement of Germany.

In the philosophical discussion of Kantian philosophy Jacobi, Beck, Maimon, Reinhold, Fries, represent most different attitudes, yet none of them suggests real progress. But Kant's system demanded further development; the subjective factor of his system was not really connected with the objective factor. The genius of Fichte (1762–1814) created a system whose ethical idealism made the object itself dependent upon the will-act of the subject, while Herbart (1776–1841) moved in the opposite direction, developing out of Kant's objective factor a realistic system which gave impulses to modern psychology. Directly from Kant, too, is derived Schopenhauer's (1788–1860) voluntaristic system of pessimism, which combines Kant's doctrine of the categories with Platonism and Buddhism. Schleiermacher (1768–1834) finally seeks to harmonize the ideal and the real factor in the interest of ethics and religion. It was Fichte's system which showed the direction for the further movement. The life of nature had been neglected in Kant and Fichte; as soon as it becomes a factor in philosophic thought, ethical idealism turns into the objective idealism of Schelling (1775–1854), and ultimately into the absolute idealism of Hegel (1770–1831), which understands nature and mind as the logically necessary expression of the Absolute. At every stage idealism exercised influence on the intellectual life of the time. From Fichte started the ethical regeneration of Prussia, expressed in the foundation of the university of Berlin (1810), and the romantic movement of Schlegel and Novalis. Schelling, on the other hand, influenced most deeply the naturalists, men like Oken, Oersted, Carus, Ness von Esenbeck, and many others who brought natural science itself under the categories of Schelling's system of identity, but philosophers like Krause and Solger also followed him. The strongest philosophical influence, however, resulted from the Hegelian system which, at about 1830, entirely controlled the academic philosophy of Prussia. But the triumph of Hegelianism meant an overtension of purely speculative thought, the maximum distance of theoretical and metaphysical construction from the facts of observation. This neglect of experience demanded a necessary reaction against speculation; the breakdown of metaphysical onesidedness was disastrous. In the fourth decade of the 19th century the defeat of philosophy seemed complete and it meant the triumph of natural science as against metaphysics, of analysis as against synthesis, of realism and materialism as against idealism, of technique as against art, of specialisation as against generalisation. This naturalistic reaction filled the larger part of the 19th century in all civilized countries and brought to them the manifold discoveries and inventions which seem most characteristic of the time. Only at the end of the 19th century does the pendulum seem to begin again its backward swing with a new awaking of the idealistic spirit and deeper philosophical interests as reaction against the philosophical superficiality and incoherency of mere specialistic science.

4. In every new phase of this 19th century movement German scholars have taken the leadership. The deep philosophical longing of the German soul had created the unique movement which led from Kant to Hegel, but when the opposite tendency of the newer time demanded the patient work of the specialist, it was the world-known German thoroughness which won the laurels for the German laboratory experiment and naturalistic research and historical investigation.

Of course this specializing work had not waited for the downfall of philosophy; it took its rise in the work which we traced through the period of enlightenment in the 18th century. And further, the emphasis on specialisation does not mean that the scientific life of Germany lacks in the 19th century great central figures, scholars with broad synthetic energy: the geographer Alexander von Humboldt, the physicist Helmholtz, the pathologist Virchow, the historians Ranke and Mommsen, are certainly not specialists in the narrow sense of the word. A short survey of the different fields indicates the abundance of brilliant thinkers who were grouped about such leaders. We may begin with mathematics and the inorganic natural sciences, then turn to the organic sciences and medicine, then to the historical and philological, economical and juristic, finally to the theological and philosophical fields.

For mathematics the first place belongs to Gauss (1777–1855) and after him the chief advance came through Jacobi, Dirichlet, Riemann, Kronecker, Weierstrass and others; yet the mathematical achievements were always blending with the works of physicists and astronomers — as not a small part of the mathematical progress belongs to naturalists like Kirchhoff, Helmholtz, Encke, Clausius, etc.

Gauss gave the strongest theoretical impulse also to astronomy, while Bessel (1784–1846) may be considered the founder of the practical astronomy of the century. Most influential for the theory were Hansen and Encke and their followers, Bruhns, Argelander, Brünnow, Auwers, etc. Here belongs also as a special triumph of German thought, the discovery of spectral analysis by Kirchoff and Bunsen, applied by Zöllner and others.

In physics the turning point of the century lies at its middle when Helmholtz (1821–1894) and independently R. Mayer (1841–1878) formulated the law of the conservation of energy. In the first half of the century the best work in physics was done outside of Germany; among the Germans excelled Ohm (1787–1854) with his fundamental theories of galvanism; the brothers Weber, Poggendorff, Lenz, belong to the same period. The influence of Helmholz is felt not only in the theory of energy, but in the whole field of mechanics, optics, and acoustics, besides physiology and psychology. The next and last climax is reached by Hertz through his study of the propagation of electric waves. Important too are the thermodynamics of Clausius, the electrolytic work of Hittorf, and most recently the discoveries of Röntgen concerning cathode rays.

In chemistry the decisive step was the foundation of a chemical university laboratory in Giessen by Justus Liebig (1803–1873), the greatest chemist of his time, who revolutionized organic chemistry and whose researches became invaluable for agriculture, pharmacy, the preparation of food, etc. Out of his school came influential chemists of all nationalities; in Germany itself especially, Kekule, Hofmann, Fehling, Kopp, Bayer, V. Meyer. Other centres of chemical ideas were the laboratories of Wöhler in Göttingen, of Bunsen in Heidelberg, of Mitscherlich and Rose in Berlin. The theory of atomistic combination was furthered by the antagonists Kekule and Kolbe, stereochemistry by Wislicenus and von Meyer, inorganic analysis by Wöhler, Winkler, Kirchoff, Bunsen, whose epoch-making spectral analysis has been mentioned before. The first organic synthesis is the famous work of Wöhler in 1829. It opened the long series of synthetic successes of which not a few became technically important, as those of Fettig, Gräbe, Hofmann, Fischer. Practical gain also to pharmacy came directly from German chemistry; chlorohydrate and chloroform, salicyl and antipyrin, etc., are products of German laboratories. The incomparable position of German chemical industry is the immediate outcome of the wonderful development of chemical science in German universities and technological institutes.

The independent growth of physical chemistry prepared by Kopp, Bunsen, Wiedemann, became most significant in recent times through Ostwald, Van't Hoff, Nernst, etc. Mineralogy and crystallography connects its development in Germany in first line with the name of C. S. Weiss in Berlin, Neumann in Königsberg, Hessel in Marburg, Rose in Berlin, von Rath in Bonn, Zirkel in Leipzig, etc.

Geology became a science in Germany through A. G. Werner, in Freiberg, at the beginning of the century, and L. v. Buch developed the doctrine of the slow upheaval of continents; his geological map of Germany appeared in 1824. But greater was their pupil, Alexander von Humboldt (1769–1859), the most comprehensive German naturalist of his time. His studies in South and Central America and in Asia, his incomparable richness of observation in all fields of descriptive science, his unifying apperception of nature, as expressed in his 'Kosmos,' make him the most imposing and most sympathetic figure in the German science of the first half of the last century.

Inasmuch as Humboldt's geography was essentially physical, it seemed opposed to the historical-geographical interest. A synthesis of both tendencies characterises the work of Carl Ritter (1779–1859), whom his time considered the founder of scientific geography. His contributions to theoretical geography found a brilliant continuation through Peschel, Kiepert, Gerland, Ratzel, and others. In the meantime, practical geography was stimulated by Richthofen, Peschuel-Lösche, etc. Well known are the maps of Petermann, Perthes, etc.

Geography may connect the inorganic with the organic world. To begin with botany, the first decades of the last century belonged to plant anatomy; the highest point was reached by H. v. Mohl. Then came, about 1840, the turn to the genetic study, and the development of plant histology. The epoch-making discoveries of Schleiden (1804-1881) and of Nägeli showed the way. The morphologic work, partly with histological, partly with phylogenetic interest, was continued by Schwann, Hofmeister, Pringsheim, DeBary, Strasburger, Solms, etc. The fundaments of plant physiology were laid by Julius Sachs, whose 'Experimental Physiology of Plants' appeared 1865. Pfeffer, Klebs, Stahl, etc., followed.

In zoölogy the century began with systematic interests, but turned soon to morphological ones and came on this path to the brilliant achievements connected with the names of Köllicker and Siebold, Ehrenberg and Max Schultze, Leydig, Leuckart, and Hertwig. The leader in comparative anatomy, which started in Germany with Meckel, the "German Curvier," was Gegenbaur; the prophet of Darwinism became Haeckel, and the most influential critics of Darwinism, Wagner and Weismann.

The progress of human anatomy links itself partly with the same names which became influential in Zoölogy; at the middle of the century the anatomists Henle, Hyrtl, Baer, and Köllicker stand as the acknowledged leaders. His, Hertwig, Roux, and Waldeyer represent the later decades. Yet, it is characteristic for the German mind, that its most brilliant achievements belonged to physiology rather than to anatomy. No field, indeed, has greater names than physiology, with Joh. v. Müller and Helmholtz. Rudolphi and Burdach, whose large physiology appeared 1832, made physiology at home in Germany, and soon came the master, Johannes v. Müller (1801-1858). His influence — it is said that he wrote 16,000 printed pages — was deeply felt throughout physiology, embryology, anatomy, and zoölogy; most popular is, perhaps, his doctrine of the specific energy of the senses. Among his many important pupils none was greater than H. v. Helmholtz (1821-1894), whose invention of the ophthalmoscope (1851) created the new ophthalmology. His physiological optics and his book on tone sensations are still authoritative to-day. Dubois-Reymond's investigations of electrophysiological phenomena, Ludwig's analysis of the functions of the heart opened new ways also, and so did Voit, Pettenkofer, Hering, Brücke, Pflüger, etc., in various directions.

In the development of pathology the central figure is Rudolf Virchow (1821-1902), whose cellular pathology revolutionized the theory of disease and led it to the heights of modern histology. His pupils, Cohnheim and Recklinghausen, continued his proof that the organic laws working in disease are identical with those of the normal organism. A new movement came in with bacteriology; the discovery of the tubercle bacillus (1882) through R. Koch and his investigations of anthrax, turned his attention from the diseased cell to the microscopical causes of the diseases. From bacteriology pathology finally turned to chemistry, studying the substances produced by the diseased tissues. This led to the theory of antitoxins and to Behring's discovery of the antitoxin treatment of diphtheria. Practical medicine was in the meantime led by men like Frerichs and Erb, Langenbeck and Billroth, Graefe and Griesinger.

5. In the world of mental sciences it is philology whose specialistic ramification in the 19th century is similar to the work of the naturalists. The classical philologians led the way, and the grammatical scholar Hermann deepened the linguistic interest in the classical authors; his opponents, Boeck, Welcker, O. Müller, and others stood for the wider view of F. A. Wolf, taking philology in its fullest meaning. Zeller, Niebuhr, Droysen, Mommsen, Curtius gave new life to the thought and politics of the old nations, and Lachmann, Haupt, Ritschl and others interpreted their authors.

Germanic philology is entirely a product of the 19th century. The romanticists, Schlegel and Tieck, stimulated interest in it, but it became a real branch of scholarship through Lachmann, Benecke, and especially the brothers Jacob Grimm (1785-1863) and Wilhelm Grimm (1786-1859), whose studies in the history of the German language and literature became of paramount importance. As to other languages German scholarship has con-[illegible]uted much to Romanic, English, Slavic, but most of all to Oriental philology in the widest sense of the word, and through Bopp, Pott, Benfey, W. v. Humboldt, Schleicher, etc., is the comparative science of language essentially a German creation.

History, too, took the stamp of the specializing scholarship of the century. An overwhelming mass of material has been gathered by the research of the German historical schools. Typical are the 'Monumenta Germaniæ historica.' But the pride of this field of German scholarship is the noble line of great historical writers. Niebuhr (1776-1831) gave to the world a perfect reconstruction of early Roman history, and Mommsen (1817-1903) equally eminent as historian, jurist, and philologist, gave in his Roman history the German masterpiece of classical history writing. Yet the greatest figure of this group was Leopold Ranke (1795-1886), whose works deal with the popes, with Prussia, England, France, especially in the 16th and 17th centuries, and in the last years of his life with world history; they are famous alike for their style and composition, for their richness of material, and for their objective presentation. Schlosser and Gervinus went their own way; Sybel and Waitz, Giesebrecht and Treitschke, however, were deeply under Ranke's influence.

The economic life of the social community was seen at the beginning of the century through the eyes of France and England. The abstract theory of economy with its individualistic tendency controlled the first decades; of this the work of Rau is typical. With the year 1840 begins the growing reaction. The historical relativistic view is developed by Roscher, Kries, and others, and List, in his National System, Rodbertus, in his Social Letters, Marx, in his Kapital, led the attack of collectivism against the abstract individualistic theory. Brentano, Knapp, and Schmoller turned the attention to the objective history of economic conditions.

The legal life of the community and the theory of law was the object of not less intense discussion. Among the leaders of the century Savigny, Windscheid, and Jhering may be mentioned for Roman Law, Eichhorn and Grimm for German Law, Mohl and Bluntschli for State Law, Feuerbach and Mittermaier for Criminal Law, Thibaut and Dernburg for Private Law, etc.

In the field of religion the naturalistic tendency of this post-idealistic period demanded, first of all, historical criticism, and yet positive theology was not idle. In the study of the Old Testament most fundamental research work was done by Hengstenberg, Delitzch, and Hofmann; in the study of the New Testament by F. C. Baur, the founder of the school of Tübingen, D. F. Strauss, and in sharp contrast to them, Ritschl and Weizsäcker; in the study of church history by Planck, Neander, Ritschl, and Harnack; in the study of Systematic Theology by Schleiermacher, Rothe, Lipsius, Nitzsch, Ritschl.

And finally, philosophy. The period which we have just characterized by the abundance of its specializing work began with the downfall of Hegelianism. The age became indifferent to real philosophy and substituted either an uncritical materialism with Büchner, Vogt, or the history of philosophy which naturally became the domain of Hegelians like Erdmann, Kuno Fischer, etc., or developed a specialistic study of empirical psychology. In the latter field Germany founded, through Fechner and Wundt, the new science of experimental psychology. In the last two decades of the century new interest in real philosophy has set in, partly in the midst of the special sciences, as mathematics, physics, history, etc., where a disappointment in mere fact-gathering has everywhere led to the deeper problems of principle, partly in pure philosophy. This new idealistic movement has grown rapidly; logical, ethical, metaphysical, æsthetical discussions come again more and more to the foreground, welcomed by the empirical sciences which held them in contempt for half a century. And thus it can be said that with the beginning of the 20th century the anti-idealistic specialistic movement, which began in the third decade of the last century, has come to an end and a new synthetic idealistic tendency appears to-day throughout German science and thought.

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7. **Germany — History of Painting and Sculpture.** The inward relationship and intimate connection of sculpture and painting in German art render it desirable to treat of their development as a whole. Painting is the more important of the two branches, because of its greater possibilities of expression. Christian art, and especially German art, demands the representation of inward emotion, of individual character, of spiritual aspirations, not the realization of outward beauty, and perfection of form. The aim of German sculpture and painting is, therefore, not so much the perfecting of the typical, as the complete characterization of the individual.

The first beginnings of plastic and painting are to be found in the sphere of ornament. Peculiar patterns formed by ribbons, bands, plaited, twisted and intertwined with fantastic representations of beasts and birds exist in the miniatures of the 7th century and in the decorations of early architecture. These ornaments differ in character according to their locality. Under Charlemagne the first attempt was made to produce a national characteristic style, which was based upon a direct and conscious imitation of late Roman art. Under the Ottoman Empire a second weighty element became the influence of Byzantine models.

In the 9th and 10th centuries bishops and abbots were the chief patrons of art. A large part of the income of the cloisters was devoted to decorative purposes. The monastery of St. Gallen ranked foremost in the number and importance of its illustrators. We hear of various series of rural paintings, but one alone is preserved to us, that of St. George in Oberzell (c. 1000.) The first inspiration to monumental works in plastic was likewise due to the taste and erudition of the church. Bishop Bernward (d. 1023) became the centre of an art movement of enduring value, as is attested by the Bernward's column, the bronze doors, and various other works of the cathedral in Hildesheim. This art, containing strong Byzantine reminiscences, influenced by late Roman models, but transformed by the glowing imagination of the North into a new beauty, was the first flower of the Romanesque period, in which we can generally class all the works of the 11th and 12th centuries in Germany. The oldest work of German easel painting belongs to this period — the wooden Antependium in Soest (1166). The "Hortus Deliciarum," of the Abbess Herrad of Landsperg shows most clearly the progress of painting, which was chiefly developed by the miniaturists. In Schwarzheindorf, in Brauweiler, in Brunswick and in other places cycles of frescoes attest the presence of artists, who with simple means attained inspiring results. The highest expression of the lofty spirit of the Romanesque period is, however, to be found in the sculptures of the 12th and 13th centuries. The Crucifixion in Wechselburg, the choir-reliefs in Halberstadt, the Golden Gate of the cathedral in Freiberg in Saxony, the Apostles of the cathedral in Bamberg, together with the statues of the princely patrons of Naumburg show a truth to nature and a technical mastery of material, an elevation of taste, and an understanding of the possibilities and necessary restraints of sculpture which in such perfection are not again reached by German plastic.

About the middle of the 13th century the Gothic, entering Germany from France, celebrates its triumph over Romanesque ideals. The forms of the figures in sculpture as in painting undergo a gradual change. The statuesque pose, the truthful portraiture of the individual, the large dignified treatment of drapery of the Romanesque period are abandoned. A general type of contrast movements is adopted. The human body is represented in a strongly curved position, the hip bent sidewise, the head drooping, while an extreme delicacy of hands and affected position of the arms is sought for. The peculiarly long, thin proportions of this type are the result of the influence of Gothic architecture, which demanded extraordinary height in its decorative members; the naïve charm of expression is a reflex of the rich, though conventional, poetical, and religious life of the period. The most important plastic works of Gothic Germany are to be found in its cathedrals. First among these is the portal of the minster in Freiburg i. Br. (c. 1270) unsurpassed in feeling and grace in German Gothic. Strassburg, Mayence, Nürnberg, and Brunswick follow with portals and façades covered with a wealth of decorative figures. The subjects are drawn from Biblical legend and scholastic dogma.

In the field of painting the illustration of sacred books and classic poets occupied numberless miniaturists. Repressed by the conditions of Gothic architecture, fresco decoration did not flourish. The leadership fell to easel-painting, and soon wooden altar-pieces of monumental size filled the churches. In the 14th century three cities became the centres of art development, Prag, Nürnberg, and Cologne. History begins now to record the names of individual artists. Under Charles IV Nicolas Wurmser enjoyed great popularity. The Nürnberg local school evinced earnest endeavor to depict nature and to discover the laws of its proper presentation. Foremost in power, however, ranked the school of Cologne. The city was then a centre of the mystical movement of Germany. The religious leaders were full of poetry and of love of the Beautiful. They recommended the use of paintings in the churches as an aid to the devotional spirit. The simple, fervent belief in Madonna and saints which inspired the people finds expression in their altar-pieces of the 14th century, gathered largely to-day in the museum of Cologne. Sunk in revery, or rapt in ecstasy the aerial Gothic figures appeal to us as embodied ideals of the æsthetic and religious spirit of the middle ages. The glowing colors, the gold and the deep blue, are in themselves a symbolism of pure joy. The creations of Meister Wilhelm (Hermann Wynrich) may be regarded as the most finished works in conception and execution of early German painting. A note of such exquisite and unconscious loveliness is not again attained, for no tarrying was possible upon this height. The lyric of the Minnesinger and the piety of the mystic had reached their full artistic expression. About 1400 a new era broke over German art. Not Heaven but earth claimed its interest. A naive realism replaced the dreamy vision of soulful saints. The Gothic type gradually disappears. It is succeeded by a naturalistic tendency bent upon characteristic representation of the individual. In the social life of the nation knighthood yielded to the might of the burghers. A new commerce sprung up in flourishing cities. The spirit of discovery and of invention arose in its power. Thus the beginning of the 15th century became again a period of experiment and of new technical processes. Especially influential in bringing about this change was the great altar of Ghent, which in 1432 made the names of the Flemish painters, Hubert and Jan van Eyck, famous for all time. A practically new technique — the use of oil mixtures — presented itself here, and soon all Europe was engaged in working out new problems of painting. Italy called upon science to aid art, and there the problems of perspective, of anatomy, of composition, and of artistic harmony were systematically solved, so that the artist built his lofty structure upon a sure foundation. Not so in Germany. Individual painters reached here during the first half of the 15th century at times a high degree of excellence, but the works of this period show in general a lack of constructive ability.

Stephan Lochener (d. 1452) in the beginning of his career painted a series of harmoniously beautiful works in the spirit of the early Cologne school, of which the best known is the altar-piece of the cathedral. Later Lochener loses himself in imitation of the Flemish masters, as do the later painters of Cologne, "Master of the Life of Maria," "Master of the Lyversburg Passion," "Master of St. Severin," "Master of Liesborn," and other painters of this school.

Lucas Moser in Swabia and Pfennig in Nürnberg are the most important painters of the South. Their works form a strange contrast to those of the foregoing period in their short, heavy figures and in their genre-like use of the incidents and implements of daily life.

Flemish influence during the 15th century gradually becomes paramount, not only in technique, but also in the type of figure adopted, in costume, landscape, portraiture, composition, and color. Different local schools progress in the knowledge of perspective, anatomy, in the management of drapery, and in atmospheric unity. In Kolmar Kaspar Isenmann (d. 1466) founded a workshop in which was trained the artist who was destined to give to the school of the Upper Rhine a position of leading power, Martin Schongauer (d. 1491). Schongauer's rich phantasy and high artistic talent covered a wide range of subject and technique. His influence upon his time was far-reaching. Especially as an engraver was he an inspiration and a model to his compatriots.

In Ulm, Bartholomäus Zeitblom (c. 1450–1517) took the leading position, through the exceptional restraint and simplicity of his compositions. In the local school of Augsburg the chief place is filled by Hans Holbein the Elder (1460–c. 1524). In his works it is possible to trace the progress made by German art in this period from narrow realism and exaggerated movement to an understanding of the harmony of form and color characteristic of the Renaissance.

Nürnberg continued during the 15th century to be a centre of artistic energy. Hans Pleydenwurff is the first name in a long list of local artists. Pleydenwurff has a talent of superior order and delicate artistic appreciation, but he died young, leaving his workshop to Michael Wolgemut, under whose name many of Pleydenwurff's paintings are known. To Wolgemut (1434–1519) art was a business. A clever artisan and imitator of Rogier von der Weyden, he lacked all deeper feeling and higher imagination. In his works, as well as in numberless other productions of the Nürnberg school, we can best see the subject-matter to which the early artists of the 15th century devoted their attention. Not soulful representations of Madonna and gentle saints, such as are found in the early Cologne school, enthrall the imagination, but the subject of the Passion of Christ, and the sufferings of martyrs, become the theme of their art. The Italians, seeking the highest beauty in subject, as in form, had more and more abandoned the scenes of the passion as their art advanced to its full height. The Germans, on the contrary, found in their representation of the heartrending agony and unbridled cruelty of the Cross an outward expression for their inward religious emotion. The countless crucifixions of this period show an imagination quivering with intensity of feeling, but devoid of artistic balance. With passionate earnestness every detail of distortion, of rude ribaldry, is dwelt upon, while compositional construction and loveliness of form and color are neglected.

If this striving after a delineation of highest tragic was incompatible with æsthetic beauty in painting, how much more was this the case in sculpture. Without regard for the potentialities of representation in stone or wood, the German of this period poured his intense feeling, his love of movement, and of detail into the altar-pieces of the cathedrals. Plastic separates itself gradually from architecture. Shrines, reliefs, statues, monuments, are placed in the churches as entities, not as integral parts of the architecture as heretofore. An earnest study of nature is characteristic of the time, but it lacks the system of a great school, or the inspiration of a great leader. The sculptors in general may be divided into two groups. In northern Germany the centre is again Cologne, whose masters are influenced in plastic, as in painting, by Flemish models. In southern Germany the centre is Nürnberg, where sculpture precedes painting in importance until the end of the century. Michael Wolgemut is the first artist we meet here, in whose busy workshop sculptors, as well as painters, were employed. From primitive beginnings an art is developed which shows increasing mastery over technique and a clearer understanding of the problems of plastic. Humanistic studies and classic models gradually influence artists as well as scholars. When we think upon the sculpture of the developed Renaissance, we see that a change of view and of purpose has taken place. Perfection of form and harmony of composition are sought. The individual and the momentary are changed into the typical and the enduring. Three artists stand out in prominence, all in Nürnberg; the one, a carver of wood; the second, a cutter of stone; the third, a founder of bronze — Veit Stoss, Adam Krafft, and Peter Vischer.

Of the woodcarver, Veit Stoss (c. 1440–1533), the best known work is the "Angel's Greeting" in the St. Lawrence Church of Nürnberg, the most attractive is the statue attributed to him of a full length Mater Dolorosa in the Germanic Museum. This figure in its grace and beauty of pose, its simple treatment of drapery, and its sincerity of feeling justly ranks among the best statues of German art.

Adam Krafft (c. 1450–1507) is chiefly known through his representations in sandstone of the "Seven Stations" recorded by holy legend as the scenes of Christ's journey from the house of Pilate to Golgotha. These realistic sculptures in high relief show the costume and countenance of Nürnberg burghers; the composition is clear and admirable.

Neither Stoss nor Krafft, however, attained that perfected excellence of style which is found in the works of Peter Vischer (c. 1450–1529). As Dürer is the first representative of German Renaissance in painting, so Vischer must be regarded as its highest expression in sculpture. The influence of Italian art is powerful with him, and his inspiration is drawn largely from an enthusiastic study of the antique, though he never for a moment loses his own individuality. Vischer's masterpiece is the tomb of St. Sebaldus in the church dedicated to that saint, a bronze work of mixed Gothic and Renaissance features, which on account of its originality of conception and artistic perfection of detail has become the pride of Nürnberg. Totally different in character, it is comparable in beauty to Ghiberti's "Gates of Paradise," the much prized jewel of Renaissance sculpture in Italy.

Vischer's sons and pupils continued his workshop, but toward the middle of the 16th century the deterioration of the commerce and power of Nürnberg closed the door of the famous foundry, which for nearly 100 years had furnished the best bronze reliefs, grave tablets, shrines, and statues of German Renaissance sculpture.

Outside of Nürnberg we find only the sculptors of Lower Franken, in and near Würzburg, of importance. The "Master of the Creglinger Altar" and Tillmann Riemenschneider (1460–1531) are the two names worthy of especial note. The latter's masterpiece is the celebrated tomb of Emperor Henry II. and his wife Kunigunde in the cathedral of Bamberg.

The representatives of the Swabian school of this period are Jörg Syrlin and Friedrich Herlen. In northern Germany the development of woodcarving culminated in the richly-decorated altar of Hans Brüggermann (1515), now in the cathedral of Schleswig.

In Tyrol we find a sculptor, who, although near to the Italian boundary, nevertheless shows himself a northerner in form and feeling. Michael Pacher (d. 1498) owes his refined taste and his monumental composition to his contact with Italy, his wealth of fanciful detail and his treatment of drapery to his native surroundings.

In remaining Germany exist numberless altar-pieces and statues by unknown or unimportant masters. These altar-pieces are usually divided into various compartments, and, almost without exception, are richly colored and gilded.

It was no mere chance that in painting, as in sculpture, Nürnberg produced the first great artist who united theory and practice to a noble whole. The city had been for generations the chief centre of artistic movement and interest. In Albrecht Dürer we find the full and complete expression of the spirit of German Humanism, which was ethical as well as æsthetic in its nature. His works are mirrors of universal personality. In him took place that transfiguration of art which stamps its creations with living truth and gives to them enduring value.

Albrecht Dürer (1471–1528) was the third among eighteen children. He entered the workshop of his father, a skillful goldsmith, to learn his trade, but was sent later (1486) as a pupil to some unknown painter in the workshop of Michael Wolgemut. Dürer's portrait by his own hand at 13 years in Vienna shows the early talent of the boy. In 1490 he started on the usual pilgrimage of young German artists to distant centres of art, and visited Kolmar, where he came under the influence of Schongauer, then Augsburg, Basel, and Italy. In 1494 after his return to Nürnberg he was married to Agnes Fry. He enjoyed the protection and friendship of the learned young patrician, Willibald Pirkheimer, through whose influence he entered the circle of the humanists where his mind was stirred by contact with such men as Erasmus von Rotterdam and Reuchlin. In 1506 Durer made a second journey to Italy, where he spent a year, devoting himself especially to Venice. In 1520-'21 he undertook a lengthy visit to the Netherlands. On the 6th of April 1528 Dürer died in Nurnberg, the scene of his life labors. In the open square which bears his name, the city erected in 1840 a bronze statue by Rauch to his memory. In the quiet cemetery of the Johannis church lies, as the inscription says, "That part of him which is mortal."

Dürer's genius belongs to the highest class. He far surpasses in range of imagination, in depth of feeling, in understanding of nature, and in artistic power of presentation any of his compatriots. His productiveness was especially great in the field of engraving. His wood cuts and engravings stand unsurpassed. Among the most important wood cuts are The Revelation of John, The Small Passion, The Large Passion, The Life of Mary, and Maximilian's Gate of Honor, the largest existing wood cut. For the Emperor Maximilian were also made the celebrated 'Triumphal Chariot' and the illustrations of The Prayer Book.

Dürer's best known engravings are: Melancholy, St. Jerome, Adam and Eve. As a painter Dürer produced portraits which belong to the world's masterpieces. Among many of great value those of the Nürnberg Senator Muffel, and of Hieronymus Holzschuher, both in the Berlin museum, take the highest rank.

Among Dürer's numerous religious paintings: 'The Trinity' in Vienna, 'Christ on the Cross' in Dresden, must be especially mentioned, while the crowning masterpiece of his art is to be found in the 'Four Apostles' in Munich, a work unparalleled in the history of German painting for monumental greatness and truth to nature.

Dürer's writings as well as his creations with the brush were epoch-making. His works were translated into Latin and most of the modern languages. The most important among them is the treatise 'Concerning Human Proportions.'

An artist of Dürer's genius necessarily had a powerful influence upon the further development of his country. His wood cuts and engravings carried the knowledge of his great spirit into the most distant provinces. The later painters of the Nürnberg school according to their own greater or less pronounced individuality followed in his foot-steps. Among Dürer's own pupils his brother Hans Dürer (1490-1538) deserves mention, also Hans Schaüfelein (c. 1840-1540), Hans von Kulmbach (1475-1522). Among the younger generation of his followers Georg Penz (c. 1500-1550) and the two brothers, Hans Sebald Beham (1500-1550) and Barthel Beham (1502-1540) were, like Dürer himself, enthusiastic supporters of the Reformation.

In the district of the Upper Rhine a school of painters, whose chief representative is Matthias Grünewald, preserved an element of independence. Grünewald's (c. 1479-1525) importance lies in the artistic means which he employed to give his paintings life and beauty. He was, in contrast with his contemporaries, a colorist. Effects of light and harmony of color formed his ideal. He seemed a German forerunner of the light and shadow painters of Holland. In spite of a naturalism which depicts every revolting detail of a crucifixion, Grünewald has been named the "German Correggio." To him belongs by right the fame of first arranging his compositions with regard to value of mass and poetry of light.

Grünewald's influence is seen most clearly in the works of Hans Baldung Grien (c. 1475-1545) who combines coloristic aims with a baroque imitation of Dürer's forms.

Albrecht Altdorfer (c. 1475-1538) is also a product of the art of Durer and Grünewald, but a painter of decided individuality who developed in his landscapes and atmospheric quality which gives to them great charm.

To this period belongs Hans Burgkmair (1473-1531) who endeavored to transform the circumscribed naturalism of the 15th century into greater nobility of form through the use of Italian types. Burgkmair was followed by Christoph Amberger (c. 1500-1561) by Martin Schaffner (t. 1541) and Berhard Strigel (c. 1460-1528), who excelled especially as portraitists.

In Augsburg, the centre of riches and culture, was born Hans Holbein the younger (1497-1543), that painter, who, together with Dürer, stands in the foremost rank of Renaissance art. Holbein's first instruction was received from his father in his native city. Later he was occupied in Basel as well as in Augsburg. When the storm of fanaticism against art broke during the Reformation, Holbein turned his attention to England and in 1526 visited that country for the first time. In 1538 he became the court painter to Henry the VIII and in this position fell a victim to the pest in November 1543.

Holbein possessed a remarkable sharpness of eye for every detail of nature, a boldness of drawing comparable to that of Mantegna, an exquisitely fine sense of modelling, and a greatness of conception classical in its spirit. As a colorist he is unequalled in German art. Holbein's Madonna of the Bürgermeister Meyer now in Darmstadt (an excellent Dutch copy of the 17th century exists in the gallery of Dresden) is to German art that which the Sistine Madonna of Raphael is to Italian painting, the culmination of a long period of artistic evolution.

A long list of portraits by the hand of Holbein vie with one another in excellence, none however surpassing that of the Ambassadors in London. To estimate correctly the greatness of Holbein's genius, a careful study must be made not only of his paintings, but also of his engravings and wood cuts. The deep earnestness of his nature and his fiery religious zeal speak from his illustrations of the Bible, his representations of daily life and above all in his celebrated series of the Dance of Death.

The remaining painters of this period were scarcely more than imitators, or clever artisans. In Saxony, however, a school of influence was founded by Lucas Cranach the elder (1472-1553), whose name became for a time almost as popular as those of the great artists of southern Germany. As a landscape painter and harmonious colorist, Cranach deserves a high rank, but he soon became affected in his types and sterile in his compositions, losing himself in countless soulless repetitions.

With the masterpieces of Dürer and Holbein the development of German art had reached its height. In their works we find that ripe union of nature and style which is the secret of classical epochs. The period of fruition, however, was not in proportion to the slow ripening of German art. Scarcely had it reached its full power when the signs of decay imposed from without became apparent. The art of Italy gave to the great masters of Germany inspiration, and helped them to develop their own ideals. To their immediate followers it became a law foreign to their nature. They began to use forms which they did not feel. Virtuosity soon replaced living art.

Upon the great period of Dürer and Holbein followed a weakening and lassitude of artistic power, which lasted nearly 200 years. The later 16th and the early 17th century were filled by poor productions in imitation of Italian art, later in imitation of Flemish models. The only real artist whom Germany produced at this time was Adam Elsheimer (1578–1620), who created a new form of landscape, in which the human figure became an integral part of the compositional whole.

In the 18th century there are likewise but few names of especial note. Denner (1685–1749), a portraitist, depicted the human face with the exaggerated detail of a microscopic vision. Chodoviecki (1726–1801) paints the life of the burgher. Anton Graff (1736–1813) possesses in portraiture excellent technique. Architectural scenes, animal hunts, still life were copied from Flemish models. Academic barrenness paralyzed inner life.

Sculpture shared the general downfall. The Thirty Years War destroyed the seeds from which new life might have sprung. From the end of the 16th century until the last decade of the 17th foreign sculptors were almost exclusively employed. Superficial beauty and emptiness of form replace healthy naturalism. At the beginning of the 18th century single cities produce some good works of home talent. As the best of these is to be regarded the bronze statue of the great Kurfürst in Berlin by Andreas Schlüter (1664–1714), the foremost representative of German baroque. In southern Germany Georg Raphael Donner (1692–1741), in contrast with Schlüter, devotes himself to a study of the antique, striving after simplicity of composition and form, as is shown in his celebrated fountain in Vienna. A return to nature is sought by the Berlin sculptor Johann Gottfried Schadow (1764–1850), whose worthy followers are Christian Rauch (1777–1857) and Ernst Rietschel (1804–1861).

Winckelmann's History of Antique Art in 1764 created a new artistic enthusiasm in the minds of Germany. His followers hoped for a new birth of art through contact with and appreciation of the art of Greece. When Goethe in theory and practice lent his influence to this teaching, the supremacy of antique ideals became settled. Raphael Mengs (1728–1779) adopted the principles propounded by Winckelmann as his guide and became the founder of German classicism. Although his perfectly formed figures possess no inner life, Mengs was in his own time looked upon as a new Raphael. Angelica Kauffmann (1741–1807) painted allegorical and historical scenes of merit as well as portraits of sentimental charm. Carstens (1754–1798) may be regarded as an artist who possessed not only the form but also much of the spirit of the classical models he followed. In Peter Cornelius (1783–1867) we greet a powerful artist of this period, burning with energy and ideality, his hand trained, his eye set on mighty deeds. The figures, however, which crowd his frescoes, have no root in the soil from which they spring. His compositions are the result of abstract theories, so that his true greatness makes shipwreck on the dangerous shoals of imitation. Of lesser talent but similar aims are Wilhelm von Kaulbach (1805–1874) and Julius Schnorr von Carolsfeld (1794–1872).

With the beginning of the 19th century a group of artists, preserving each his own individuality and technique, found their way again to the thoughts and hearts of the people. The principal names among these are Moriz von Schwind (1804–1871), Ludwig Richter (1803–1884) and Adolf Menzel (1815–1904). Schwind is the pleasant narrator of German fairy tales. Richter the illustrator of the homely, hearty scenes of everyday life, while Menzel is the enduring naturalist, historian of national aims and deeds, a painter and especially a draughtsman of great power. Anselm Feuerbach (1829–1880) sought to unite romantic ideals with classic form. To Hans Makart (1840–1884) a brilliant colorist and pupil of Piloty's, the world appeared as a theatrical scene of bright draperies and gay personages. Landscape painting rose to a high degree of excellence through the painters Friedrich Preller (1804–1878), Karl F. Lessing (1808–1880), and the brothers Andreas and Oswald Achenbach.

With these artists of note are associated in the second half of the century the painters of religious scenes and of genre, Knaus, Vautier, Defregger, Edward von Gebhard, Gabriel Max, Piglheim, and Fritz von Uhde.

At the close of the 19th century three names stand out in prominence — Lenbach, Thoma, and Böcklin. Franz von Lenbach (1836–1905) is the leader among portraitists and a colorist of power. Hans Thoma (b. 1839) depicts in simple truthfulness the German peasant and repeats in poetical landscapes the scenes of his native land. In Arnold Böcklin (1827–1901) the naturalistic pantheism of the Greeks is born again. He gives us a new world of satyrs, fauns, nymphs, and nereids. He experiments in new technical methods and invents new tones of vivid color. As a landscape painter he possesses the charm of composer of melodious music.

In this morning of the 20th century, individual artists are following individual paths. Adolf Hildebrand (b. 1047) in sculpture possesses in his best works simple greatness and pure beauty. Volkmann follows his lead. In contrast to Hildebrand is the sculptor Reinhold Begas (b. 1831), who relies for his effect upon a modern baroque splendor. In painting and in sculpture Max Klinger (b. 1857) stands forth as an artist of power, while a large group of painters, prominent among whom are Kalckreuth and Max Liebermann, devote themselves to the development of the aims of the French impressionist school. According to the talent and insight of the artist we find the individual striving after the accurate delineation of actual things, after sound portraiture, above all after the subtle effects of light and shade in landscape. As these aims have their root in an appreciation of nature and a reverence for her harmonious laws we may hope that the new century in Germany will be rich in artistic expression of its inward vision.

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8. Germany — History of German Music. The chief epochs in the history of German music are these,— sacred, polyphonic music, and its culmination in the works of Bach and Handel; the birth and development of modern instrumental forms; the German romantic opera,— von Weber; the German Lied; the Romantic School, Schumann, Liszt; the Music dramas of Wagner; modern tendencies as found in the works of Strauss and others.

The first promising epoch in the development of German music was the Reformation. In that period of storm and stress, of burning questions and of intense longing for religious and social independence, sacred music, that expression of man's belief in the Eternal, was cultivated with the greatest fervor. The music which was the natural outcome of such conditions was of far-reaching influence, especially upon the great vocal and instrumental compositions of Sebastian Bach (q.v.).

Martin Luther, the leader of the movement, was not a composer of chorals or hymn-tunes, as is often supposed, but a writer of the words of hymns to which he and others set traditional melodies taken from the rich stores of religious folk songs then extant. Luther's distinct contribution to the musical life of the time was (1) his writing of about 30 hymns which, deeply imbued with patriotic and moral feeling, spoke directly to the heart of the German people, and (2) his associating with him the best musicians of the period to collect and write chorals suited to his words. Of these the most famous were Johann Walther and Ludwig Senfl.

In 1524 there was published in Wittenberg Walther's choral-book with a preface by Luther. The melody of 'Ein Feste Burg,' which Frederick the Great called "God Almighty's grenadier march," has exercised a powerful influence throughout the course of German music, as may be seen from the prominent part it bears in the works of Bach, Mendelssohn (Reformation Symphony) Meyerbeer (Huguenots) and finally in Wagner who uses its strains in the 'Kaiser-March' to typify the military triumphs of united Germany.

The first representative composer, often spoken of as "the father of German music"— whose works clearly foreshadowed two of the important directions of modern art,— was Heinrich Schütz (q.v.). He was born in 1585, just a century before Bach, and died in 1672, while he was court director of music at Dresden. Quite early in life he came under the stimulating influence of the Venetian school as a pupil of the famous Giovanni Gabrieli. Schütz, as the composer of the first German opera 'Daphne,' is the progenitor of the line which includes Gluck, Mozart, von Weber and Wagner. Schütz's real importance however centres in his sacred compositions, the 'Resurrection,' the 'Seven Last Words' and the four settings of the Passion. In these works, in which a sacred story in dramatic form is told without the aid of scenery or action, Schutz was the real founder of German Oratorio, and in his power of vivid, dramatic characterization anticipated some of the essential features in the Passions and Oratorios of Bach and Handel. In Schutz we also see traces of that Teutonic power of introspection and deep thought which prevented German Oratorio from yielding to the baleful theatrical influence of Italian music, and which, exercised by the great composers of the following century, led to such triumphant achievements in German Art. The prime of Schütz's life unfortunately coincided with the Thirty-years War (1618–1648)— that time of devastation and horror which diverted all men from the peaceful cultivation of either Art or Literature.

On the other hand this period of ferment and of the breaking up of established routine had a stimulating effect upon German music in that composers were brought into closer touch with men and ideas from other nations. German artistic development had suffered from too much isolation, but henceforth, by reason of this intermingling of continental peoples, music began to speak a more universal language. This change is strikingly typified in the Instrumental Suite which was a somewhat loosely connected series of national dances — as may be seen from the names of the principal numbers, Allemande (Germany), Couraunte or Corrente (France or Italy), Sarabande (Spain), Bourée and Gavotte (both French), and Jig (English).

Prior to the complete development of the Sonata and Rondo forms in the time of Haydn, the Suite was about the only instrumental form (with the exception of the Fugue), which made any pretence to artistic organization, and was the favorite form in the clavichord compositions of Bach, Handel, and contemporary composers.

The real supremacy of German music dates from the 18th century, for at that time began the careers of Bach and Handel (qq.v.), both born in the year 1685.

Handel was undoubtedly a man of great force of character and of quick comprehensive intellect; in whatever he undertook, as composer, impresario, or chapel-master, he succeeded through sheer force of will and personal magnetism. His purely musical gifts, great as they were, often seem the least of his powers. His varied career affords a striking contrast to the simple life of Sebastian Bach, who spent his days in a rather obscure part of Germany, was practically unknown, and certainly unappreciated outside his native land, and began to receive due recognition only about a century after his death.

Handel's early studies were made in Italy and in his 47 operas he stood forth as the finest representative up to that time of the flowing Italian vocal style. These operas, although now entirely obsolete on account of their weak, meaningless libretti and lack of dramatic unity, yet contain some of Handel's finest songs, and as a song-writer his power is undoubted.

Handel's fame to-day rests almost entirely upon his Oratorios, among which may be mentioned 'Israel in Egypt,' 'Sampson,' 'Judas Maccabaeus' and the 'Messiah.' His vast number of other instrumental and vocal works on account of their old-fashioned, conventional idiom, and their somewhat monotonous harmonic scheme, are fast becoming obsolete. In the Oratorios, although they contain many arias noted for pathos and beauty of expression, the choruses are the portions in which Handel's distinctive power is chiefly shown. His vocal solos are too often of stereotyped design and defaced by meaningless roulades — a survival of the vain-glorious operatic style of the period. As a chorus-writer, Handel is supreme in the history of music. He was a great impressionist and for dramatic effect, for majesty and dignity of utterance in dealing with large masses of voices, has never been surpassed. Early in middle life Handel became a naturalized Englishman, wrote his most famous works to English words, with special reference to English religious feeling, and so his influence there has at times amounted almost to idolatry. Upon other nations, France, Italy, and Germany, Handel's influence has been much less and is weakening year by year.

If human greatness is to be measured by a constantly growing concensus of approval, Bach was in some ways the greatest musician who ever lived. He is practically the founder of modern music, and his influence is supreme in such different composers as Beethoven, Schumann, Chopin, and Wagner (qq.v.). In wealth of harmonic resource Bach was at least a century ahead of his time, and only recently have the inexhaustible vitality and suggestiveness of his works been fully appreciated. Bach's power is shown in three important branches of composition — as a choral-writer, as an organ-composer, and as the precursor of the important modern developments in pianoforte style and pianoforte playing. Bach's great choral-works are the two settings of the 'Passion according to Saint Matthew' and 'Saint John,' the 'B minor Mass,' the 'Christmas Oratorio,' and innumerable church cantatas. Words are entirely inadequate to describe the sublimity and pathos of these stupendous cathedrals in tone. In the words of Schumann "music owes almost as great a debt to Bach as religion owes to its Founder."

To the general public Bach is best known by his organ-compositions, Preludes, Fugues, Toccatas, Fantasies, Choral-Preludes, etc., and as an organ composer no one can even be mentioned in the same class. These works are all remarkable for their variety of construction, for their free, untrammeled use of every possible contrapuntal device, and notwithstanding their intricacy, for the complete subordination of mere learning to the needs of a personal expression of mood. Bach's most important work for clavier — the prototype of our modern pianoforte — is the 'Well-tempered Clavichord.' This work, in substance a set of 48 Preludes and Fugues (in all the major and minor keys), took its name from the new system of tuning, largely originated and sanctioned by Bach, by which all keys became of equal importance, and modulation was made possible into remote tonalities. The 'Well-tempered Clavichord,' often called the musician's Bible, represents not only the essence of Bach's genius, but contains within it the seeds of the whole growth of music since that day. In strong distinction to the somewhat local influence of Handel, the leading composers of every nation, Italy, France, Germany, America, etc., have taken Bach as their model and have stated unmistakably that they have based their work on his. Other notable compositions of Bach are the French and English Suites, the Chromatic Fantasie and Fugue and the Two and Three-Voiced Inventions. Mention should be made of the Orchestral Suite in D, of the Sonatas for Violin and 'Cello, and of the celebrated Chaconne for violin solo.

Between the culmination of the vocal style of Bach and Handel and the development of modern instrumental music there was an interregnum, a period of overlapping tendencies, and of experimentation as to what the course of music should be.

Sebastian Bach himself said in the latter part of his life that musical taste had altered wonderfully and that the old music no longer sounded good to the ear.

Among many worthy names, two are of real prominence. Gluck (q.v.), (1714–1787), will always be honored as the first reformer of the opera, and although his best works, 'Iphigenia in Aulis' and 'Iphigenia in Tauris' were written to French libretti and brought out in Paris, the peculiarly Teutonic characteristics of the man, his sincerity, his courage and unerring instinct for dramatic truth were the animating causes of his reforms. To carry them out Gluck needed all the strong physical and mental qualities which came to him from his peasant ancestry. Italian opera as he found it was an artificial and undignified form of art, in complete subservience to the capricious whims of singers and the vitiated taste of ignorant patrons. Gluck's title to fame is the fact that in such circumstances he set himself resolutely to express himself in his music, and to make it manly and sincere. His dramatic creed is expressed in the famous preface to 'Alceste.' One of his chief canons was to make the music subordinate to the spirit of the words,— a principle sometimes carried so far as to make the music lacking in beauty for its own sake.

Gluck is rightly regarded as the father of modern opera; his theories and reforms have had great influence upon all opera composers, notably upon Wagner, and his works are the earliest which hold the stage to this day. He was great both in impassioned and pathetic melody and his dramatic use of the chorus is unsurpassed. He was also the first to anticipate in many ways the organization of our modern orchestra.

Emmanuel Bach (q.v.) (1714–1788), third son of the great Sebastian, the forerunner of Haydn and Mozart, is important for his contribution to the development of instrumental form, especially in music for the clavier. In fact many of his first movements all but reach the completely organized Sonata Form as found in Haydn. He was also an important factor in settling the most effective manner of writing for the clavier, *i. e.*, solo-melodies lightly accompanied, brilliant passage-work, etc., instead of the old polyphonic style on a vocal basis. His celebrated treatise on 'The true art of playing the Clavier' contains the principles which have since been developed by Clementi, Cramer, and others into the pianoforte style of our own time.

Haydn (q.v.), (1732 .) is called the Father of the Symphony and the String Quartet, and the term, though a slight exaggeration, is well deserved, for he summed up and amplified the tentative efforts of the many instrumental composers of the period. Born at Rohrau in Austria, near the Hungarian frontier, his peasant origin and his life-long contact with the common people and with rural life must be kept in mind in estimating his music. Much light has been shed upon the causes of Haydn's peculiar genius by the researches of a Croatian scholar, Dr. Kuhac, who has shown conclusively that Haydn was of Croatian stock. The evident and pervasive signs in Haydn's music of light gypsy dance rhythms and of folk-songs are thus accounted for. His earlier years were of intense hardship and his musical education due almost entirely to his own efforts. Finally he came in 1761 under the patronage of the Esterhazy family in Hungary — a post held uninterruptedly for 30 years, in which Haydn's status was typical of the musical patronage in vogue at that epoch. The most prominent external events of Haydn's life were the two visits to London in 1791 and 1794 at the invitation of the violinist Salomon. For these occasions were composed the 12 "Salomon Symphonies" which include Haydn's best work — the 'Surprise,' the 'Oxford,' etc. Haydn received the degree of Doctor of Music at Oxford and also became acquainted with the vocal style of Handel, which influenced him in the composition of the 'Creation' and the 'Seasons,' those remarkable works of his old age. Haydn, a distinctly uneducated man, but one of great musical concentration, was just suited to organize the tunes and rhythms of the people into coherent forms of art. In movements in the so-called Sonata Form his establishment of the second theme and free treatment of thematic development were organic changes of the greatest moment. To the old three-movement Sonata or Symphony with its mechanical contrast of fast, slow, fast, Haydn added the Minuet, in which his fondness for light graceful rhythms and spirit of playful humor found free scope. The modern String Quartet owes almost more to Haydn than the Symphony. His String Quartets contain his most vital and lasting work and show his inexhaustibly fertile invention in varied rhythms and in the individualizing of the instruments. Haydn's music is noted for its cheerfulness and dainty grace, and though it seldom rises to a high level of dignity, bids fair to be immortal as a genuine expression of the optimistic sunny temperament of the man.

Mozart (q.v.), (1756–1791), a most prolific genius, worked in every form of musical art known to his time; his significance however (from the standpoint of historical development) lies in his symphonies, his string quartets and allied forms, and most of all in his operas. Born at Salzburg, the son of Leopold Mozart, a famous violin teacher, the first 25 years of his life were chiefly spent in professional tours. His marvellous precocity both as composer and executant is well known. In 1772 he became music director at Salzburg, but unable to endure the galling system of patronage went in 1781 to Vienna, where he continued to pour forth masterpieces until his tragic death, largely brought on by poverty and hardship. He was buried in a pauper's grave. Mozart is the supreme example in history of the inborn spontaneous musical temperament, and his wonderful gifts were supplemented by a perfect mastery of the technique of his day. In some ways his music is more Italian than Teutonic, and though often limited in depth of expression, is perfect in its beauty of melodic outline, in its fineness of detail and in its serene purity of sound. His works are a complete embodiment of abstract classic beauty in distinction to the arbitrary self-expression of the Romantic composers.

Mozart's first string quartets (1782) were dedicated to Haydn, who greatly improved his own symphonic style by a study of Mozart's three great symphonies, all written in 1788. His pianoforte Sonatas, owing to the limitations of the instruments of that time, are often superficial, but in his compositions for pianoforte and orchestra he is virtually the founder of the modern pianoforte concerto.

Mozart's most vital influence is felt in his operas. In no way a reformer like Gluck, he accepted the existing Italian models, but through sheer power of musical beauty and wonderful dramatic characterization he created the greatest operatic works of his century, which to-day are still full of life. The most important are 'Don Giovanni,' 'Figaro' and 'Cosi fan Tutte.' The operas written to German words, including 'Die Entfhrung aus dem Serail' and 'Die Zauberflöte' are of historic interest from their connection with the German Singspiel and as forerunners of the romantic opera of the following century.

Beethoven's (q.v.), (1770–1827) historic relationship is akin to that of Bach in that he concentrated all forms of expression then extant, and also foreshadowed many of the important developments still to come. His artistic growth is to be studied in relation to his times. His life coincided with the French Revolution, with the American War of Independence, and the German struggle for National Unity; the most prominent single note in his music, the free expression of individualism, is a definite result of the spirit of emancipation so prevalent in both literature and political life, and shows Beethoven's intense susceptibility to all the contemporary currents of thought. With him music ceases to be merely an art depending for its effect upon fineness of workmanship; it becomes a language capable of expressing the deepest emotions of the composer and voicing the joys and sorrows of humanity. Beethoven, of mixed ancestry, was born at Bonn but spent the chief part of his life in Vienna and the neighborhood. His study characteristics of body and mind may be traced to his Dutch grandfather while his intensely emotional and romantic nature came from the German blood on the maternal side.

Beethoven's greatness depends on the perfect equipoise found in his works of the intellectual and emotional elements. His symphonies and sonates embody the most carefully planned musical architecture and yet are so surcharged with emotion that our deepest feelings are touched. In him the principle of thematic development reached its climax; entire movements were founded on some striking motive, *e. g.*, the opening movements of the 'Heroic' and the 5th symphonies. This method of construction, by which instrumental music was freed from its former diffuseness, has had great influence on all modern composers.

Beethoven's sketch books illustrate his method of work; we see how an idea springing from an emotional source was worked over, changed, and improved, until it could stand forth as a perfect expression of musical thought. This concentration is shown by the fact that, although an unceasing worker for 37 years, he produced but 133 works, in contrast to the many hundreds of Haydn and Mozart which are largely in the same style.

Beethoven in variety of conception ranks with Shakespeare. Each of his nine Symphonies is unique, differing from any one of the others. He also first revealed the possibilities of humor in music as distinct from the light wit and playfulness of Haydn, and in many of his works substituted for the Minuet a movement to which he gave the name "Scheroz." His nature had a vein of brusquerie and irony and this may be seen manifested in such movements as the Scherzi of the 3d and 5th Symphonies and in the Finale of the 8th.

Great advance in the art of orchestration is due to Beethoven; he studied the expressive qualities of each instrument and first showed the entire capabilities of the horns, clarinets, kettledrums, contrabass, and bassons. His imagination was distinctly orchestral, even when he was composing for the pianoforte. In Beethoven's works we see striking anticipations of modern "programmistic" tendencies, witness the frequent titles, *e. g.*, the 'Heroic' and 'Pastoral' symphonies, the Overtures to 'Coriolanus' and 'Egmont'; the sonata called 'Adieu, Absence and Return'. He said himself that he generally composed with some poetic thought in mind, and his music is often symbolic of mental states. His favorite name was "Ton Dichter". Since his day there has been a growing tendency to bring instrumental music into closer touch with external poetic thoughts. Beethoven, though not highly educated in the modern sense, was of a powerful, comprehensive intellect. His disposition, a strange mixture of contradictory traits, was at bottom warm-hearted and loyal. His character was one of perfect honor. Although thrown back on himself by his deafness which began in his thirtieth year his music never became morbid, but continued to sound the notes of sublimity and spiritual exaltation. He would not allow "destiny to drag him down", kept a firm grasp on his lofty ideals, the love of liberty, the brotherhood of man, and expressed them in immortal music in his 'Heroic' symphony and in the Choral symphony, the last movement of which is based on Schiller's 'Ode to Joy'. Beethoven is the central figure in the development of music. His supreme power is manifested in his influence over all the composers of the 19th century as indicated in their works and recorded eulogies.

During the latter part of Beethoven's life, *i. e.*, the first quarter of the 19th century, there were going on two most important movements in German music, the creation of a distinctly German opera, and the establishment of the German Lied. The former is chiefly due to the genius of von Weber (q.v) (1786–1826), the latter to that of Franz Schubert (q.v.) (1797–1828). Both these achievements had their birth in the war of liberation waged in art and literature against the long domination of French and Italian standards. Weber did not create the German romantic opera *de novo*. Its origin was in the Singspiel, a light piece with plot and characters drawn from native sources, copiously supplied with incidental music often based on folk songs. Fairy tales and local legends were also much used. Closely connected with this operatic movement was the Romantic school of poetry founded about 1800. Breaking away from classic themes the Romanticists found their inspiration in the German world about them, the mystery of the forest, the charm of out-of-door peasant life, etc., and upon such themes and other fantastic subjects suggested by his glowing imagination, Weber built his dramatic works. His first success was gained during the Napoleonic invasion by some spirited settings of Körner's war songs 'Lyer und Schwert'. His great operatic triumphs began with 'Der Freischutz' in 1821, that most German of operas, the mere name of which affords a clue to the wealth of color and fancy displayed in the descriptive music.

Weber's wounderful power of characterization was unique at the time, and has by no means lost its telling force to-day. He was completely saturated with the romantic spirit and entered in his works all the realms of fancy thrown open by the poets. Thus in 'Euryanthe' we are taken back to the Middle Ages, and the days of Chivalry, in 'Oberon', brought out in London in 1826, we hear "the horns of Elfland faintly blowing." Weber was also of considerable influence in his pianoforte compositions, as a forerunner of the "brilliant" school of Liszt (q.v.), and others.

Spohr (q.v.) deserves passing notice as an associate with Weber in the romantic movement in opera, and as one of the great violinists of his day. Although essentially a classicist, Spohr often gave titles to his instrumental works. They are lacking, however, in real poetic vitality, and so are seldom heard to-day.

Schubert (q.v.), the inheritor of Mozart and Beethoven, the last of the purely classic school, notwithstanding the many interesting phases of his genius, must be treated here as the founder of the German Lied (see LIED), the first of the great group of Song Composers which includes Schumann, Franz, Brahms, and Richard Strauss. Schubert, whose highest gift was that of expressive melody, with an imagination keenly susceptible to poetic suggestion, lived at just the right epoch to take full advantage of the wealth of German lyric poetry which was one of the results of the romantic movement. The difference between the Lied and other earlier forms of solo song, aria, etc, is that no longer the music itself is the chief element, but the word-text. Instead of setting several stanzas to the same simple tune the composer endeavors by continuous musical development to suggest every sentiment and mood of the poem. Imagination is made submissive to the suggestiveness of the poet. The music exists not independently, but as a means of carrying the essence of the poem to the soul of the hearer. Words and music are blended in a composite form of art, which is always enhanced by suggestive pianoforte accompaniment. In the union of these three factors Schubert was supreme. With few exceptions he always selected poems of intrinsic merit, *e. g.*, by Goethe, Schiller, Shakespeare, Klopstock, Müller, and Heine; of unsurpassed power as a melodist, he followed each varying sentiment of the words in the most subtle manner, and although recent composers have enlarged the scope of the piano accompaniment, he first revealed its possibilities. In illustration of the last point we may cite the accompaniment to 'Der Erlkönig' and 'Auf dem Wasser zu singen'. Schubert's genius for instrumental music was continually growing; indeed it was his intention to devote himself to orchestral music. His early tragic death cut short these fair prospects, but we have a priceless legacy in the great symphonies — the 'Unfinished' and the one in C major — and in the Chamber music — notably the Quartet in D minor. These are inferior to the best works of Beethoven only in a certain lack of organic concentrated treatment; in warmth of melody, in wealth of tonal effect, and in boldness of modulation they have seldom been surpassed. Schubert's short characteristic pieces for pianoforte, such as the 'Impromptus', 'Moments Musicales', Waltzes, etc., are unique in style and of great interest in that they opened the way for the short lyric forms in modern literature. Witness the pianoforte compositions of Schumann, Mendelssohn, Grieg, and Brahms.

In 1830, two years after the death of Schubert, began the career of Schumann (born in 1810), the most prominent — together with his great contemporary, Berlioz (q.v.) — of the romantic composers in the realm of instrumental music. In Schumann we have a unique personality, intensely subjective and of deep poetic feeling — "the greatest musical thinker since Beethoven" according to Liszt. Manifesting very early a strong love for the imaginative poets of the period, notably Jean Paul Richter (q.v.), Schumann definitely moulded his music in accord with poetic ideas, and with his great literary gifts, became the formulator of the romantic idea in the entire musical thought of the time. Up to 1840 Schumann's chief work was his pianoforte compositions. These although in small form, from the novelty of their style, and their exquisite fancy, began a new epoch in pianoforte music. These pieces all have titles. 'Papillons', 'Nachtstücke', 'Fantasiestücke', etc., and indicate with delicate touches of romanticism the moods which the music is to symbolize. In his larger pianoforte works, the two Sonatas, the Fantasie in C and the Etudes symphonique, the defects as well as the merits of the school are apparent Together with a wealth of invention there is often a lack of balance and unity. The romanticist always teems with emotion; whether he succeeds in impressing this on the hearer by means of music is quite another question.

In 1840, the year of Schumann's marriage with Clara Wieck, most of his wonderful songs were composed. In some ways these surpass even Schubert, especially in delicate treatment of subtle shades of meaning in the poems and in variety of piano accompaniment. Many of his most inspired songs are set to poems by Heine. In his four Symphonies, Schumann was of unequal power, and opinions vary as to their permanent worth. There is no doubt of the warmth and variety of the original ideas, but sustained development is often lacking and the orchestration leaves much to be desired. By far the strongest of the symphonies is the second in C major in which the Adagio with its poignant pathos reaches a high point of emotional expression. The fourth symphony is noteworthy for experiments in a more plastic treatment of the conventional symphonic form. Schumann's vocal works, though unequal, contain much fine inspiration — the most sustained is 'Manfred'. Schumann's literary labors in founding 'Die neue Zeitschrift für musik' in 1834 must not be overlooked. His critical writings with those of Berlioz and List have revolutionized musical taste and established new ideals.

Mendelssohn (q.v.) (1809–1847), Schumann's contemporary, although classed with the German school from the style of his works is, strictly speaking, outside the Teutonic line, as he was of Jewish extraction on both sides.

Franz Liszt (q.v.) (1811–1886), although likewise not of pure Teutonic blood—his father was a Hungarian — is of far greater importance, not only for his intrinsic powers as composer and pianist, but for the stimulating influence he has had upon the musical culture of the day. Any sketch of Liszt must be inadequate, and is to be supplemented by reference to the vast amount of biographic and critical literature connected with him and his tendencies. He is one of the compelling forces in music of our times. The greatest pianist the world has ever seen, the modern school of pianoforte playing is largely derived from him. In his pianoforte compositions many new elements were introduced in rhythm, harmony, freedom of form, and pure pianistic effect. In many of these pieces a strong Hungarian, gypsy element is found. In his orchestral works Liszt is a firm adherent of the programme school, agreeing with Berlioz as to the descriptive value of music. His two great symphonies, the 'Faust' and the 'Dante' are unique works in their subtle musical characterization and in their beauty of orchestral tone-painting. In the 'Symphonic Poem' an entirely new form was contributed, one which has had far-reaching consequences not yet exhausted. A symphonic poem is a work in a single movement in which the classic sonata form is abjured and the entire structure and style of treatment are made subservient to the guiding spirit of the poetic subject. Of these works the most famous are 'Orpheus', 'Tasso', 'Mazeppa', and 'Les Preludes'. Liszt was also a prolific vocal composer and his Masses and Oratorios of 'Saint Elizabeth' and 'Christus' contain many noble thoughts. His solo songs are of rare distinction. Liszt's rank as a composer is still hotly debated and cannot yet be settled. His influence was certainly many-sided, as composer, critic, conductor, and teacher. From the loftiness of his ideals and the generosity of his character he has done an inestimable service in raising the standard of music in the eyes of the world. His championship of the dramatic reforms of Wagner is an inspiring chapter in the annals of art.

The comparative youth of modern music and likewise its continuity of development is strikingly shown by the fact that the birth of Wagner in 1813 is within four years of the death of Hayden in 1809. The mere name of Wagner provokes a wide range of discussion, but though to the specialist he may be of interest as a philosopher, a writer on æsthetics, and a sociologist, by the general public he is admired as the founder of the music-drama, and as a mighty musician. Considerable harm, in fact, has been done to Wagner's music by the metaphsical speculation in which his rabid admirers have tried to submerge it. "I require nothing from the public" writes Wagner to Liszt "but healthy senses and a human heart". Surely he may be taken at his own word in an estimate of his works. Wagner's reforms may be briefly summarized as follows: (1) to make the opera a serious and uplifting form of art instead of a mere passing amusement; (2) to treat in his dramas subjects which had moral and intellectual value; and (3) to combine all the factors, poetry, music, action, and scenery into a homogeneous means of direct influence upon the emotion and intellect of the hearer. Wonderful as was Wagner's growth in originality, his early works show distinctly derivative influence. Brought up in the shadow of the theatre, his inborn dramatic instinct was strengthened by an early acquaintance with the works of Shakespeare, Goethe, and Schiller, while on the musical side he became familiar with the operas of von Weber and the instrumental works of Beethoven, many of which he had copied out in score before his eighteenth year. The real Wagner begins with 'Der Fliegende Holländer.' In this, notwithstanding traces of French and Italian influence, the effort toward dramatic and musical unity is apparent. 'Tannhäuser' and 'Lohengrin' are transitional works in which we find certain survivals of conventional opera, together with prophecies of the highly developed, later style.

In his mature works, 'Der Ring,' 'Tristan,' 'Die Meistersinger,' and 'Parsifal,' traditional forms, the aria, the set chorus, etc., are entirely renounced, and the growth and form of the music are derived from the spirit of the text. Richly accompanied recitative makes up the body of the work. The melody is composed poetically and, to use Wagner's term, is "endless," running sometimes through a whole act without a break. The expansion of the descriptive powers of the orchestra reached a climax in Wagner. His power as a musical scene-painter is incontestible. Building on the work of von Weber, Berlioz, Meyerbeer, and Liszt, he evolved an entirely new orchestra boundless in wealth of tone-color and in power of emotional appeal. In fact, the chief beauty is often in the instrumental part and the vocal melody is at times rather crudely plastered upon this. As a discoverer of new harmonic effects and as a contrapuntist, Wagner ranks with Bach and Beethoven.

One of Wagner's organic changes was the use of "Leading Motives." These are not mere musical labels with fantastic names — this conception is due to the misguided Wagner commentators,— but musical epitomes of the chief characters and the important objects in the drama, *e. g.*, 'Wotan,' the 'Sword,' 'Fire,' etc. By their use the music though plastic becomes highly organic. Wagner himself says it is the thematic development of Beethoven expanded and used for dramatic purposes.

Not the least feature in Wagner's operas are the scenic effects. He revolutionized the art of stage mounting. Such scenes as the Grail Castle in Parsifal and the final scene of 'Die Walküre' have never been surpassed. Wagner's pen as a literary man was ever busy. His writings are collected in 10 large volumes. The essays 'On the Art of Conducting' and on the Symphonies of Beethoven are noteworthy.

The position of Brahms (q.v.) (1833–1897), in modern music is remarkable in that by temperament standing apart from two of the main tendencies of the times, the operatic and the programistic, he made free use of the polyphony of Bach and the classic forms of Beethoven to voice his own individual message. A man of singularly deep and simple human feeling,— what strikes us most in his music is its emotional wholesomeness. Never morbid, hysterical, or theatric, Brahms' compositions in their broad impersonality make the impression of a work of nature. With the exceptions just noted, Brahms has worked in every field of modern art. His pianoforte music, with its complexity of rhythm and its subtle harmonic tissue, is distinctive and novel. His songs in their consumate blending of poetic sentiment and musical expression are the most perfect since Schumann. The chamber-works for strings alone or for various combinations of instruments contain some of the noblest thoughts ever uttered in that form. Brahms' four symphonies are comparable with those of Beethoven in their variety and latent strength. Each has its own peculiar atmosphere; Brahms has not written *one* symphony in *four* parts. His 'German Requiem' is one of the grandest compositions of modern times.

Debate is still going on as to the final position of Brahms. To some he seems austere, lacking in emotional warmth; to others he represents all that is truest in music. He is certainly one of the few since Beethoven to sound the note of sublimity. His musice is Miltonic in its dignity and repose. Such qualities may well be considered lasting in music.

Since Wagner and Brahms the German school has been most prolific. Among others, Wolff, Schilling, Hüber, Mahler, Humperdink, Weingartner, and Reger (qq.v), are prominent.

Most important of all however is Richard Strauss (q.v.) (1864), who has carried the programme method to undreamed-of lengths. In technical resource Strauss is undoubtedly the greatest master of the orchestra who has yet appeared. In his great symphonic poems 'Don Juan,' 'Tod und Verklarung,' 'Also sprach Zarathustra,' and others, by utilizing and expounding the discoveries of Berlioz, Liszt, and Wagner, he has produced orchestral effects of brilliance and sonority which are unparalled. Strauss is also a composer of prodigious contrapuntal skill, and his works are marvels of musical architecture. In fact so audacious is the use he makes of his descriptive and realistic powers that music seems to be changing its entire nature. The controversy rages about him and his tendencies as violently as in former times about Wagner. It would be premature to forecast Strauss' permanent rank. Whatever else he has done he has weakened the former assertion that music has no power of definite portrayal. So wonderful are his effects of musical symbolism, that music just stops short of being articulate. Such vast works as 'Ein Heldenleben' and 'Don Quixote' have emanated from the most daring musical imagination of our time, and embody tendencies which cannot be ignored. Music no longer exists primarily for its own sake, but as a means of descriptive expression for whatever philosophic or psychologic scheme the composer may have in mind. Strauss has also written in the smaller forms with distinct success, piano pieces, chamber music, etc. His songs are in direct contrast to the complexity of his orchestral works and abound in simple and yet characteristic melody. Strauss' three operas, 'Guntram,' 'Feuersnoth,' and 'Salomé,' are laid out on the broadest lines of any since Wagner.

A closing word must be said about the great array of critics, biographers, historians, and teachers which Germany has produced. Such men as Jahn, Spita, Pohl, and Chrysander in their well-known biographies; Ehlert, Hanslick, and Ambros as critics; Haupt, Jadassohn, Rheinberger, and Riemann as theorists and teachers have had world-wide influence and are largely responsible for the fact that Germany is still the chief centre of a comprehensive musical activity.

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9. Germany—History of German Religion. The earliest religious ideas and forms of worship among the ancient Germans have been the object of scientific study since the epoch-making work of Jakob Grimm (q.v.) (d. 1863), but so far without such generally accepted results as give confidence in their correctness and completeness. The Germans appear to have shared the religious conceptions of the great "Indo-European" family, to which, in the absence of entire certainty as to their origin, we continue to assign them. Their religion thus presents, at the time when they first enter into the field of historical inquiry, the aspect of a well-developed mythology.

Beginning presumably with a simple reverence and dread for the beneficial and harmful forces of outward Nature, they had advanced with a more highly developed social organization to a more elaborate system of personal deities. Three central ideas seem to have been common to the several tribal groups into which the people thought of themselves as divided. The god of War (Thiu, Thiwas), the god of the Storm (Wotan, Odin), and a goddess of Fertility (Freya) appear in a variety of forms and have their history of local adherence, of diffusion, and of adoption. These figures are distinct enough to have left their names on days of the week and to have attracted the attention of Roman observers. In the descriptions of Cæsar and Tacitus they appear respectively as Mars, Hercules, and Isis, so that we may be quite sure that at the beginning of our era these principal figures had taken on a fairly definite shape. They were accompanied by a world of secondary mythological creations, spirits of the air, the forest, and the stream, giants, dwarfs, and other half-human personalities. Later, and especially among the Teutons of the far north, there was added the conception of a cosmos created out of nothing, and, as the climax of the system, appears another equally vivid notion of an ultimate cataclysm in which gods and universe alike shall be overwhelmed.

In their dealings with the unseen powers the Germans seem not to have evolved or needed any formal ritual in the hands of an organized, mediatorial priesthood. The chiefs of the family or the tribe performed the necessary sacrifices by which the favor of the gods was propitated or their wrath averted. No theology or speculative development of these original simple ideas was ever reached. The whole system bears the marks of a fresh, vigorous, and spontaneous expression of intimacy between conquering freemen and the divine governance under which they lived. The conflicts of the gods, their spacious repose in Walhalla, reflect the ideals of a race which from our earliest glimpses of it appears in a slow but steady movement upward toward higher levels of social, economic, and spiritual experience.

Thus equipped the Germanic peoples enter upon their fateful contact with the Romans. In the course of this contact, whether in the form of Roman military or commercial visits to them, or in their own military service in the Roman armies, they may have undergone a species of religious disintegration such as often accompanies profound changes of national experience. The ancient gods of the tribe could not long maintain their hold on the affections of a people whose tribal life was shattered to its foundations by the manifold reactions of the Roman culture. It was probably this weakening of the ancient ties of religion that combined with the more obvious political motives to bring about the transition to Christianity.

It is an undoubted fact that all those German tribes which left their ancient homes beyond the Rhine and the Danube and moved in mass southward and westward on to the lands of Rome had already at the time of this occupation become converted to the religion of Christ. The process of this conversion is, however, almost entirely obscure. Among the Greek and Roman populations Christianity had made its way for three centuries, wholly by the method of individual conviction, and even during the 4th century, after the weight of imperial pressure had been added, the same process had gone on. Christianity had made its appeal to these highly developed peoples as a system of thought and as a rule of life. To the uncultured and intellectually undisciplined Germans such an appeal seems obviously impossible. They encountered Christianity long after it had entered upon its institutional stage. They met it as one of those governmental agencies by which Rome seemed to have grown great, and adopted it as a new means of greatness for themselves. Once adopted they clung to it with unshaken loyalty and gradually came to understand its spirit. Further these same peoples,— the migrating tribes in stricter sense, including the Visigoths, Ostrogoths, Burgundians, Vandals, and Lombards — were all converted to the Arian form of Christianity, that form which was condemned by the first General Council at Nicæa (325), but which continued during the next two centuries, under various disguises, to maintain a powerful hold on Eastern speculative thought. Attempts have been made to show that this doctrinal divergence of the Germans is to be accounted for by some spiritual affinity between their mental attitude and that of the Arian agencies through which they received the new faith. It does not, however, seem likely that it is to be explained on any intellectual grounds whatever. Their conversion took place mainly from the East at a time when Arianism was dominant at Constantinople, and it was altogether in accord with their stage of religious culture that they should take what was offered them without nice discrimination. Later, long after their settlement in their respective homes on Roman soil, such of these tribes as survived changed their form of Christianity to that which had then, under the leadership of the bishops of Rome, come to be dominant in the western world. But one really striking figure emerges out of the obscurity of this period, that of Ulfila the Visigoth, whose translation of the Hebrew and Christian Scriptures from Greek into a written Gothic language which he himself invented for the purpose remains the most important document of the conversion, precious alike to the theologian and the philologist. A copy written in silver letters upon purple parchment and known as the "Silver Codex" is in the library of the University at Upsala, Sweden.

Quite similar in motive and process, but infinitely different in result, is the conversion of those Germanic peoples which did not abandon their ancient homes, but remaining rooted there sent out branches to overspread the more or less Romanised lands of Gaul and Britain. The Anglo-Saxons, coming over into England from about 450 onward and striking upon a Christianized Keltic population not greatly superior to them in culture, early developed a race antagonism which prevented any effective reaction upon themselves. It was not until the close of the 6th century that they were visited by missionaries sent out directly from Rome by Pope Gregory I and converted to Christianity under the Roman form. Their attitude toward it seems to have been the same as that of their brethren of the lower Danube two centuries before. They accepted it at the bidding of chieftains who saw in it a means of sharing in the larger life represented to them by the name of Rome. A generation later Anglo-Saxon Christianity was undoubtedly promoted by Keltic missionary activity in the North. The Anglo-Saxons appear to have been quite uninfluenced by their Teutonic neighbors and kinsfolk across the Channel, the Franks, whose conversion had taken place almost a century before.

The elements of the story in the case of the Franks are again much the same: a heathen king (Clovis) married to a Christian Germanic wife, to whom freedom of worship has been guaranteed, a series of persuasions all based on the superiority of Christianity as a working religion and finally a dramatic event, the victory of the Frankish host over a heathen enemy, and then a tribal conversion with wholesale baptism. In the account of these events wholesale baptism. In the account of this event written a hundred years later by the bishop Gregory of Tours, the gods of Clovis are described in Roman terms, as Jupiter, Hercules, etc., so completely had the sense of distinction among heathen religious systems disappeared from the Christian consciousness.

The decisive incident in these two northern conversions was that they were made into the fellowship of the Roman Catholic Church and thus determined for the future the religious allegiance of those two Gemanic races which were destined to survive or to incorporate the rest. In the furious struggles for power among the Merovingian successors of Clovis, the Church appears as the one civilizing and humanizing agency in a society that seems to be on the verge of complete disintegration. Yet even its influence was fitful and ineffective. The Roman bishopric, involved in a life and death struggle with German Arian invaders and with the revived activity of the Eastern Empire in Italy, was unable to offer to the West the unifying force it needed. The great efforts of Gregory I in this direction do not seem to have had permanent results in placing the church of Gaul on a solid basis. It was reserved for the newly established power of the Carolingian *Majors Domus*, especially the sons of Charles Martel, about the middle of the 8th century, to reorganize the Frankish Church on the two-fold foundation of national control and papal supervision.

This alliance of the Frankish state with the Roman power was strengthened by the effective work of the Anglo-Saxon Winfried, who under his Latinized name of Boniface became the active agent of both in the definite establishment of the Roman church system in Germany. He was made first Archbishop of Mainz and was the founder of the monastery of Fulda in Hessen, long to be the most important outpost of Franco-Roman Christianity toward the still heathen Saxons and Frisians lying in the vast lowlands of the North from Rhine to Elbe.

The contemporary accounts of the long conflict in Charlemagne with the Saxons shows them at practically the same stage of civilization as were their kinsfolk in the narrative of Tacitus 700 years earlier. Still almost untouched by Roman influences, they resisted with heroic courage every attempt to impose upon them Frankish supremacy and Roman religion. Their final defea and incorporation into the political scheme of Charlemagne was by far the most important contribution yet made toward the upbuilding of a distinctively German Christianity. So complete was this process of assimilation that when, about a hundred years later, one of their own historians tells the story of their conquest, the tribal point of view is almost wholly forgotten in the pride of the writer over the delivery of his people from the bonds of a degrading superstition. Episcopal centres were established at Minden, Paderborn, Verden, Bremen, Osnabrück, and Halberstadt, and were henceforth maintained as bulwarks of the Church against the still rampant heathenism of Scandinavia and of the Slavic peoples beyond the Elbe. From an early day the bishoprics of Germany shared with other landholding interests the character of territorial lordships, closely identified with the soil, loyal to the vast Roman ecclesiastical system of which they formed a noteworthy part, but primarily German in character and sentiment. In the struggles for power in the 9th century among the local chiefs the support of the great bishops was indispensable, and they come out in the 10th century firmly established as the equals of the highest among the lay lords, and even superior to many of these in the wide range of their influence and the security of their landed revenues.

With the definite organization of Feudalism (q.v.), after the break-up of the Carolingian system they enter into the scheme of this newly-constructed society as in some ways its most important units. Their selection is so largely influenced by the kings, whenever these chance to be men of weight, that the bishops come to be thought of as a kind of royal officials, and from this close association with temporal affairs come those often well-founded charges of worldliness which are the moving cause of the clerical reform movement of the 11th century. In this movement for the betterment of society through an increased emphasis on the ascetic life Germany took less active interest than those southern regions, notably of France, in which it originated. German monasticism had from the beginning an eminently practical character. Its work had been largely that of the pioneer in a new country, developing industry by the improvement of the land and cultivating learning in the comparative security of its protected life. On the whole we hear little of the corruption that had often led to serious outbreaks against the monastic system in the South. The leading abbacies in the houses for women as well as for men were often filled by members or intimate connections of the royal families, and such persons, as for example, the abbots of Fulda, Saint Gallen, or Reichenau, take their place alongside the bishops as feudal princes. Also their appointments, like those of the bishops, was greatly influenced by the policy of the government.

It is largely this close identification of the higher church offices with the royal power that leads to the most important struggle of the Middle Ages, the Wars of the Investiture (1075–1122). The direct issue in that long conflict was whether the German Church was to continue in its former intimate relation to the German king or was to become, through the process of the papal investiture, subject to a foreign political control. The outcome, as expressed in the Concordat of Worms (1122), was in appearance a compromise based upon a division of the temporal from the spiritual powers of the episcopate; but in reality resolute kings continued afterward, as before, to bring pressure upon the higher clerical appointments. During this period it is the Holy Roman Emperor of the German Nation who stands forth as the spokesman of all temporal powers against the aggressions of his colleague in the administration of the Christian world of the West, the successor of Saint Peter. The conflict is mainly political on both sides, but political ideas were during the strictly mediæval period hopelessly entangled with religious claims. The defeat of the imperial power in its efforts at aggrandizement in Italy was an advantage to the greater clerical powers in Germany as it was also to the territorial lords. From the middle of the 13th to the middle of the 14th century Germany passed through that development of almost independent principalities which was guaranteed by the Golden Bull of 1356. The control over the clergy formerly exercised by the emperor passed thus into the hands of a group of princes with whom the central power of the Church has henceforth to deal. During the Conciliar period (1408–1448) it is they who present schemes of reform for the action of the Councils at Constance and Basel, and who enter into Concordats with the Papacy of the Reaction after 1448, by which it was hoped that the ever-increasing complaints against clerical abuses might forever be laid to rest.

The agitations of the Conciliar period, however, especially in Germany, had driven men into deeper reflection upon the actual sources of authority for religious faith and practice. Three directions of thought were thus stimulated which were to move on side by side into the full current of the Protestant Reformation.

These were the "evangelical," the mystical, and the intellectual. (1) The first of these found its support in the doctrines of Wicliffe in England and Huss in Bohemia in regard to the ultimate authority of Scripture. Whatever in the thought or in the institutions of the Church was not plainly to be discovered in these original documents of Christianity was open to criticism and ought at least to be investigated. If not clearly deducible from Scripture it ought to be reformed. (2) The mystical tendency of German thought was a reaction against the overgrown institutionalism of the later mediæval Church. If it was true that the absolute comprehension of God and the complete identification of the devout soul with Him was possible through a process of individual discipline, then obviously the importance of all ecclesiastical mechanism was proportianately reduced. A formal priesthood might come to be rather an obstacle than an aid to the highest attainment of religious certainty. So also, the most elaborate demonstrations of scholastic ingenuity were made unnecessary by this direct process of spiritual illumination. (3) The purely intellectual element came, in Germany, with the general awakening of the spirit of inquiry in the Revival of Learning. The serious northern mind turned at once away from the frivolities of mere intellectualism to its bearings upon the vital problems of religion. The principle of "common sense" found for the first time its application to religious as to other questions. Especially was this true in the field of textual study and criticism. The German Johann Reuchlin (q.v.) (d. 1522) was the first to break through the barrier of ignorant superstition that had prevented the study of Hebrew. The German Erasmus (q.v.) was the earliest scholar to approach the Greek New Testament in the true scholarly spirit.

On this threefold foundation of scriptural authority, direct spiritual insight, and the right of the human intellect to work out its own conclusions, the German Reformation built up its defense against the institutionalism of the mediæval church system. Its central doctrine, the Justification by Faith, was the expression, crude though it might be, of that harmony between the righteous soul and the order of a divinely governed universe, which had ever been the truest ideal of Christian thought. Its emphasis on the idea of individual sinfulness, exaggerated as it may now seem, was the necessary counterpoise to the equally exaggerated laxness in the existing methods of dealing with this never-ending problem. The outward success of the German Reformation was largely due to the skill with which its leaders, notably Luther (q.v.), succeeded in avoiding the logical extremes of doctrine into which a radical wing under the lead of Thomas Münzer (q.v.) and others sought to force them and also to the clear insight which led them from the first to identify their cause with that of the independent territorial princes. By this eminently conservative and constructive policy they were able to give to their work a distinctively national character, to ensure it against attack from without and thus to make it the starting point for still further advance.

Under the protection and hence to a certain extent under the direction of the several governments Lutheranism acquired during the 16th and 17th centuries a rigidity of form and of doctrine apparently no less dangerous to the free movement of human thought than the system it had supplanted. The doctrine of scriptural authority endangered by an inevitable freedom of interpretation was pushed by one wing to an extreme of literalism which could end only in self-destruction. The doctrine of the "enslaved will," strengthened by the reaction of Calvinistic predestination, was in danger of hardening into an unchristian fatalism. From these dangers Germany was saved by the growth, first, of a healthy, humane spirit, such as had always served to modify the severity of Luther's theology, and, second, of a new philosophy or method of thought, which gave an ever-widening scope to the exercise of plain human reason. Luther himself had indeed laid the foundations deeper and broader than he knew when he had declared that he could be convinced of error only by "Scripture and plain reason." If these two were to have equal rights in determining religious truth it must follow of itself that reason should be applied to the interpretation of Scripture.

This is the special service of Germany in the field of modern religious thought: to have given to the accepted doctrine of Christianity a form that might make it acceptable to the modern world. The key-note is sounded in the writings of Gotthold Ephraim Lessing (q.v.), and this the more clearly because Lessing had no formal system of philosophy to offer, but approached this subject as he did all others from the point of view of the free human spirit working on the divine mysteries in virtue of a divine element within itself. Especially he demanded in religious matters the widest possible use of the critical method, the freest investigation into the original sources, in short, the treatment of the Bible as a collection of literature produced by human means and therefore subject to the same rules of criticism as all other human productions. In so far Lessing stood on the same ground as the English Deists of the previous century and their French followers, Voltaire and the Encyclopedists; but Germany was not ready at once to give up its adherence to formal Christianity. As it had escaped the frivolity of the Renaissance, so it sought to avert the frivolity of "enlightenment." It demanded a principle of thought by which it could reconcile the right of the thinking mind with what seemed to be the essential things in the inherited religious system.

This solution is the special contribution of Immanuel Kant (q.v.) (d. 1804). Others had struggled to find an expression for the idea that our reason may accept anything that is not *above* it, provided only it be not called upon to accept anything that is *contrary* to it. Kant analysed the nature of Reason itself and found a distinction between pure reason which could never penetrate into the supernatural and a "practical" reason to which the absolute moral law is revealed. Through this principle it became possible to give new interpretations to the formal doctrines of Christianity. The intense emphasis thus laid upon the thinking individual as the final authority could not fail, however, to produce in Germany, even among most serious thinkers a growing indifference to the formulas of faith and to the institutions that had come to represent them. Out of this comparative indifference to formal dogmas grew the two directions of religious life and thought which have specially characterized Germany to the present day. Pietism (q.v.), the emphasis upon an overstrict personal morality as the only real condition of religious satisfaction had already found its chief expression at the University of Halle under the teaching of Spener (q.v.) (d. 1705), and Francke (q.v.) (d. 1727). It was profoundly modified by the new philosophic impulse, but it had sunk too deep into the character of the German people to be easily removed. On the other hand Rationalism, the right of the human reason to be heard in every determination of religious truth and in every institution of the religious life was greatly strengthened by the Kantian reconciliation.

Both these directions of thought, Pietism and Naturalism (q.v.), go back in the last analysis to the same principle of the individual as the unit of religious experience and the ultimate authority in matters of faith. German religious thought in the 19th century tried to keep its hold on both these aspects of individualism. In various organizations, notably in the Evangelical Union and the *Protestantenverein* it sought to embody the practical demands for a reformed faith that should not give up the personal and social foundations of the early Reformation. In the successive schools of theological interpretation, the "rational-supernatural" of Schleiermacher and Neander (qq.v.), the "historical" school of Tübingen (q.v.), and the mediatorial school of Ritschl (q.v.), Germany has aimed to keep the balance between the extravagance of modern materialism and a relapse into an official literalism. The problem of the moment in Germany as elsewhere is to bring back a sentiment of religious obligation without sacrificing the gains of modern exact science.

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10. **Germany—The Government.** Germany has a national government only since the establishment of the new empire in the year 1871; for neither the old Holy Roman Empire nor the individual territorial states had a national character. The old empire rested upon the mediæval idea of a Christian *imperium mundi*, as the counterpart of the papal *sacerdotium mundi;* but even in the middle ages the impossibility of realizing this ideal was demonstrated, and the empire fell apart unavoidably into a loose federation of territories that was anything but the political organization of a uniform people. Nor were these territories political units by any means. They were not the organization of natural divisions of the race, of tribes, or districts. On the contrary, they were essentially nothing but enlarged manors, which were sold, mortgaged, divided, and inherited, just like private property. From the manorial rights and prerogatives incident to such a system was gradually developed the conception of "Landeshoheit." When, after the time of the Reformation, the absolute monarchy, which had its most brilliant and perfect development in France, laid hold of almost every country of continental Europe, Germany was without any sort of real state organization; and the existing territorial dominion offered the only opportunity for the establishment of absolute monarchy. In accordance with the need of the times and the prevailing theory of state, these manors were transformed on the model of the absolute monarchy and became substitutes for states. But only in the case of the larger domains was it possible to produce anything like the appearance of actual statehood; and even here there was no national unity of any kind. Such a makeshift of a state was only a complex of many small individual territories which, by inheritance, marriage, purchase, or conquest, had come into the possession of a single dynasty; and its unity consisted merely in the ruler and the dynasty. These facts explain the by far greater individualistic character of the several state monarchies in Germany, as compared with the monarchies of the national Europeon states; likewise the peculiar position which these monarchies still occupy, for historically all of the German dynasties are older than their respective states.

It was this lack of a national government that defeated Germany in the war with France early in the last century. That country, so recently regenerated by the revolution, had a modernized national organization to which disorganized Germany could offer no successful resistance. The result of this conflict was, that the old German Empire, which had in fact already been dead for centuries, was formally dissolved in 1806. But this was not all. At the same time the smallest of the states were abolished, and their total number, which up to this time had been in the hundreds, was reduced to some thirty. These were formally independent states; but almost all of them, mediately or immediately, came under the domination of France, and thus under the influence of modern French legislation. After her terrible defeat, Prussia, the largest of the German states, was reduced to about half her former size and weakened almost to the point of dissolution. Such straightened circumstances compelled the absolute monarchy to attempt a fundamental reform: and it was the purpose of the Stein-Hardenberg measures to modernize legal and social conditions and secure a basis for national government. The reform was begun at the bottom by reviving self-government in the cities, a system that had flourished back in the middle ages but had later been destroyed by the absolute territorial state. Herein lies the far-reaching political significance of the Stein city-ordinance of 1808. It was the plan to reorganize the country parishes on the principle of self-government, as well as the cities; then to organize these into provincial corporations; and finally to unite these larger units under a single government with national representation. However, with the overthrow of Napoleon the necessity for such a complete reform was removed, and these plans were not carried out. Despite solemn promises from the crown, Prussia held fast to absolutism until the year 1848.

On the other hand, the dynasties of the southern German states, after foreign domination had been shaken off and a loose association of German states formed, were willing to adopt a constitutional system in order to retain their independence. The feeling of German nationality developed by the War of Independence undoubtedly threatened the independent existence of the individual states; and, as the best means of averting this danger, the small states formed each a sort of national government of its own, in which the citizens were allowed an active part, thereby encouraging a feeling of attachment to the restricted "Fatherland." Such a narrow patriotism was strengthened by the contrast to the large absolute states, Austria and Prussia, and the alliance which they dominated. Thus, between 1818 and 1820 constitutional government was inaugurated in Bavaria, Baden, Württemberg, and Hessen-Darmstadt, even if parliamentary rights were rather limited. The constitutional movement made farther progress as a result of the July Revolution in France. During the years following 1830 numerous small northern German states received constitutions. However, the decisive victory for constitutionalism was won by the political agitation of 1848, as a result of which Prussia, through the constitutional charter of 31 Jan. 1850, finally took her place among the constitutional states.

Aside from the establishment of constitutionalism in the several states, the goal of the agitation of 1848 had been a national government for the whole of Germany. A direct attempt to secure such national organization, which was made by the first German parliament in Saint Paul's Church, at Frankfort-on-Main, was unsuccessful owing to the unfavorableness of the political situation. However, the kernel of the problem was laid bare; and the view came to be generally accepted that the political union of Germany was possible only with Austria left out, and under the leadership of Prussia. If such a national German state was thinkable only under a constitutional form, then only a constitutional Prussia could be called to the leadership of future Germany. The War of 1866 decided the question of leadership once for all in favor of Prussia; and the overwhelming victory over France resulted in the national organization of Germany under the imperial constitution of 16 April, 1871.

The Imperial Government.—The historical development of the territorial states and their several dynasties accounts for the noteworthy fact, that, even to-day, there is still a dispute in Germany regarding the character of the German Empire. For instance, it is argued that it is the essential nature of a monarchy, at least according to German law, to unite all state power and authority in the monarchy, even though he be limited in the exercise of certain functions, as legislation, by a representative assembly. Since now, according to the imperial constitution, all power and authority has not thus been given to the emperor, it is further argued that he is not the monarch of the empire, and that the empire is not a monarchy. As to what other form of state it is, various answers are given; but all are untenable. In truth, that assumed essential nature of a monarchy is not characteristic of monarchies in general, but only of an absolute monarchy; while every constitutional state is distinguished from the absolute form by the fact, that in the exercise of the highest functions of state, *i. e.*, legislation, several coordinate organs must act together. This applies to the individual states as well as to the empire; and the emperor, as the hereditary head of the empire, does not lose the character of a monarch, nor the empire the character of a monarchy because the emperor is more limited in his functions than are the monarchs of the individual states, and too not only by the Reichstag, but also by the Bundesrat or Federal Council, which represents the individual states as such. That is to say, the German Empire is a monarchy which is limited both federatively and constitutionally. Accordingly, the emperor, the Bundesrat, and the Reichstag are the highest organs of the government. No one of these is appointed by the other: no one is subordinate to the other; no one derives its powers from the other; but all receive their authority immediately from the constitution.

The Kaiser.— The German constitution makes the position of the emperor hereditary and limits the succession to the Prussian dynasty, so that the king of Prussia is at the same time necessarily the head of the empire. The whole organization is built up on this combination of imperial authority with Prussian state authority. While the empire is a federation superior to the individual states, still this peculiar union between Prussia and the empire gives Prussia a certain hegemonial position. But this is merely the political expression of the dynamic fact, that Prussia alone has three-fifths of the territory, as well as of the population, of the German Empire, while the remaining two-fifths is divided among 24 small and medium-sized states. Further, only such a constitutional union of Prussian with imperial authority made it possible to bring Prussia into the federation on a formally equal footing with the smaller states; and, on the other hand, the constitutional position of the emperor is thinkable and possible only if he be at the same time the king of Prussia and able to control the Prussian influence in imperial affairs, and particularly the Prussian votes in the Bundesrat.

The Bundesrat — The Bundesrat is a council composed of plenipotentiaries of the individual German states. Since these states vary so greatly in size and importance, it was impossible to give each and all equal voice in this council; but, on the other side, it was impracticable to make representation in the council strictly proportionate to the size of the states, for then Prussia would always have had a majority of three-fifths, and the supposed cooperation of the other states would have become purely illusory. Since there was no rational criterion at hand, recourse was had to history, and the apportionment of representation in the Plenum of the old German alliance was adopted, making allowance for the states annexed to Prussia in 1866 and granting Bavaria special favors. According to this plan, the 58 votes in the Bundesrat are apportioned as follows: Prussia 17, Bavaria 6, Saxony and Württemberg, 4 each, Baden and Hessia 3 each, Mecklenburg-Schwerin and Brunswick 2 each, and all the other states one vote each. It is not alone in the manner of apportioning the representation that the Bundesrat differs from similar bodies in other federations, as for instance the United States Senate or the Swiss Ständerat, but more particularly in this, that the members, who are appointed by the individual states and are officials of the same, cannot vote according to their own conviction, but must follow binding instructions received from their respective governments. It is not the individual member that votes in the Bundesrat, but the state of Prussia, or Bavaria, as the case may be, that votes through its plenipotentiaries. For this reason the plural votes of a state can only be cast together. The Bundesrat is no house of parliament, and thus no fixed times for meeting. Any state can recall its representatives at any time and replace them with others. Since only the individual states are represented in the Bundesrat, the emperor does not appoint any member, except the president in the person of the imperial chancellor (Reichskanzler).

The Reichstag.— The Reichstag is the parliamentary representation of the German people as a whole. The 307 members are elected by universal and equal suffrage; and the voting is direct and secret. Every German male 25 years old has a vote, and is eligible to election, in so far as he is not under guardianship, or involved in bankruptcy proceedings, or if he has not been supported by public charity in recent years, or if he has not lost the rights of citizenship through sentence in court. When the election-districts for representation in the Reichstag were laid out, it was the intention that a representative should be elected for every 100,000 inhabitants, but that such an election-district should not be formed of parts of different states, and that any state with less than 100,000 inhabitants should still be entitled to a representative. Since, now, the number of these representative districts does not grow with the population, but can be changed only by imperial law, the principle upon which the apportionment of representation was originally based has now, owing to the increase and drift of population, no practical significance. If there were now a representative for every 100,000 inhabitants, instead of having 307 members the Reichstag would have five or six hundred members; and instead of six representatives in the Reichstag, the city of Berlin would now elect 20. It is clear that the maintenance of this old system of representative, or congressional, districts favors greatly the rural population at the expense of the large cities. The Reichstag is elected for five years; but the Bundesrat, with the consent of the emperor, can dissolve this body during a legislative period, whereupon, within a limited period, general elections take place and a new Reichstag is convened. Both the Bundesrat and the Reichstag must be convened at least once a year; though the fact is, that the Bundesrat has come to be a permanent college which takes holidays, to be sure, but has no regular sessions. The members of the Reichstag enjoy the usual parliamentary immunities, but they draw no salary. The sessions of the Reichstag are public; and the speeches made there, as well as truthful reports of the press regarding the same, cannot be made a basis for any prosecution whatever.

The Reichskanzler.— The imperial chancellor, who is appointed and dismissed by the emperor, is not only the president of the Bundesrat, but also the responsible prime minister of the empire; for all official acts of the emperor have to be countersigned by the chancellor, who thereby becomes responsible for the same. The correlative of the responsibility of the chancellor is the non-responsibility of the emperor. But this ministerial responsibility is merely constitutional and formal. The chancellor must account to the Bundesrat and the Reichstag for those acts of the emperor to which he has given validity with his signature; but he cannot be held responsible in the sense that he can be impeached. Originally, the chancellor was the only constitutionally responsible imperial minister; but the impossibility of the responsible conduct of the entire imperial government by one man led to the formation of an imperial ministry with several heads. This was organized on the prefecture, not on the collegial, plan; and the chancellor remained the leader of the government. On the proposal of the chancellor, the emperor appoints for certain branches of the administration secretaries of state and the chiefs of the departments in question (Department of the Interior, Treasury, Department of Justice, Imperial Post Office, Foreign Office, etc.); but these officials are subordinate to the chancellor and merely the responsible representatives of the chancellor in these departments. They can countersign the imperial acts of the emperor; but the chancellor remains their superior and the chief of the entire imperial administration. In his character as president of the Bundesrat the chancellor is also spokesman of the Prussian plenipotentiaries, in so far as he does not have some one to represent him in this function. Further, from the relation between Prussia and the empire, it follows that the imperial chancellor must at the same time be, in fact, the Prussian prime minister. This is not expressly mentioned in the constitution; but the union of empire and kingdom in the sphere of monarchial nonresponsibility must logically have its counterpart in the sphere of constitutional ministerial responsibility, in that the leader of the Prussian administration must at the same time be the head of the imperial administration. Every attempt to separate the two offices has only proved the impossibility of such a thing.

Imperial Legislation.— Imperial laws are passed by a majority vote of both the Bundesrat and the Reichstag. The initiative to legislation may be taken by the individual states in the Bundesrat, or by members of the Reichstag, or — through this is not mentioned in the imperial constitution — by the imperial government, which introduces its bills in the Bundesrat. Bills passed by the Bundesrat are represented before the Reichstag by the Reichskanzler or his deputy, or by members or representatives of the Bundesrat. Laws passed by both Bundesrat and Reichstag must receive the signature of the chancellor and be officially published by the emperor before they can go into effect. The emperor is legally obligated to make such publication, in so far as the law in question is constitutional. The emperor decides the matter of constitutionality; but the chancellor assumes the responsibility. It is possible to change the imperial constitution itself by legislation; but this is difficult, for any constitutional amendment is defeated if it receives 14 adverse votes in the Bundesrat. Since, now, Prussia has 17 votes in the Bundesrat, the emperor in his character as king of Prussia can actually prevent any change whatever in the constitution. (It may be added that the southern German states have reserved certain rights regarding military, postal, and financial affairs, of which they cannot be deprived without their consent.) Further, with the Prussian votes in the Bundesrat, the emperor can prevent any proposed change in the existing laws regulating the army, the navy, the tariff system, and the indirect imperial taxes, so that in fact he can put a veto on any legislation affecting the most important interests of the nation.— The annual imperial budget, which must contain an estimate of all receipts and expenses of the empire, is a matter of imperial legislation; and the empire can negotiate loans only on the basis of similar legislative action.

Imperial Jurisdiction.— As regards the division of authority between the empire and the several states, three spheres of jurisdiction may be distinguished. The sphere of immediate imperial administration comprehends those matters that are not only exclusively regulated by imperial law, but are actually conducted directly by the central government. Here belongs essentially foreign politics, maintenance of embassies, etc. (despite the active and passive diplomatic rights still retained by the individual states out of dynastic considerations); the entire consular system; the navy, colonial affairs, and finances of the empire; the management of the postal and telegraph systems (with the exception of certain rights reserved by Bavaria and Württemberg); and finally, as a matter of fact, the army and military affairs, though the formal rights and regulations here vary somewhat. The second sphere of jurisdiction includes imperial legislation and the inspection of self-government in the individual states. This is the normal form of imperial authority, while the sphere first mentioned is an exception. Here belongs the entire tariff system; the judiciary system, so far as civil, criminal, and procedure law are concerned; the regulation of immigration and citizenship; the banking system; coinage, weights, and measures; control of railway affairs, the press, and of all kinds of unions and organizations. Aside from certain rights reserved by Bavaria, affecting some of these matters, the empire here both makes the laws and sees to it that they are carried out, though the immediate administration of them is left to the several states as self-governing organizations. In case one of the states fails to fulfil the duties thus imposed then sentence can be passed against the said state by the Bundesrat, acting for the empire, and their edict is executed by the emperor. In the whole range of imperial authority the laws of the empire are immediately binding on all citizens, without any regard as to what the laws of the single states may be. State laws that contradict imperial law are *ipso jure* void; for it is a principle that imperial law takes precedence of state law. Finally, the third sphere of jurisdiction is the autonomy of the individual states. The single states as such administer their own affairs and make their own laws (except civil, criminal, and procedure law) without any positive interference from the national government. Negatively, however, the imperial government does interfere, in that it sees to it that the state gevornments do not transcend their authority. Here belongs the constitutional and administrative organization of the states themselves, as well as of their towns, cities, etc.; also taxation, finances, school organization, cultivation of science and art, ecclesiastical affairs, and, in short, everything pertaining to the function of a state which has not already, under the constitution or by special laws based on the same, been turned over to the imperial government. Since the constitution of the empire only determines positively the authority of the empire, but not that of the individual states, the presumption should be in favor of the individual state. In the meanwhile, however, it cannot be denied that, in spite of all opposition, there is a tendency toward a gradual but irresistable extension of imperial authority at the expense of state autonomy.

State Organization.— The empire consists of 25 single states and the province Alsace-Lorraine. Up to the present, the last has not been recognized as a state, but is regarded as an imperial territory. It has no voice in the Bundesrat, but has representation in the Reichstag, of course. At the head of the government is a viceroy, appointed by the emperor, who is supported by a ministry lead by a secretary of state, and by a territorial parliament. Among the individual states the three Hanse cities, Hamburg, Lübeck, and Bremen have a republican constitution: and here the old city-state has been retained in a modified form. The highest organs of government are two coordinated legislative assemblies, the senate which is presided over by the mayor, which is both municipal council and parliament, and elected by the «Bürgerschaft;» and the «Bügerschaft,» elected by the people.

The remaining 22 states are all constitutionally limited monarchies; but it must be added that in two of them, the two grand-duchies of Mecklenburg, the constitution is organized on the old feudal plan, in that their common Landtag, is not composed of representatives elected by the people, but of all the owners of manors entitled to representation, and of representatives of the cities. Otherwise, all the German states have modern constitutions, and, with the exception of the very small states, two legislative chambers. Without exception the upper chambers are mistaken imitations of the English House of Lords, modified by the influence of the French *Charte Constitutionelle*. The most remarkable example of this type is undoubtedly the Prussian Herrenhaus. It consists of hereditary members, and of such as are appointed by the king for life, partly on the recommendation of certain organizations of landowners, and of noble families, as well as of universities and cities. The members of the lower legislative chambers are usually elected by the people, except that occasionally privileged classes for whom there was no room in the upper house are slipped in here. In some states the ruler even appoints popular representatives.

Elections.— Suffrage in the different states is exceedingly varied, being partly direct or indirect, partly secret or public, sometimes on the class-system, sometimes on the census-system. Recently in the southern German states there has been a strong tendency to make the rights of suffrage in state elections conform to the rights obtaining in elections to the Reichstag. The state system in force in Prussia is in sharp contrast to that governing representation in the Reichstag. To be sure, suffrage is universal in Prussia, in that every citizen 24 years old, unless disqualified on the grounds mentioned above, has the active right of suffrage, and the passive right after he has completed his thirtieth year. But suffrage is indirect, since the voters only vote for electors, and these elect the representatives. Further, voting is public, since both the original voters and the electors use no printed ballot, but vote by registration; and, above all, it is unequal. In each of the assembly districts all the voters are divided into three classes, on the basis of the amount of direct taxes they pay. The largest taxpayers, or the voters who pay the first third of the total direct taxes, form the first class; those who pay the second third, the second class; all others, including those who pay no taxes, the third class. Each of these classes elects the same number of electors; then all the electors for a given assembly district, without distinction, together elect the assemblyman. It is clear that the small minority who vote in the first two classes always have a majority of two-thirds in the electoral college; and so the voting-power of the third class becomes illusory. Even if a gradation of political rights on the basis of direct taxation (without regard to the enormous taxes paid indirectly) were a suitable criterion, still this is not by any means consistently carried out by the present election system. As a matter of fact, the retention of the old assembly districts, despite changes in population, makes impossible any relation between taxation and political power. For instance, Berlin pays more than one-seventh of the total direct taxes of Prussia; and yet, of the 433 members of the Prussian Abgeordnetenhaus, only nine are elected from Berlin. Other towns and cities are proportionately poorly represented. Besides, if we will bear in mind the pressure necessarily placed upon the dependent voter by the public ballot, then we see how it is possible for a state election to give results entirely different from those of an election to the Reichstag, and too, even in the same district. For instance, at the last general election of the empire the Social Democrats polled almost a third of the total vote cast; but in the Prussian Abgeordnetenhaus they have not a single representative.

It is a noteworthy political fact, that in the empire, and still more in the individual states, the influence of parliament is less than in other countries enjoying constitutional government. Here the government is not made by a parliamentary majority; and if in important matters it suffers a parliamentary defeat, there is no necessity for the ministry to resign. This state of affairs has often been traced to the antithesis between two political principles, namely, the constitutional system, prevailing in Germany, and the parliamentary system, obtaining in other countries. In truth, however, this distinction is merely one of political development, not of political organization. Despite all the imperfections of the German constitutions, almost all the parliaments have those constitutional rights which would enable them to make their influence effective, just as in other parliamentary countries. Though here the governments never take their origin in the parliaments, but are a band of officials appointed by the sovereign, the explanation of this may be found in the historical development of the states. It is a relic of the feudal system in the territorial states. The lack of political initiative in the German character accounts for the persistence of this system. For this reason, political parties are weak and divided against themselves. The development of large popular parties, able to rule and determined to rule, would be sufficient to develop in every state a real parliamentary government, without the changing of a letter of the existing constitutions; for the difficulty is merely in the political situation, not in the constitutional organization.

Communal Organization.— In the absolute state even local administration was purely a function of the state government. In contrast to this system, the Stein city-ordinance of 1808, mentioned above, has led to the development of communal self-government, though not exactly to the extent that all municipal administration is self-government. Even here the state has retained control of more or less important branches of the local administration, which are either in the hands of state officials, or of local officials treated as state officials. The last is true of the local police in Prussia. In the larger cities they are managed directly by the royal police authorities, but otherwise by the local administrations, acting immediately under directions from the state government. Besides, the entire system of communal self-government is under the inspection of the state. Often the limits of this right of inspection are extended, by law and by constant usage, to such an extent that it is impossible to distinguish mere inspection from actual communal administration by the state authorities. But conditions of municipal government vary in the different states, likewise the organization of parishes, and the relation of towns to country communities, and the rights of suffrage, etc. In this respect there is not even a uniform system within the larger states. For instance, Prussia has seven different city-ordinances and as many systems for the organization of country communities; and similarly in Bavaria municipal rights on one side of the Rhine are different from those on the other side. Under these circumstances it is impossible here to do more than sketch some of the main features.

In the first place, there are two systems of organization. Either all local municipalities have uniform constitutions, or else there are different constitutions for town and country organizations. The first system, developed under French influence, prevails in the west, *i. e.*, in Alsace-Lorraine, the Bavarian Pfalz, the Prussian Rhine province, Hessia, and essentially in Baden, Württemburg, and some Thuringian states. On the other hand, the second system is in force in the remaining Prussian provinces, in Bavaria east of the Rhine, in Saxony, etc. It is exceptional when the distinction between country and town organization is based on area or population. Usually the historical character is decisive. Again, the organization of country parishes in the west is different from that in the east. In the west large organizations are the rule. The villages, which are of themselves well populated, are combined into large communal bodies and include the not very numerous large estates. On the other hand, in the east, where the villages are usually small, every little village forms a separate political corporation; and these weak organizations are naturally unable to absorb the large estates, which are the rule here. Thus, besides the regular rural parishes, there are in eastern Prussia some fifteen or sixteen thousand independent manors, in which the owner unites the rights and duties of a communal organization.

Similarly, there are two different types of city organization: the council-system, on the model of the old German city government; and the mayor-system, developed under the influence of the French administrative organization. In the first there are two coordinated administrative bodies, the town council (Stadtrat Magiprat) and the common council Stadtverordnetenversamlung), or board of aldermen. Here the mayor is essentially only the chairman of the town council. This dualistic system maintains in Prussia, except in the Rhine province, also in Bavaria east of the Rhine, and in Württemberg, Baden, Saxony, etc. The mayor-system exists in the Rhine province, in the Bavarian Pfalz, Hessia, etc. Here there is only one council, the board of aldermen, and the administration is carried on by the mayor, who is at the same time the chairman of the board of aldermen.

The mayor and the members of the town council are partly salaried officials, partly honorary functionaries. As a rule, they are elected, and, too, mostly by the board of aldermen, though according to some laws by the town council and the board of aldermen acting together, or directly by the people. The election is usually for a period of six or twelve years, and sometimes for life; but this last is exceptional. Except in Baden, the election must be confirmed by the state, at least as regards the mayor; and in Prussia, with the exception of Schleswig-Holstein and Frankfort-on-Main, such confirmation is necessary for all members of a town council. The aldermen are elected by the people, partly on the census-system, partly on the three-class system, which here differs somewhat from the class-system of the Prussian state elections. The most important difference is, that here voting is direct, each of the classes voting immediately for the aldermen, and not for electors.

In the large German states the local town and rural municipalities are organized into larger communal units. For instance, in Prussia the districts and provinces are not only state governmental departments, but are also communal self-governing organizations. Such a district has its assembly, elected by the smaller parishes and municipalities and manors thus bound together; and this assembly elects an executive committee, which is at the same time also the board of the state administrations and of the administrative court. Both assembly and executive committees are presided over by the «Landrat,» an official appointed by the state. A province has likewise its assembly, which is elected by the district assemblies. It is the organ of the provincial administration and elects the provincial executive committee and the «Landesdirektor,» or head of the provincial self-government.

The union of these organizations with the system of state administrative and judicial authority is too highly complicated, by far, to be summarized briefly; and, for this very reason, the present condition of affairs cannot be regarded as the final stage of communal development in Germany. Indeed, there is still much work in the future to do, if the principle of local self-government is to be carried out consistently.

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11. **Germany — The Political Parties.** Although the German empire is a federation similar to the American union, the political life of these two countries is entirely different. While in the United States there is practically only one system of suffrage, valid alike in all essential respects both for the union and for the individual states, in Germany the voting systems obtaining in the several states are not only different one from the other, but nearly all are fundamentally different from the system that governs representation in the Reichstag. Since the establishment of the new German empire members of the Reichstag have been elected directly by a suffrage that is secret, equal and universal. Every male citizen 25 years old (with only a few excep-

tions as: members of the army and navy, publicly sustained paupers and some others) has a right to vote in an election to the Reichstag. In the individual states of the empire, however, suffrage may be restricted and thus be made unequal; or it may be robbed of secrecy; or it may lose both equality and secrecy. In Prussia, the largest and most important of the German states, voting is done by "classes," there being three grades of voters with unequal voting power. This class-system unites about all the bad qualities of all the bad systems of voting in the world. To show how it works it is only necessary to call attention to the fact that in the Prussian House of Representatives the Social Democrats, by far the largest political party in Prussia, have not a single representative; while in the same body the Conservatives number about 150, although at a general election they cannot poll half so many votes in Prussia as the Social Democrats. When, therefore, we speak of the strength of political parties in Germany, we are limited to representation in the Reichstag and conditions of election to that body.

Some Recent Party Changes.— Since 1890 elections to the Reichstag have taken place every five years, except in cases where that body has been prematurely dissolved. Formerly such general elections occurred every three years. Since the establishment of the German empire elections to the Reichstag have been held in 1871, 1874, 1877, 1878 (on account of a premature dissolution of the body), 1881, 1884, 1887, 1890, 1893 (on account of a premature dissolution of the body), 1898, 1903. During this time various changes have taken place in political parties, both as to organization and designation. Especially within the fold of liberalism have new groupings been frequent. In 1880 the freetraders bolted the Nation Liberal Party and formed the Liberal Union, which in 1884 fused with the so-called Progressive Party. The new organization thus formed took the name German Liberal (deutschfreisinnige) Party; but in 1893 the two elements fell apart again into the Liberal Union (Freisinnige Vereinigung) and the People's Liberal Party (Freisinnige Volkspartei).

Strength of Different Parties in the Reichstag.— The Reichstag is composed of 397 members. The political parties now represented in this body, with the number of members elected by each in 1903, is as follows: Conservatives 52, German Imperialists 20, Antisemitics 11, Farmer's Alliance 7, the Centre 100, Alsacians 9, Danes 1, Poles 16, Guelphs 6, National Liberals 50, Liberal Unionists 10, People's Liberal Party 21, German People's Party 6, Social Democrats 81, independent 7.

Since these numerous parties are more or less closely related, we may, for convenience, group them as follows:

I. *The Conservatives*, including the Conservatives proper, the German Imperialists, the Antisemitics, and the Farmer's Alliance — altogether 90 members.

II. *The Centre*, *i. e.*, the Catholic-Clerical Party, with 100 members; occasionally supported by the Poles, the Alsacians, and a part of the Guelphs.

III. *The Liberals*, including the National Liberals, who are rather conservative and lean toward protection; also the Liberal Unionists, the People's Liberal Party, and the German People's Party — which latter groups represent a more decided liberalism and with greater insistence on free trade. Altogether these related parties control 87 votes.

IV. *The Social Democrats.*— They have 81 members.

Disregarding minor party divisions and taking into consideration only these four larger groups, we see that the strongest of them, the Centre, represents only one-fourth of the Reichstag. Even when supported by the conservative group, with which the Centre has a strong affinity, it cannot control a majority. Again, the Liberals and Social Democrats are equally unable to secure a majority.

The Parties and the Popular Vote.— The relative strength of these parties takes on quite a different aspect when we consider the popular vote, and not merely present representation in the Reichstag. Speaking in round numbers, there were in the empire at the election of 1903 12,500,000 citizens entitled to suffrage, and 9,500,000, or 76 per cent. of them availed themselves of this privilege. Of these 9,500,000 votes 3,000,000 went to social democracy, 2,200,000 to the liberal groups, 1,875,000 to the Centre, and 1,750,000 to the conservative groups. At the elections of 1903, on an average, a representative was elected for every 24,000 votes cast. Therefore it is clear that, on the basis of a popular vote, the conservative groups would be entitled to only 73 members, instead of 90; the Centre to only 78, instead of 100; the Liberals to 92, instead of 87; and the Social Democrats to 125, instead of only 81. Such an apportionment would give the Liberals and Social Democrats, acting together, a considerable majority. In other words, that part of population of the German Empire which gives its support to liberalism and social democracy is in the majority; and any policy which shall express the genuine will of the people must be liberal and democratic.

Despite the fact of universal suffrage, such is the discrepancy between the actual representation in the Reichstag and the will of the majority of the people. This state of affairs is due mostly to the way in which election districts have been laid out and rigidly maintained regardless of variations in population. These districts were fixed when the empire was first established; and they have never been changed. In the past thirty-five years the population of the empire has increased by 20,000,000. These gains have been made in the large cities and industrial districts, *i. e.*, in those quarters where liberalism and democracy find most of their recruits. On the other hand, the population of the rural districts, the main stronghold of the Conservatives and Clericals, has remained practically stable. In this way abnormal conditions have been developed. When these congressional districts were originally marked out it was the intention to have one representative in the Reichstag for every 100,000 inhabitants. That was the law. To-day in the large cities and highly developed industrial parts of the country there are many congressional districts that have several hundred thousand inhabitants each, some of them even passing the half-million mark. This disproportion is augmented by the fact that the population of similar districts in the country falls far short of the required 100,000. If we did not thus take into account the effects of this obsolete system of election districts, our view of political parties and conditions in Germany would be a distorted one indeed.

The Conservative Party.— The Prussian aristocracy, or landed nobility, form the nucleus of the Conservative Party. At the time when Prussia was an agricultural state they gained undisputed sway both in the army and in affairs of state, *i. e.,* in so far as such a thing was possible under an absolute monarchy. Their position at this time is well characterized by the proverb, "Und der König absolut, wenn er unsern Willen tut." Since then Prussia has secured a constitution and a degree of representative government: and under her guidance the German Empire has come into being. From a simple agricultural state Prussia has gradually developed into a powerful industrial state; and her exports now encircle the globe. Under these changed conditions the Prussian landed nobility have continued to assert their claims to political leadership, but naturally they have had to seek new means of defending them. Their chiefest care has been to maintain their favored position at the court, in the army and in the civil government. But they soon saw that, under a system of universal suffrage in the empire, they would have to form a political party that would find support among the populace.

Thus, under the leadership of the Prussian aristocracy, the Conservative Party was gradually developed — a party that has stood sponsor for every reactionary movement, both in the empire and in the individual states. In the internal development of the empire liberalism has been the potent and deciding factor. It had removed many obstacles to economic progress, disposing once for all with the restraints thrown around emigration and industrial freedom; and, in general, it had wiped out much of the hide bound conservatism that had been accumulating for centuries. Thus free play was given to industry, intelligence, technical skill and talent for organization. Competition became vital and strenuous. Since all these changes took place in a comparatively short time, such elements of the population as were unable to adjust themselves to the new conditions had to suffer. Just as is the case with every reform, many were dissatisfied. Now, to marshal these discontented elements against the reformers, *i. e.,* the Liberals, and arouse in them enthusiasm for the "good old times" — that was to be the work of the Conservative Party. They went to the farmers and bailed them with the tale of woe that agriculture was suffering, and that there should be a high protective tariff on all farm products. They went to the mechanics who were suffering under industrial competition and made them believe that unrestricted competition was to blame for all their troubles. Further, the anti-semitic sentiment was used to incite the people against the stock-exchange, that modern machine of commerce. In short, wherever there was an opportunity to enlist a discontented element of society, this was done; and the malcontents were promptly promised legal redress. In this way a conservative party was gradually formed of heterogeneous elements which, in fact, were anything else but conservative. At the same time, this Prussian aristocracy was endeavoring to keep in closest touch with the crown, the court and the government, and to influence legislation in a manner calculated to better the condition of large landowners. The Conservative Party has been the principal support of the Agrarian Protective Tariff System, which, since 1879, has been the focus of all political conflict in Germany.

The Centre, or Catholic Party.— In all essential respects the aims of the Centre, as a political party, coincide with the interests of the Roman Catholic Church. This party sprang up in the early seventies of the past century as a result of the so-called culture-conflict (Kulturkampf) that Bismarck and the Liberals waged against the Ultramontanes. With the new dogma of Infallibility this extreme Catholic party had taken on a more dangerous character. Bismarck withdrew his opposition toward the end of the seventies, when he needed the support of the Centre in order to carry through his protective tariff program. Since then the Centre has made secure its position in the Reichstag and has exerted an uninterrupted influence on legislation in the German Empire. It holds the balance of power in the legislative assembly and for years has nominated the President of the Reichstag.

The composition of this party is by no means homogeneous. Here we find feudal landlords with strong conservative tendencies pulling shoulder to shoulder with unintelligent mechanics, democratic chaplains and day-laborers for whom the Catholic Church is still the supreme authority. Clerical discipline encompasses and binds together all these heterogeneous elements. Even to-day the traditions of the culture-conflict play a considerable part in this party; and the demand that the Catholics be allowed equal rights with the Protestants is still heard, although the Catholics have long been political *enfants gâtés.*

The policy of the Centre is in perfect accord with its heterogeneous composition. For instance, to appease the Agrarians, it will favor the Agrarian protective tariff, and even demand a protective tariff on food-products; or, in order to hold its laboring contingent, it will propose legislation in the interest of the day-laborer; or, again, to keep the hard-pressed mechanic in a good humor, it will support the demands of compulsory guilds. It is the champion of every political attempt to restrain and limit artistic freedom in literature and the fine arts; and, finally, its chief concern is the enlargement of the influence of the Catholic Church, in opposition to the temporal power of the state.

Minor Parties Related to the Centre.— Following close in the train of the Centre are: (1) the *Poles, i. e.*, Catholic Prussians of Polish nationality who oppose with might and main the Germanizing of their country, and yet, as true Catholics, are closely related to the Centre; (2) the *Alsacians*, likewise Catholics principally, who have not yet become completely reconciled to the annexation of Alsace-Lorraine in 1871, but are becoming more and more friendly toward Germany since the violent outbreak against the clericals in France — especially as the relations between the Vatican and the German government continue to become more cordial. The Centre is also on friendly terms with, (3) the *Guelphs*, those Hanoverians who have not yet become reconciled to the annexation of Hanover in 1867.

The Liberals.— The Liberals and the Social Democrats represent modern industrial Germany, the former chiefly from the point of view of the employer, the latter chiefly from the point of view of the workman. The stock-exchange, and the banking, commercial, manufacturing and shipping interests form the main support of liberalism. Besides, there are the "Intellectuals" of science and invention; and, under the secret ballot, a considerable part of the lower classes and many of the minor government employes vote the liberal ticket. The higher up in the social scale these elements of the population may be, the more they are inclined toward a moderate degree of liberalism, such as that represented by the National Liberals. They have in many respects a leaning to the Conservatives and are willing to make considerable concessions to that party. They will accede to the Agrarian protective tariff; but, in turn, they expect the Conservatives to defend the large industrial interests against labor unions and help in the development of syndicates, trusts and similar organizations of promoters. The other liberal parties mentioned above represent a more pronounced degree of liberalism. They are free-traders from principle and believe in a constitutional monarchy from which every phase of absolutism has been eliminated.

During the past 25 years a process of differentiation has been especially noticeable in the ranks of liberalism. Less than a generation ago the greater part of the industrial laboring classes and minor official classes were enlisted on the side of liberalism. With the development of social democracy these elements of the population have gradually deserted the liberal banner and joined the more radical party.

The Social Democrats.— The Social Democratic Party was organized in the interest of the proletariat and has appealed to class prejudice as the most effective means of political propaganda. With only 100,000 votes at the first election to the Reichstag in 1871, the Social Democrats polled 3,000,000 votes at the election of 1903. No other political party in Germany can show a growth even approximating this.

In the year 1878 a ban in the nature of a special law was placed on social democracy, making organization and political agitation extremely difficult. More in a spirit of revenge than of reason, to this party had been attributed the two attempts by Hodel and Nobiling on the life of Emperor William I. At the general election of 1881, the first under this new law, the Social Democrats polled only 311,961 votes, *i. e.*, about 125,000 less than at the election of 1878. Since then, however, this restrictive measure has proved extremely effective in establishing and spreading social democracy. At the Reichstag election of 1890, shortly before the repeal of the statute in question, the Social Democrats were able to poll 1,427,000 votes; and since then their numbers have increased by leaps and bounds. Between the elections of 1898 and 1903 they gained 900,000 votes.

The official programme of the Social Democrats is radical in the extreme. It contains an indorsement of "collectivism" and a republican form of government. But in practical politics these radical demands scarcely come into consideration; and the custom of the social democratic members of the Reichstag to reject the entire Reichstag budget has gradually become purely perfunctory. So far as practical legislative work is concerned, the Social Democrats are forced to adopt a liberal policy, preferably with radical tendencies, and join with the Liberals in combating the views of the Clericals and Conservatives. The more progressive Liberals and the Social Democrats are always on the same side whenever any legislative attempt is made to put a high tariff on food-products, or to limit industrial freedom and the rights of the laborer, or to curb freedom of thought and expression, or to restrict the universal suffrage now obtaining in elections to the Reichstag. The Social Democrats have also joined in the defense of the stock-exchange against the attacks of the Clericals and the Conservatives, and have likewise taken part in maintaining the gold standard. And yet this community of interests which is constantly in evidence in practical politics has not been able to effect a closer political union between liberalism and social democracy. These two parties continue to fight one another bitterly, both in the press and at the polls — naturally to the very great satisfaction of their common enemies, the Conservatives and the Clericals, who see in the continued breach between the liberal middle classes and the social democratic working classes the best guarantee for the maintenance of their own political supremacy. For this reason reactionaries of every type are always endeavoring to stir up anew the conflict between the Liberals and the Socialists.

The Political Outlook.— The question, in how far will it be possible in the future to establish a *modus vivendi* between the Liberals and the Social Democrats, is of unusual importance for the entire political development of Germany. In both parties there is no lack of men of insight who recognize the fact that neither liberalism nor social democracy alone is able to secure in Germany a modern progressive policy; and that, therefore, the co-operation of the two parties in Germany is a political necessity, just as it is in France and Belgium. Just as in liberalism there are two elements, one rather conservative, the other more radical, so in social democracy there are two factions. One is concerned primarily with the practical affairs of state; the other, composed of social extremists, is concerned entirely with socialism. These last would like for the party to devote its entire political activity to the exploitation of Marx's theory of "collectivism." This conflict between social theory and the present political needs of the state is always in progress. It will probably continue for many a year; and the reactionaries may count on deriving advantage from it for a long time yet.

However, the general trend of economic development in Germany seems to lead inevitably toward democracy. The yearly increase of population, which is some eight or nine hundred thousand, forces the political centre of gravity more and more toward the commercial and industrial side; and, in time, industrial Germany must mean democratic Germany.

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12. **Germany — The Judiciary.** In the organization of justice and administration in Germany the distinction between the two has not been made in such a way that the guardianship of the law, *i. e.*, its application to the fullest extent in a given case, is a function of the courts. On the contrary, the business of the courts was considered to lie solely in the application of private and criminal law, while the decision of all cases in the whole field of public law, and of administrative law in particular, was regarded as a function of the administrative authorities. Such a view owes its origin to the absolute police-state, which it has now outlived; but it still persists. Only in recent decades have some of the German states introduced a special kind of legal proceedings for deciding certain cases of administrative law; but such innovations are as yet in a fragmentary and unsystematic condition. Even to-day the incorrect usage persists of calling only the civil and criminal courts "regular courts," as distinguished from these aforesaid administrative courts. To be sure, the organization and procedure of the so-called regular courts are legally made uniform throughout the empire by the imperial law under which these courts are organized and by uniform civil and criminal codes; while the organization and procedure of the administrative courts are left completely to the autonomy of the individual states.

Regular Courts.— In this sense the "regular courts" are: The county courts, the district state courts, the courts of appeal, and the supreme court of the empire. They are called respectively, Amtsgericht, Landgericht, Oberlandesgericht, and Reichsgericht. Excepting the last, all these courts pertain to the individual states, though their formation and proceedings are unified and determined by imperial law in the above-mentioned manner. The smaller states have courts of appeal in common, while the smallest states have their state courts in common with a neighboring state. The judges in all these county and state courts are appointed for life by the ruler of the state in which the courts are; and members of the Reichsgericht are appointed by the emperor on the recommendation of the Bundesrat, *i.e.*, the Federal Council. They cannot be transferred against their will; and they cannot be removed except by judicial disciplinary proceedings, or by reason of conviction in a criminal court. The qualification for a judgeship is prescribed by imperial law, which requires the study of law for at least three years at a university, and two rigid and comprehensive examinations, between which lies a period of practical experience in judicial work. The district state courts are divided into civil and criminal chambers, composed of three and five members respectively. The courts of appeal fall into civil and criminal senate, each composed of five members. The Reichsgericht is divided into similar senates, each composed of seven members.

Civil Proceedings.— In litigation in private law, where the sum involved does not exceed $75, and in certain specially designated cases, the judge of the county court alone decides the case in the first instance; in all other cases the suit is instituted, in the first instance, in the civil chamber of the state court. Besides, in judicial districts where a large amount of business is done, the state court has a special branch for the disposition of commercial matters. This court is presided over by a regular judge, assisted by two commercial judges. These last are business men, and their office is honorary. The course of appeal is from the county court to the district court, from the district court to the court of appeal; from the court of appeal to the supreme court of the empire for revision. In the larger commercial cities there is also provision for the formation of special courts to try cases growing out of business, commercial, and labor relations. Such courts are composed of employers and employes in equal numbers, and are presided over by some municipal official.

Criminal Proceedings.— For light misdemeanors criminal proceedings begin in the Schöffengericht, or sheriff's court, which is presided over by a judge of the county court, assisted by two magistrates. For more grave offenses the court of first instance is the criminal chamber of the district court; for serious crimes the Schwurgericht, or jury court. This last is composed of three regular judges and twelve jurors, forming two separate colleges, so that jurors only have to decide the question of guilt or innocence. In cases of treason against the emperor and against the empire the Reichsgericht alone has jurisdiction. We see that criminal courts of first instance are organized on three distinct principles. In some of them regular judges and laymen act together, in others they act as two separate units, and in still others the judges act alone. This condition is a result of a compromise that was agreed upon when the imperial statutes regulating the judiciary were passed. The original draft provided for three kinds of sheriff's courts, organized on a unifying principle. At present there is a reform movement in progress, looking toward the establishment of greater unity; but, in so far as such efforts threaten the existence of the jury-courts, they meet strong opposition in the public sentiment. In criminal matters, appeal, properly speaking, can only be taken from the decisions of the sheriff's court, from which the case goes to the criminal chamber of the district court. From the decisions of a district court, as well as from those of a jury court, there is no appeal, the only legal remedy being revision, in some cases by the criminal senate of the court of appeal but usually by the Reichsgericht.

The Public Prosecutor.— Aside from light cases of personal offense, insult, etc., the right to institute proceedings does not rest with the injured party but rests exclusively with the public authorities, or, so to say, with the Staatsanwaltschaft. It is the business of the attorney-general — district attorney, state's attorney, or whatever we may call him — to follow up every crime that comes to his notice; and only in certain light misdemeanors does the prosecution depend upon the will of the injured party. But, on the other hand, if a case is thrown out by the public prosecutor, the aggrieved party can bring about a legal decision on the matter. The qualification of prosecuting attorneys is the same as that of judges; but they are administrative, not judicial, officials. They are appointed by the several state sovereigns, and are subject to the legal regulations of the state administration. For the Reichsgericht also there are similar attorneys-general. They are appointed by the emperor on the recommendation of the Bundesrat, and are subordinate to the imperial chancellor and the imperial department of justice. The prosecuting attorneys also represent the public interest in matrimonial and guardianship litigation.

Attorneys.— The qualification of an attorney or counselor-at-law is likewise the same as that of a judge; though lawyers are by no means officials, but free practitioners. To be sure, in order to practise his profession, he must be enrolled in the list of lawyers at a certain court; but such enrollment cannot be denied any one who has the qualification of a lawyer. Only for the Reichsgericht does the right to practise depend upon the vote of the council, which decides the question whether a need exists, or not. In criminal proceedings every lawyer can represent the defendant in any German court; but in civil proceedings only in the court where he is enrolled. Only in the county court is it unnecessary for the defendant to have a lawyer; in other courts it is compulsory. Distinct from the attorneys are the notaries. These are regular state officials, appointed by the state department of justice, and in most states from the ranks of the lawyers.

Besides the administration of civil and criminal law, a number of matters have been turned over to the courts, which are properly beyond, but are said to fall within the "voluntary," jurisdiction of the courts. They are scarcely legal affairs at all, but rather administrative business. Among such may be mentioned, the control of guardianships, the keeping of the land-register, and the trade-register, and similar things.

Special Courts.— In addition to the general courts there are special courts for certain classes of persons. Particularly to be mentioned are military courts, having jurisdiction in criminal matters. Military persons are not subject to the general criminal justice, but come under special criminal proceedings managed, in the first instance, by the military, by the military supreme, or by the naval courts, and, in the last instance, by the military court of the empire. These courts are composed of officers and military judicial officials; and here particularly the lord of the court, a survival of the Middle Ages, plays an untimely part. Further, the various systems of state laws provide for special civil and criminal proceedings against the members of the state's dynasties, and for civil proceedings even against the ruler himself. For criminal acts, the head of a German state cannot be tried in any court, and so cannot be held responsible.

In the German protectorates there are also special courts, and likewise special consular courts in those foreign localities where Europeans are exempted from local jurisdiction.

Independence of the Judiciary.— The principle of independence in the judiciary is shown not only by the fact that the judge can neither be transferred nor peremptorily dismissed, but also by the fact that the courts render their decisions independently of any higher orders, and are under no authority but that of the law. The pardoning power in cases of criminals belongs to the heads of the individual states and free cities, except for sentences passed by the Reichsgericht; for these the right of pardoning belongs to the emperor.

The Question of Legality.— From the principle that the courts alone have the right to apply law is deduced the further principle that they have to test the legality of laws and ordinances before they apply them. In Prussia, however, there is a constitutional clause against this, which precludes absolutely the possibility of testing the legality of any properly proclaimed statutes, or even of the royal mandates. But whenever a given law violating the basal principles of a legal system has not been expressly sanctioned, there exists the right to test its legality. This is true of the empire and of many states. It must be added that the weight of opinion in Germany is that this right of the courts to test the legality of a law does not, as in the United States, touch the question of the constitutionality of a statute that is formally valid. While in America legislation, justice, and administration are coördinated, and all are subordinate only to the specially organized constitutional law, in Germany constitutional law is not essentially different from ordinary law; and it is under ordinary law that both justice and administration are subordinated.

The Question of Constitutionality.— Accordingly the whole field of constitutional law, properly speaking, is without any secure protection on the side of the courts; for the American institution of impeachment has not yet been developed in Germany. In all the constitutions, of course, the principle of the responsibility of ministries for their acts is expressed, and many individual states have a legal regulation for the indictment of ministers. Charges are preferred by the state legislature, and the case is usually tried by a specially formed state court. But in the empire, as such, and in Prussia the legal regulation for such proceedings is lacking. However, regardless of the question whether such indictments should be brought against ministers, some sort of control by the courts over the constitutionality of laws and the acts of the government is absolutely necessary. The custom, taken from French law, of allowing the Staatsrat, or state council, to decide whether an official shall be prosecuted in the courts, or not, for acts committed in performing the functions of his office, has been done away with for the empire; but in the individual states, under certain circumstances, a similar arrangement has been retained. Prussia and some other states have made use of it. For instance, if civil or criminal charges are preferred against an administrative official for acts done in his official capacity, his superiors can submit to the highest administrative state court, the Oberverwaltungsgericht, the question whether the official has violated his duty or not. If this court decides that the official on trial committed the offensive acts in the performance of his duty the case is brought before the regular courts.

Whether the courts are to be allowed to test the legality of administrative acts, and in what way and to what extent, this is a matter that the imperial laws leave to the legislation of the individual states. As a matter of fact, Prussia, Bavaria, Saxony, Württemberg, Baden, and many small German states have recently undertaken judicial control of administrative jurisdiction. They have organized a so-called "Verwaltungsgerichtsbarkeit;" but the extent to which this has been done is exceedingly varied; and it is exceptional that the principle is expressed, that every infringement on subjective rights by an administrative act is sufficient ground for an indictment. Usually, as in Prussia, the legal method is to enumerate all the possible cases in which such an administrative indictment is admissible. The list generally includes all police dispositions. However, the decision of such cases is never left to the ordinary courts, but to special administrative courts; and these do not belong to the judicial system, but to the administrative system. Usually, in the first instance, the question of administrative jurisdiction is decided by the administrative authorities themselves, but in collegial formation with laymen and in special proceedings similar to civil proceedings. Only in the last instance does the question go to an administrative court formed especially for the cases in hand. In Prussia administrative courts of first and second instance are simply the administrative county and district boards, which are composed partly of regular, paid officials, and partly of honorary elected officials. The court of final appeal is the Oberverwaltungsgericht, which is composed exclusively of members appointed for life by the king. Half of the members must have the qualification of a judge, the other half the usual qualification required for high administrative service. As to independence, this court offers all the guarantees of the highest courts of justice.

In view of the complication of the limits to the competency of law courts on the one side, and administrative authorities and administrative courts on the other, it is clear that disputes over such competency can easily arise. The imperial law states that the courts are to decide upon the competency of himself; but here too it leaves it to state legislation to form, under certain conditions, special courts for deciding such disputes about competency. As in other states, this has happened in Prussia. Here a so-called competence-court, composed of judges and administrative officials, decides such conflicts. This special court is summoned either by the administrative authorities when the matter is pending, or by the disputants, after both the courts and the administrative authorities have declared themselves incompetent. On the other hand, disputes of competence between the administrative courts and administrative authorities are decided once for all by the Oberverwaltungsgericht.

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13. **Germany — The Schools.** The history of German schools begins with the time of Charlemagne. True, before his time, the Church had made it its business to provide, in the monasteries, instruction in theology and other subjects for boys intended for the ministry, and later also for the children of especially prominent families; but it was the great emperor who, advised by such scholars as Alkuin, Paulus Diaconus, and Petrus Lombardus, first strove to introduce really popular instruction in Germany and thus lift his subjects to a higher intellectual plane. School-rooms were fitted up in his castles, as well as in the monasteries, where not only his own children and the sons of the highest nobility, but also capable boys of the lower classes were instructed and educated. In the following wars and confusion many of those schools were abandoned, and under the successors of Charlemagne nothing was done for the youth of the common people for centuries, though scions of distinguished families still found in the monastic schools opportunity to learn the three R's and occasionally even Latin. With the rise of the cities after the Crusades and the increased prosperity of the middle classes came naturally a popular desire to better educational conditions. Already before the 14th century German merchants had established secular writing-schools, in which the subjects of instruction were no longer merely those things that the Church was trying to teach to its new recruits, but more particularly penmanship and commercial arithmetic, and such other things as the business world of that time needed to know. After this time the development of

the German school system was stimulated largely by the examples of Holland and Italy, respectively. While the monastic and cathedral schools still remained under the domination of the scholastic spirit, humanism was victorious in the "brotherhood-schools" that were spreading all over lower Germany, modelled after those established in the Netherlands by Geert Groote. The revival of learning in Italy prepared the way for a reorganization of higher instruction in Germany and led to a more thorough study of the classic languages and literatures. Yet, with a few famous exceptions, there was a lack of really capable teachers. Just as in the guilds, there were masters and apprentices among schoolmen; and hundreds of poorly qualified beginners in the profession roved from place to place as traveling scholars, usually taking with them a number of "A B C" words, which they treated brutally enough and often led astray.

The most important educational reform in Germany was effected by Melanchthon (præceptor Germaniæ) and Martin Luther. Supported by Bugenhagen in northern Germany and Johannes Brenz in Würtemberg, these two reformers sought to improve upon earlier attempts at popular education. Both worked for a popular education that should really become general; and they emphasized effectively the legal duty of all parishes to employ the necessary number of qualified teachers. Just as the school-ordinance of Würtemberg, so also those of Brunswick, and the Electorate of Saxony demanded German schools in every village, besides particular schools of five classes in the towns. Continuing the work of the latter, the three ducal schools (Fürstenschulen) at Meissen, Grimma, and Schulpforta took the pupils through a six years' course, thus preparing them for the university. Besides the old monastic schools there were now also Protestant Latin-schools, where philosophy, mathematics, and the elements of Hebrew were taught as well as Latin and Greek; but it must be added that in the lower Latin-schools Latin and religion were for a long time the only subjects taught. Through the efforts of Hieronymus Wolf, Valentin Friedland, of Trotzendorf, and Johannes Sturm — all pupils and followers of Melanchthon — the Latin high schools (often called monastic, public, and ducal schools) were gradually raised to the dignity and significance of those humanistic Gymnasien, which for some centuries formed the chief stepping-stones to the German universities. The Catholic Church unwilling to be outstripped also took up the work of reform and helped to increase the number of country public schools, and also the charity schools in the towns and cities. The Jesuits furnished some excellent teachers for the Catholic portion of the population. Though girls had received instruction in the convents of the Middle Ages, still it remained for the 16th century to give the daughters of the poorer classes opportunity to receive even a modest amount of elementary instruction.

However, in the following cycle humanism was on the wane. In directing attention to the study of nature Bacon and Descartes had proclaimed the rise of new educational ideals, and now Germany again needed new pedagogical guides. These were found in the persons of the school-reformers Ratichius and Comenius. While the latter emphasized the value of observation and practice (übung) and regarded the "realities" as the kernel of scientific education, Ratichius was more practical and directed his efforts toward the introduction of a quick method of learning languages. During their lifetime compulsory education was introduced, at least in some of the smaller principalities. A number of school-ordinances published later show the far-reaching influence of the pedagogy of Comenius, and particularly a gratifying effort to increase more and more the number of subjects taught. The nobility of the 17th century looked upon humanistic learning as the work of a pedant, and blinded by the brilliance of French culture, they established their Ritterakademien, or academies for young noblemen. Of these institutions, which were of rapid growth, a few are still in existence. August Hermann Francke made a name for himself as the creator of the first German orphan-asylum, of the Bürgerschule, and of the high school for girls. He likewise made the first attempt to unite organically the new subjects of instruction with the traditional subject-matter of instruction. Just as Francke had done, the so-called Philanthropists (Basedow, Campe, Salzmann), under the influence of Locke and Rousseau, laid stress on the importance of educating as well as of instructing youth, and prepared a number of good school manuals and reading books. It is to pupils of Francke that Germany is indebted for the first Realschulen, in which the greatest stress was put upon the German language and literature, to the exclusion of Latin and Greek.

Frederick II., of Prussia, saw in the spread of elementary instruction the best means of enlightening his people; but von Zedlitz, his minister of state, also did much to elevate and multiply the Gymnasien. The final examination (Abiturientenexamen), introduced in 1788, made instruction and courses of study more uniform. Freiherr von Stein laid the foundation for the later Ministry of Public Worship and Instruction in Prussia. Examination-ordinances for the pupils of the various schools were either revised or introduced for the first time, likewise for teachers of public and other schools; also a trial-year for teachers was instituted; a normal programme of study was published for the Prussian Gymnasien; and, finally, the value of gymnastic exercises, which had been advocated by Jahn, was recognized in the programmes of public schools.

However, the wonderful educational progress made by Germany along all lines during the first half of the 19th century was due principally to the work of the great pedagogical reformers Pestalozzi, Fröbel, and Herbart. They emphasized the necessity of a natural beginning and the importance of thorough rudimentary instruction; they insisted that education go hand-in-hand with instruction; and they demanded that Forbildungsschulen, or continuation schools, be established, that the trial-schools for teachers be united with the training-colleges, and that methodically arranged school manuals be prepared. Kindergartens, in which play is made an important factor in education and instruction, trace their origin back to Fröbel, while Herbart was the creator of our scientific pedagogy. He brought pedagogy into its natural relation to psychology and ethics and sought to build up instruction in high schools on the same principles as in the public elementary schools (Volksschulen).

The credit for the excellent and generally admired school system of Germany, with the consequent high level of popular education, is not due to such deserving men alone, but also in a large measure to wise legislation, particularly regarding the thorough preparation of teachers and the compulsory attendance of pupils. All children from 6 to 14 years old must receive instruction, at least in the public elementary schools. Here tuition is free, but not so books, tablets, etc.; and every parish or municipality is legally obligated to establish and maintain such schools. Here and there the state renders some assistance, but claims the right to confirm the teachers and supervise the school. The simplest form of such a free school is the village school with only one class, where children of both sexes and of every school-age sit together in one room and are instructed simultaneously by one single teacher. The subjects taught are: Religion, German, Arithmetic, the Realities, Singing, and Gymnastics, besides some instruction in needlework for the girls. In larger communities similar schools have two or three grades instead of only one, and a corresponding number of teachers, under a regularly certificated principal. In towns and cities the boys and girls are separated, there being such free schools for each sex. Since 1 Oct. 1902, such city schools have had eight grades, and in them are taught, in addition to the subjects mentioned above, also Geometry, Geography, and Natural History. The administration of these common schools is in the hands of the city school commissioners, who are elected by the representatives of the citizens. These commissioners elect the superintendents and the principals and teachers of the individual public schools. State supervision of schools, including the one-grade country schools, is carried out by the district superintendent, or by the head of the district government, or, in the last instance, by the royal government.

The intermediate and high schools for boys, as well as similar institutions for girls, serve more general educational purposes, in that here modern languages are added to the curriculum. All teachers employed in the common and intermediate schools must have been prepared in a state training-college for teachers. In Prussia there are usually separate training-colleges for Protestants and Catholics, and all are under the royal provincial school commissions, in which the head of the provincial government in question is the chairman. Every training college is organically united with a one-grade and with a three-grade practice school. The so-called Präparandenanstalt, a preparatory training school, serves as a stepping-stone to the training college. Pupils who have not attended such an institution must pass an entrance examination at the higher institution. The course of study at a training college embraces three years, and tuition is free. In none of these training schools is there co-education, there being separate institutions for males and females. Usually these colleges for teachers are at the same time homes, where the pupils eat and sleep. Pedagogy, Religion, German, and Music play an important part in the course of instruction. For entrance the pupil must have completed his 17th year, but must not be over 24 years old. After three years, the last of which is devoted chiefly to a practical study of methods in teaching, the pupil must pass a final examination, which qualifies provisionally for the work of a teacher. However, the right of permanent employment in the school service is conditioned on another examination, which the young teacher can take only after the lapse of two years, at latest five years. The candidate must then show that he or she is capable of filling a school position permanently. Any one desiring to become a teacher in an intermediate or a high school, or a teacher or principal in a training college, or a school principal or superintendent, must stand special examinations of correspondingly more rigid requirements.

At the beginning of the year 1902 there were 59,364 public elementary schools in Germany, with 146,584 teachers in full employment, and 8,921,440 pupils. In 1901–02 the total expenditure for public elementary instruction was $104,475,000, of which $30,100,000 came from state funds. There was a public elementary school for every 950 inhabitants, with 158 scholars for every 1,000 inhabitants, and 61 scholars pro teacher. There were further 666 private schools of the same grade, with 39,939 scholars. The teachers of all kinds of public schools in Germany are entitled to pensions, and can, for the most part, be dismissed only by a judge's sentence. In the sum mentioned above, as representing the cost of public elementary education in Germany, the expense of general school management, of school inspection, and of training teachers, is not included. The general level of popular education in Germany is favorably characterized by the fact that in October, 1901, the precentage of illiteracy among army recruits was only ½ per cent per 1,000, not taking into account the one-year volunteers, who, as is well known, are admitted only on the basis of a certificate obtained for six years' successful study at a higher institution of learning.

In Prussia there were, in 1902, 12,183 students at the public training colleges. The total expenditure for such institutions in the same year was some $2,375,000, of which about $2,000,000 was paid by the state. Of the 6,103,745 children in Prussia in 1901 subject to compulsory education (age 6 to 14 years), about 93 per cent received instruction in the public elementary schools, 6 per cent in other schools, and only 1 per cent were temporarily excused from school attendance. In 1901 there were in full employment in the Prussian public elementary schools 76,342 male and 13,866 female teachers, besides 131 male and 33,062 female assistants for such special branches as needlework, gymnastics, etc. In 1901 the cost of maintaining such schools in Prussia amounted to some $67,480,000. Of this amount only 31 per cent was covered by the usual school money, the balance being paid by the state, by the municipalities, and by parties obligated to contribute, and in part from the income of school property. In 1901 there were in Prussia 319 public intermediate schools for boys and children of both sexes, where 86,965 pupils received instruction from 2,368 male and 200 regularly employed female teachers. The number of public intermediate schools for girls was 137, with 47,776 pupils, 702 male, and 704 female teachers.

To be distinguished from these last mentioned are the public high schools for girls (Hohere Töchterschulen). Of these schools alone there are in Prussia about 220, with more than 60,000 pupils and about 2,500 teachers, of which there are only about 200 more female than male teachers. It must be remembered that we are speaking here only of state and city schools. Just in this field of female education there are numerous well-attended private institutions; and in these the female teachers are in a large majority. The ordinary public high schools for girls (Höhere Mädchenschulen) have nine grades; and here are taught, besides the general subjects already mentioned, French, English, Mathematics, Physics, and Chemistry. Not infrequently there are training colleges for girls in connection with these high schools, which have a three years' course and prepare teachers for intermediate and high schools for girls. Recently also regular gymnasial courses, with considerable Latin and some Greek, have been opened to girls, either in a private way, or as supplementing the work of some of the more prominent public high schools first mentioned.

The first Realgymnasium for girls was opened in Berlin in 1906. The curriculum is to be the same as that of the intermediate and upper classes of the Realgymnasien for boys, including Latin but not Greek (see below). In January, 1906, Dr. Studt, Minister of Public Worship and Instruction, summoned to Berlin a conference of educators in the interest of the higher education of young women. The body was composed half of male and half of female representatives of education for girls. The resolutions passed by this conference are of great significance for the further development of female education, and especially so the plan to establish colleges (Lyzeen) for girls. These institutions are to include ancient languages in their course of instruction; and the expectation is that they will give young women an equal opportunity with young men to pursue the highest educational ideals.

As regards higher institutions of learning for boys we have, in general, to distinguish between those having a six-years' course and those having a nine-years' course. All presuppose a three-years' elementary course and receive in their lowest class pupils 9 or 10 years old. When a boy has finished a six-years' course and qualified for the next higher class, he then receives a certificate entitling him to fulfill his military obligations as a one-year volunteer. The most popular and by far the most numerous of these six-year public schools are the Realschulen. Besides the usual branches, French is begun in the first year, to which English is added in the fourth, fifth, and sixth years. Other subjects taught are Mathematics, Physics, Chemistry, Biology, etc. The Oberrealschule is just like the Realschule as regards the programme of study, etc., except that here the course is merely extended organically by three years. Latin and Greek are not taught in any of these schools.

The Realgymnasium is a higher institution of learning with a nine-years' course of study. French, English, and Mathematics are the principal subjects of instructions, but heavy emphasis is also put upon Latin. Even in the first year the pupil is drilled eight hours a week in the elements of Latin grammar. A conference of leading German educators, called together by William II. in December, 1890, has proved significant for the later development of the German school-system. Since that time there has been increased interest in the establishment of institutions that take into consideration the individual talents and inclinations of the pupil and make it possible for him to get either an essentially humanistic, or a more realistic education, thus preparing him later to enter one of the learned professions, if he choose, or to pursue some more practical calling. In such reform schools Latin is banished from the lower classes and French begun instead; then in the third year English is taken up, in accordance with the programme suggested by Principal Schlee, of Altona; and not until the fourth year does Latin take its place with the other languages. The Frankfort reform programme, which has been advocated with most success by Karl Reinhardt, is more popular and really of more practical use. It provides for French as the only foreign language during the first three years; then Latin is added, and later, during the last four years, English is added. If for English we substitute Greek in this programme, there we have the curriculum of the so-called reform gymnasium. As a matter of fact, the three lowest classes are the common foundation for the Realschule and Oberrealschule on the one side, and for the Reform realgymnasium and the Reform gymnasium on the other.

In the humanistic Gymnasien of the old style Latin is studied from the first year on, French from the third, and Greek is added in the fourth year. At present these institutions are still in the majority; but the tendency is decidedly to increase the number of «realistic» institutions and reform schools.

The aim of the reforms of the last 15 years, which were initiated by William II., has been to break the monopoly of authority enjoyed by the Gymnasien. As a matter of fact, anyone who has passed the final examination at any higher institution of a nine-years' course, can now enter the university; though matriculates in the theological department who have not studied ancient languages must later take an examination in these subjects. Similarly, graduates of an Oberrealschule who intend to become physicians must learn a certain amount of Latin; and, if they devote themselves to the study of law and statecraft, they must, after a few terms, take an examination in Latin, to show that they are able to study Roman law from the sources. The certificate of graduation from a nine-year institution (Gymnasium, Realgymnasium, Oberrealschule) besides admitting to the universities and the technical Hochschulen, entitles one later to enter upon the career of an officer in the army or navy, or to take the examinations for state service in the departments of forestry, buildings, and mines, or in the higher postal and telegraph service. To enter upon a career in the revenue department it is sufficient to have studied successfully for one year in the upper class (Prima) of a nine-year institution. For admission to the study of dentistry and veterinary science, as well as to employment in the Imperial Bank, the candidate is only required to have passed the examination for promotion to the upper class. The certificate for service as a one-year volunteer, given for six years' successful study at a higher institution, admits to the Hochschule for Agriculture, also to the Academic Hochschulen for music, painting, and sculpture, as well as to the examinations for teachers of gymnastics and drawing at the high schools. On the other hand, the future apothecary must have passed the examination for promotion to the upper class; and, if he was educated at an Oberrealschule, he must have learned privately a sufficient amount of Latin.

It only remains to refer to special schools for the infirm. Germany has long regarded it as the duty of the State to provide education and instruction for children whose bodily infirmities make it impossible for them to attend the regular public schools. In addition to numerous private institutions of a similar nature, there are royal schools for the blind and for deaf-mutes; and in some of the asylums for the insane there are classes for mentally diseased children, in which the wards are chiefly directed in some kind of systematic manual employment. Further, in many municipalities auxiliary schools for weak-minded children have recently been established. Formerly, such children either received no instruction at all, or else they were allowed to attend the ordinary public schools for years to no use, feeling themselves miserable among normal children and simply hindering the regular class instruction.

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14. Germany — The University System. The conception of a university is, as part of the German educational system, free from all the difficulties of determination which are involved in the American usage of the word. In the United States the university means sometimes the best equipped colleges as distinguished from the poorer ones; sometimes those institutions which combine colleges and professional schools; yet at the same time many of the smallest and newest schools leading to the bachelor's degree call themselves universities, while the older and better ones keep the traditional name of college. There is thus on the American side no sharp demarcation line, and hundreds of hardly comparable institutions may be called universities. The situation in Germany is in every respect the opposite of this. The German Empire has 21 universities which, at least in theory, all stand on exactly the same level, have uniform entrance conditions and degrees, are sharply and absolutely different from a German school or gymnasium, from the academies and technical schools, and from every American institution: comparable perhaps with the four post-graduate departments plus the junior and senior classes of an institution like Harvard University.

The oldest German universities lie outside of the present German empire, in Austria: Prague was founded in 1348 and soon after, Vienna. In the Germany of to-day none is older than Heidelberg, founded 1385. The others are, in historical order: Leipzig (1409), Rostock (1419), Greifswald (1456), Freiburg (1457), Tübingen (1477), Marburg (1527), Königsberg (1544), Jena (1558), Würzburg (1582), Giessen (1607), Kiel (1665), Halle (1694), Breslau (1702), Göttingen (1737), Erlangen (1743), Münster (1780), Berlin (1809), Bonn (1818), München (1826), Strasshurg (1872). A lively agitation makes it probable that the next university will be founded in Hamburg.

Sixteen universities, some of them of great historical importance, existed for some centuries and disappeared again, as, for instance, Köln (1388–1794), Erfurt (1392–1816), Ingolstadt (1472–1800), Mainz (1477–1798), Wittenberg (1502–1817), Frankfurt a. O. (1506–1810), Helmstädt (1576–1809), Altdorf (1622–1807).

The essential features of these 21 institutions are given in the fact, firstly, that they are State institutions; secondly, that the instruction is adjusted to the professional training of the lawyer, the physician, the minister, the high school teacher, and the scholar; thirdly, that the teachers are appointed for their achievements in productive scholarship; and finally, that the students are left to the complete freedom of independent young scholars. We have to consider carefully the bearing of these four features to understand the meaning of those institutions which have been throughout the whole of the 19th century the chief pride of the German nation, and have secured to German scholarship the acknowledged leadership in the civilized world.

State Institutions.— The German universities are State institutions. While in America the State has organized university life wherever private initiative has been insufficient, giving to the State universities on the whole a supplementary character, inasmuch as all the leading historical universities have been under the control of private corporations, the German nation takes for granted that the higher education is a matter for the State. This administrative dependence upon the State can alone secure the necessary uniformity in the preparation of the State employes, teachers, judges, and so on. And, on the other hand, as the State demands that its employes shall have studied a number of years in German State universities, it would be impossible to develop universities on private foundations. Germany thus represents in this respect the opposite extreme to England, while America takes a middle place. But it is not the Empire which has any control of the universities. The higher education is a function of the particular states. Thus, Berlin is under the control of Prussia; Leipzig, of Saxony; Munich, of Bavaria; Heidelberg, of Baden; and so on. The State appoints the professors, determines their salaries and their functions, and determines the requirements for the State examinations. All the expenses of the university, salaries and pensions, buildings and equipment, figure in the State budget, and are independent of the small fees which the students pay and which go directly to the professors whose lectures they attend. The income of the instructors comes, thus, from two sources: the salary and the fees. In the case of disability of the professor, his whole salary is to be paid until his death; and in every case, the State takes care of the widow and orphans.

The State expenses for the universities have been about 30,000,000 marks for regular yearly expenses and about 6,000,000 marks every year for extraordinary expenses.

The leading personality in the governmental administration of the last two decades has been Dr. Friedrich Althoff, the eminent head of the Prussian University Department; his greatest achievement is the development of the naturalistic laboratories and of the clinical institutions.

This State character of the universities is in no way antagonistic to an extraordinary democratic freedom in these institutions. Their whole organization is in its essentials that of self-governed corporations, with powers in the hand of the professors which in many respects exceed those of the American Faculties and which still show much of their origin in the free medieval institutions of Germany. Fundamental is the right of the Faculties to fill their vacancies by coöptation. Whenever a professorship is to be filled, the Faculty selects three candidates and the government is bound to appoint a professor from among this number. The Faculties, also, choose each year the President, the so-called rector, out of their own number. The teaching staff consists further, not only of full professors and assistant professors, but also of docents (Privatdocenten) who have no salaries, but fees only, and their appointment is absolutely in the hands of the Faculty. In earliest times the universities had even their own courts. This exemption from civil law has been abolished, but some disciplinary rights have still been kept up. Above all, the State has no right to interfere with the teaching of any instructor. No political pressure can be applied, and no professor can be removed from his place against his will. There is no sphere of public activity in the German Empire in which the State control is so little felt as in the university; everything is adjusted to the greatest possible freedom of thought.

Professional Faculties.— The universities are schools for professional training. They stand hereby in sharp contrast to the English and American systems. In America the law schools, medical schools, and partly the divinity schools, stood in old times on a very low level of general education. Practically every one was admitted. And independent of these, the country had its colleges as places of highest education; these were the real universities of the land, with the aim of furnishing the highest liberal education, accessible alike to the future business man and to the professional students. In Germany the situation has been just the opposite of this since the days of the first university in the 14th century. From the beginning, each university has had its four Faculties, and one of them, the Faculty of Arts, the later so-called Philosophical Faculty, was distinctly the preparation for the three upper Faculties of Divinity, Law and Medicine. The Faculty of Arts had not the coördinated character because its professional aim of preparing school teachers had not reached an independent standing, as all teaching was done by the clergy. As soon as lay teachers were demanded, the Faculty of Arts, too, became professional, and the four coördinated Faculties represented the university. Thus none but professional men have a real right to existence in the German University. The strong social effect of this historical development cannot be overlooked; it characterizes the social difference between Germany and the Anglo-Saxon countries. While in America the community of the best educated is represented by the alumni of the colleges, without reference to the question whether the way from the college leads to the court and hospital or to the bank and office, in Germany the circle of the intellectual leaders is confined to the professional men, as they alone have had reason to attend a university. Only the army ranks with them socially, while the representatives of all commercial and industrial activities take a second place, as they have no university education.

In a certain way the Philosophical Faculty is still to-day introductory to the three others. The students of medicine here receive the biological foundation, the students of law and divinity find here the historical, economical and philosophical work. At certain places the Philosophical Faculty itself has been divided into two, a Naturalistic and an Historical Faculty. Everywhere it is at present the most developed one, with the largest number of teachers and students. The most rapid development in the last century belongs to the Medical Faculty, which stood far behind the Law Faculty a hundred years ago, while it has now far surpassed the Law Faculty in the number of teachers, and, for a period of years, even in the number of students.

In every Faculty the foundations of the instruction are historical and theoretical. The Law Faculty, for instance, develops the juristic problems from a systematic point of view and leads up to the existing law through the history of Roman and German law. The practical preparation which the case system of the American law school provides is left in Germany to the so-called Referendarzeit, a period of several years which every young jurist — he may go into the career of the lawyer or of the judge — has to pass in the court for practical training after passing his examinations in the university. Besides the State examinations for all professions, the university offers the Doctor's Degree in Philosophy, Law and Medicine, which in itself gives no right to any appointment or to any professional work, with the exception of the career of the university docent. Yet the Doctor's Degree is taken by most of the professional men too, as it gives by tradition the stamp of real scholarship.

The relations of the different Faculties may be characterized by the following figures. In the year 1900 there were in the Philosophical Faculties 571 full professors, 52 associate professors, 323 assistant professors, 419 Privatdocents, and 12,244 students. In the Protestant Divinity Faculties 110 full professors, 7 associates, 33 assistant professors, 37 docents, 2,352 students. In the Catholic Divinity Faculties 62 professors, 2 associate, 10 assistant professors, 10 docents, 1,546 students. In the Law Faculties 156 professors, 12 associates, 32 assistant professors, 40 docents, 9,250 students. In the Medical Faculties 224 professors, 19 associates, 210 assistant professors, 329 docents, and 7,433 students. To characterize the growth of the Faculties the following figures may be added: In the year 1850 the German universities had 12,246 students (1,615 Evangel. Div., 1,391 Catholic Div., 4,306 Law, 1,932 Medicine, 3,102 Philosophy). In the year 1880, 22,863 students (2,786 Evangel. Div., 706 Catholic Div., 5,297 Law, 4,779 Medicine, 9,295 Philosophy). In the year 1903, 37,677 students (2,197 Evangel. Div., 1,580 Catholic Div., 11,747 Law, 6,948 Medicine, 15,205 Philosophy).

The Teachers.— The teachers of the university are appointed with reference to their achievements in the advancement of knowledge. No one can understand the meaning of the German university who does not acknowledge this principle as the central energy of German academic life. In this respect Germany stands in contrast to both England and France. In England the greatest scholars, from Bacon to Darwin and Spencer, have stood outside the university life, and even the leading professors of Oxford and Cambridge have little to do with the regular teaching, which is in the hands of tutors and fellows. In France the provincial universities are professional schools whose professors are expected to be first of all teachers, while scholarly production is concentrated in the academies of Paris. In Germany alone is a complete unity of academic teacher and productive scholar demanded. It is a rare exception when an important scholar does not become a university teacher in Germany, and every university teacher without exception is expected to have added to the storehouse of the world's knowledge. America comes nearer to this German system than any European country; and yet in every American university productive scholars and reproductive scholars are mixed; the contributions to knowledge still appear as a kind of private undertaking, while the appointment refers to the teacher as teacher. This cannot be otherwise in a country where there is no sharp demarcation line between the small college, which demands school teachers, and the large university from which the mere school work ought to be banished. Germany's power to reserve all university teaching for the productive scholar thus stands in immediate relation to the sharp and uniform demarcation line between all schools, on the one side, and the universities on the other.

This principle involves the most characteristic features of German university teaching. The university lecture is not intended as a reproduction of ready-made knowledge and the imparting of mere information is its least important function. Its essetial trait is rather that which the productive scholar alone can offer, the training in scholarly methods. The Gymnasium teaches facts; the university teaches a critical attitude toward all knowledge. Its vehicles are partly lectures, partly seminary exercises. The lectures are meant to be strictly personal and critical outlooks over a whole field of knowledge, independent of any special textbook. They are not to be substitutes for anything printed at all, but have to find their value in the contact of the student with a personality, acknowledged as an original productive scholar. The German idea is decidedly that the mastery of method which such a teacher has shown in his works will be more helpful and suggestive for the student than any brilliant rendering of second-hand knowledge. The seminaries, which have taken the place of the formal disputations of earlier centuries, lead the most advanced students to make individual efforts toward scholarly production.

This principle gives meaning also to the institution of Privatdocenten. In America the young scholar has to find his academic career mostly by ascending through positions in small colleges without higher university aims, where he finds neither the means nor the time nor the advanced students for higher work. This is necessary as the large universities have merely salaried teachers whose number has, of course, to be adjusted to the demand of the instruction. The result is that the academic career is discouraging for the most vigorous minds, which see before them years of a second-rate activity. In Germany the opposite prevails. There are no limits for the number of teachers of highest class in the university. The docents have no salaries, to be sure; but their right to lecture on any specialty to advanced students is equal to that of any full professor, and no obligations are involved. It is the ideal situation for the young scholar who wants to live in the academic atmosphere from the first and who wants to devote his life to productive scholarship. A remarkable piece of scientific achievement is the only condition for his admission, however large the number of teachers in the same specialty may be. This docent system thus separates the university career from its beginning, from that of the simple teacher; confines it to productive work; and has its external advantage in the fact that out of these docents the universities choose the candidates for vacant professorships. The result is that the finest and most vigorous minds of the country are drawn into this career, and it is this personal factor above all which gives to the German university its superiority. Germany is the only country in which absolutely the best human material of the nation enters into the academic career; and the docent system is the necessary condition for this situation.

The German university has thus no exact equivalent to the American university instructor, as the instructor has a paid position and is appointed with definite obligations as to teaching, while the docent may offer within the limits of his chosen field whatever he likes. The professor extraordinarius corresponds to the American assistant professor; the ordinarius, to the full professor. But it must be understood that in Germany both categories are appointed for life, and that the full professors only constitute the official Faculty in which the administrative duties are settled. Very frequently the title of professor extraordinarius is given to docents after a series of years of valuable work. This is, then, merely a title without any professorial rights. No docent earns by his years of service any right to be advanced to a real professorship, and seniority plays no rôle in the question of advancement. The principle of inbreeding, so habitual in American universities, is strictly avoided in Germany. A constant migration of the professors is the rule, and this migration includes the German universities of Austria and Switzerland too. The Faculty asks merely for the best productive scholars available, and this rejection of all claims resulting from years of service secures the eminent character of the Faculty.

The Students.— The students attend the university for from three to five years for the purpose of being prepared for a profession through a critical scholarly study of its scientific basis. The attitude of the student, at least in theory, corresponds, therefore, to the scholarly character of the Faculty. This is expressed by the scholarly preparation demanded as entrance condition, and is expressed further by the complete freedom of the student in every respect. As to the entrance conditions, recent years have modernized the system by giving to the more naturalistic Realschule the same rights as to the classicistic Gymnasium. But in no case can a student be matriculated as a full student with the right to pass state examinations who has not passed the nine years' course of one of the higher schools which presuppose a three years' course in a primary school. This twelve years' work is usually completed with the 19th year and is tested by the Abiturienten examination, which closes the school life. It is difficult to compare this point of intellectual achievement with that of American schools. On the whole, it might correspond to the beginning of the junior year in the leading American universities or to the Bachelor's Degree in the smaller colleges of good reputation. Those German students who have not passed this examination can enter merely as special students, so-called Hörer, without the right to pass university examinations. Foreigners cannot pass State examinations at all; but they can be matriculated and attain the Doctor's Degree. The American Bachelor's Degree is, then, usually counted as substitute for the German school examination, and years of post-graduate work in such American institutions as belong to the American Association of universities are accredited to them to a certain extent.

The time of study toward the philosophical degree is nearly always four years; for the medical degree, five years. The unit of study is not the academic year but the half year, the semester, of which the one lasts from the middle of October to the beginning of March and the other from the middle of April to the beginning of August. The right of women to be matriculated dates from recent years only, and is not uniform throughout the different parts of Germany But every university now admits well-prepared women as special students.

The freedom of the student goes far beyond the American habit, and is not at all confined to complete freedom in the election of courses. He is not only not limited to a minimum or maximum number of courses, but the university also does not demand any kind of test for successful study in those courses. There are no course examinations, and, of course, no registration of attendance. The student is his own master and is expected to make just such use of his opportunity as befits his scholarly aims. No textbooks are prescribed in the courses; no questions are asked of the student and the final examinations have no reference to any particular courses. The majority of students change the university repeatedly, attracted by special great teachers, or by the special charms and facilities of a university town; this migration of students is one of the strongest ties which bind the States of the union together and make the German Empire an intellectual unity. But of course it works against that spirit of loyalty which binds American students toward a particular university. In the same direction works the fact that the graduates of a university have in Germany no further administrative connection with that particular place. That which binds many German students to their special Alma Mater for their whole life is rather their belonging to a special Corps or Burschenschaft or other social club.

The social life of the German student finds its characteristic expression in such club-like institutions, which have a strong intercollegiate affiliation. There is not and cannot be any class life comparable with the undergraduate departments of American universities, but these historical clubs furnish a large amount of particular academic feeling among the students. Those students who do not belong to them live, on the whole, like any private young gentleman. To live together in dormitories is unknown, and common academic occasions are somewhat rare; but the students of the fashionable Corps and of dozens of other clubs, with their colored ribbons and colored caps, dominate the social life so completely that they appear to the outsider as the only typical academic citizens. Their forms of social enjoyment can be understood merely historically. All the well-known excessive formalities in the regulation of beer-drinking and fencing and dueling are remainders of the 17th century and partly of earlier periods. Yet the overwhelming majority of the students spend their university years only for a limited time, or not at all, under the influence of these traditional forms of enjoyment. They are seriously working in pursuit of their earnest scholarly aims and in preparation for the difficult State examinations. Sport, beyond fencing, is on the whole little developed. It must not be forgotten that the year in the army, which is the real physical training for the German nation, falls into the university years of almost every student. Politics, too, plays a very small rôle in the academic body, while, to be sure, religious tendencies, especially Catholic and anti-Catholic movements with political character, have recently not seldom disturbed the peace of the student community.

The literature on German Universities is recorded in the recent work of Erman and Horn, 'Bibliographie der deutschen Universitäten' (Leipzig 1904). The first general part contains the references for 17,363 writings; the second part, referring to the special universities, contains 21,725 titles. The best books on German Universities are W. Lexis, 'Die Universitäten im Deutschen Reich' (Berlin 1904), and Friedrich Paulsen, 'Die deutschen Universitäten und das Universitätsstudium' (Berlin 1902).

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15. **Germany — The German Army.** *Historical Outline.*—At the end of the 15th century the feudal system with its levies of tenants and vassals was in decay. The growing power of the princes, the rising spirit of the cities, the levies of foot soldiers able to contend against the knights, and especially the general introduction of firearms, accelerated the change. France organized companies of mounted orderlies which formed the first germ of a standing army.

The love of adventure and roving disposition of the Teutons was again manifested in extensive portions of the population. Armies arose composed largely of German and Swiss mercenaries. About this time Spain created a celebrated and powerful army; everywhere the feudal levy as a military force was being displaced by an army of hirelings.

The next century and a half formed a period of transition. At the time of the Thirty Years' War (1618–48) the armies generally consisted of mercenaries whose licentious character grew worse with the prolongation of the conflict. This condition continued to the time of the French Revolution. However, in nearly all European countries there existed a kind of militia, either as a survival of old institutions or as new creations.

In Brandenburg and Prussia the idea of recruiting the army from the people began to take form, and although it had many ups and downs, it was never entirely lost sight of. The Great Elector (1640–88) laid the foundation for the future greatness of Prussia by rigid economy in civil and military administration and by raising the national spirit of the Germans, which had fallen to a very low ebb. Recruitment at that time was largely from foreigners; he was the first to assign regiments to definite districts from which their recruits and reserves were to be drawn in time of war. The army was reorganized and the corps of officers placed on an efficient basis, foreigners being dismissed or naturalized. His son, as Frederick I., was crowned king of Prussia. He continued the policies of his father and established a militia for home defense. At the time of his death the Prussian army consisted of 18 regiments of infantry, 9 of cuirassiers, 5 of dragoons, and 9 organizations of guards.

Frederick William I., grandson of the Great Elector, entrusted Prince Leopold of Dessau, called the "Old Dessauer," with the organization of his military forces. The army was gradually augmented to 84,000 men. One of the king's caprices was a body guard of giants known as the Potsdam Guards. Rigid discipline, extreme accuracy of drill, and earnest performance of duty made the army not only fit for war but also gained the respect of the people. The corps of officers was selected from the nobility and carefully educated; it formed the mainstay of the forces of his successor who was to meet the armies of Europe and prevent the dismemberment of his country and the destruction of Protestantism on the continent. The system of sending the older and instructed soldiers on furlough was now introduced, and the king also formed four militia regiments for defense of the country.

When Frederick the Great came to the throne, in 1740, Prussia thus had an excellent army and a good system of recruitment which alone enabled him to keep up his forces under the strain of the Seven Years' War. The king was fortunate enough to inspire the army and the people with a strong national feeling and a degree of enthusiasm which accomplished wonders against the enormous odds organized by the coalition of Austria, France, and Russia.

At the end of the war the Prussian army stood without a peer in Europe. The king, while devoting himself principally to developing his country and building up material prosperity, increased his army, which retained its superiority in rapidity of mobilization and ability to maneuver. Abuses, however, crept in toward the end of the century and the spirit of the army departed with the death of the master mind which had astonished Europe by his victories. The hand of the giant of the French Revolution, of the great master of the art of war, with a national army, new methods of fighting, new and improved implements of war, and the strategy of the mass, destroyed the superannuated Prussian armies and humbled the state. By the treaty of Tilsit Prussia agreed to keep her army down to 42,000 men. Able men set to work to regenerate the army and to restore Prussia to her place among the great powers of Europe. The genius of Scharnhorst found a method of educating the youth of military age, at the same time keeping within the limits set by Napoleon. This was accomplished by discharging all recruits after one year's service and instruction. Many reforms were introduced and the Landwehr was established in 1813. In 1814 universal obligation to military service was adopted. Thus the armies under Blücher, Gneisanau, and York, in 1815, rose to 250,000 men.

In the long period of recuperation after the Napoleonic wars not many expensive changes could be made, owing to the condition of the finances. In 1859 the standing army consisted of 140,000 men. In the reorganization of 1860 the annual levy rose from 49,000 to 63,000. In the wars of 1864 and 1866 the Prussian army, with Landwehr organizations, brought 600,000 men under arms. For the second time in history the Prussian military system became the model for the armies of the world. Its organization utilized to the fullest extent the physical and intellectual powers of its people; its officers were highly educated, and progress in armament, instruction, and tactics had taken advantage of the most recent scientific discoveries. The people had come to look upon military service as a duty to the nation. After the formation of the North German Confederation and the enlargement of Prussia by the absorption of several German states, the organization, armament, and tactics of the Prussian army were extended to the entire North German army, and the South German States also adopted the Prussian system with some modifications. In the war of 1870–71, with France, the Germans were able to place much more than a million soldiers in the field.

On 18 Jan. 1871, the German Empire was proclaimed in the halls of Versailles. The standing army was by the law of 1874 fixed at 18 army corps, numbering in all over 400,000 men. The rapid growth of the German Empire in population and the desire to remain somewhat stronger than France led to continual increase of the annual contingent accepted for service. In 1899 the period of service for all men, except those of the cavalry and field artillery, was reduced to two years. As the result of constant development we have the German army of today — the most efficient fighting machine in the world. Only the essential details of its organization can be stated here.

Liability to Service and the System of Its Application.— Every male German is liable to military service. Only members of the ruling family and of mediatized princely houses are exempt. Evasion of service by means of substitutes is not permitted. The obligation to serve exists between the ages of 18 and 45 years, inclusive, and contemplates service either (1) in the Army or Navy, or (2) in the Landsturm.

Service in the Army begins at the end of the 20th year and terminates on the 31st of March of the calendar year in which the man completes his 39th year of age.

The first levy of the Landsturm consists of all men, from the end of the 17th year to the 31st of March of the calendar year in which they complete their 39th year, who have not served in the Army. The second levy of the Landsturm includes all men from the 39th to the end of the 45th year, whether they have served or not. The Landsturm is intended for home defense; in extraordinary cases it may be utilized to recruit the Army.

Service in the Army may be with the colors, followed by the Reserve and first and second levies of the Landwehr, or in the Ersatz Reserve. The periods of service are as follows:

	Cavalry and Horse Artillery.	All other arms of the service
With the colors	3	2
In the Reserve	4	5
In the Landwehr, 1st levy	3	5
In the Landwehr, 2nd levy (about)	9	7

Men in the reserve are simply on furlough and return to the colors when called for.

Volunteers of sufficient education who bear their own expenses are furloughed at the end of one year's service.

Volunteers serving four years in the Cavalry or Horse Artillery remain only three years in the second levy of the Landwehr.

Many soldiers of the Train are furloughed after serving one year or even less.

School teachers, apothecaries, and medical students have special reduction of service.

All the members of the annual contingents who are found fit for service and are not required with the colors are assigned to the Ersatz Reserve. Service therein is for 12 years, beginning 1 Oct. of the year in which the 20th year of age is completed. This reserve replaces the first vacancies in the standing army on mobilization and serves to form depot troops.

The annual contingents now taken for the Army are so large that the Ersatz Reserve, as formerly understood, has practically ceased to exist; no training with the colors is required in time of peace.

Officers and Noncommissioned Officers.— The officers are taken from the higher grades of society, that is, the nobility, sons of officers and officials, owners of estates, etc. Although the position of officers in the German Army is a distinguished one, they are not considered as forming a separate caste in society.

The corps of officers is recruited in two ways: (1) Through volunteers, now called *Fahnenjunker*, who join the ranks with a view to obtaining a commission; (2) through assignment of cadets.

All officers before being commissioned as second lieutenants of a regiment must be accepted by a vote of the officers of that regiment.

Officers of the Reserve are recruited from former one-year volunteers or from retired officers.

Officers of the Landwehr are taken from officers of the Reserve, from officers who have left the standing army, and from one-year volunteers and noncommissioned officers who on discharge are recommended for these positions.

Officers *at disposal* may be recalled to active service on mobilization.

The officers of the German Army are divided into grades as follows:

(1) Generals, including field marshals, colonel-generals, generals of infantry, cavalry, or artillery, lieutenant-generals and major-generals.

(2) Field officers: colonels, lieutenant-colonels, and majors.

(3) Captains; 1st and 2d class.

(4) Subalterns: 1st lieutenants and 2d lieutenants.

The noncommissioned officers are divided into two general classes. The first class are quasi-officers, wear officers' swords and correspond to our noncommissioned officers of the staff corps, first sergeants and quartermaster sergeants, and include candidates for a commission (*Fähnriche*). They are entitled to a salute from the other noncommissioned officers and men.

The second class correspond to our sergeants, corporals, and lance-corporals (*Gefreite*).

Numbers Available.— The peace strength (1900) is as follows:

Officers	23,844
Noncommissioned officers	80,556
Privates, lance-corporals, etc.	495,500
Volunteers	9,000
	608,900

The total number of trained men available (excluding Landsturm) is over 3,000,000. The number of men in the Ersatz Reserve and Landsturm is about 4,800,000, of whom 800,000 have been trained.

The number of young men annually reporting varies with the increase in population. The annual contingent of recruits changes with legislation, and had risen to 264,000 in 1897. When the law has had full time to operate, 24 years, about 4,500,000 trained soldiers will be available for war.

Men of the Reserve and Landwehr are called out for brief periods of training in accordance with the orders of the Emperor.

In time of war the Army is divided into (1) Field troops, (2) Field Reserve troops, (3) Landwehr troops, (4) Depot troops, and (5) Landsturm troops. The field troops consist of the standing army filled up by the reserves; the field reserve troops consist of the first levy of the Landwehr to which some officers and men are assigned from the active army. The Landwehr troops are formed from the second levy of the Landwehr; they usually serve on the line of communications. Depot troops are formed from the Ersatz Reserve and recruits. The Landsturm is for home defense and is called out by Imperial proclamation when required.

Organization.— The troops of the German Army in time of peace (1902) form —

625 battalions of infantry.
482 squadrons of cavalry.
574 batteries of field and horse artillery.
38 battalions of foot artillery.
26 battalions of pioneers.
8 battalions of railway troops.
3 battalions of telegraph troops.
23 battalions of train troops.

These are combined into Army Corps which are assigned to territorial districts with headquarters as follows:

Guard Corps	Berlin.
I.	East Prussia, Konigsberg.
II.	Pomerania, Stettin.
III.	Brandenburg, Berlin.
IV.	Prussian Saxony, Magdeburg.
V.	Lower Silesia, Posen.
VI.	Silesia, Breslau.
VII.	Westphalia, Munster.
VIII.	Rhineland, Coblenz.
IX.	Schleswig-Holstein and Mecklenburg, Altona.
X.	Hanover, Oldenburg, Brunswick, etc., Hanover.
XI.	Thuringia and Nassau, Cassel.
XII.	Saxony, Dresden.
XIII.	Wurttemberg, Stuttgart.
XIV.	Baden, Karlsruhe.
XV.	Alsace, Strassburg.
XVI.	Lorraine, Metz.
XVII.	West Prussia, Dantzig.
XVIII.	Hesse-Nassau, Frankfort-on-the-Main.
XIX.	Saxony, Leipzig.
I.	Bavarian, Munich.
II.	Bavarian, Wurzburg.
III.	Bavarian, Nurnberg.

The field army is divided into armies. The number and composition of the armies is kept secret, but it may be assumed that in a large war there will be four or five armies, each composed of from three to six army corps, several cavalry divisions and a variable number of reserve divisions.

Details of Organization.— The strength of units varies both in officers and men; those on the frontiers have a somewhat higher peace establishment than the normal given below.

Infantry units.	Peace.				War.					
	Officers.	Medical officers and officials.	Enlisted men.	Horses.	Officers.	Medical officers and officials.	Enlisted men.	Non-combatants.	Horses.	Wagons.
Company .	4	....	142	1	5	..	250	5	8	3
Battalion..	18	3	570	7	22	4	1,002	29	46	15
Regiment.	57	12	1,768	28	68	12	3,017	93	149	46
Brigade...	116	24	3,536	64	138	24	6,037	193	312	93

There are 11 Guard, 155 Prussian, 16 Saxon, 10 Württemberg, and 24 Bavarian Infantry Regiments.

There are also 18 battalions of Rifles (Jäger). In their strength and organization they closely resemble infantry.

Cavalry units.	Peace.				War.					
Squadron .	5	....	135	149	5	...	150	11	175	3
Regiment .	25	12	687	667	22	...	602	61	741	17
Brigade ...	...	...	...	...	48	18	1,206	135	1,496	35

Cavalry regiments have five squadrons in peace and only four in war, one being left as a depot. They are classified as follows:

Prussia (73 regiments.)— Ten cuirassiers (2 of the Guard); 26 dragoons (2 of the Guard); 18 hussars (1 of the Guard); 19 lancers (3 of the Guard); 5 squadrons Jäger zu Pferde.

Saxony (6 regiments).— Two heavy cavalry (1 of the Guard); 2 hussars; 2 lancers; 1 squadron Jäger zu Pferde.

Württemberg (4 regiments).— Two dragoons; 2 lancers.

Bavaria (10 regiments).— Two heavy cavalry; 2 lancers; 6 light horse.

Field Artillery.

War Strength.	Officers.	Men.	Horses.	Guns.	Caissons.	Store Wagons.	Provision Wagons.	Forage Wagons.
Horse batteries (42), each	5	157	218	6	6	2	1	1
Field Batteries (532), each	5	162	132	6	6	2	1	1

Two or three batteries form a battalion; two or three battalions a regiment, and two regiments a brigade.

Foot Artillery.— There are 149 batteries of foot artillery, organized into battalions and regiments. War strength of battery: 4 officers, 209 men. Armament: various calibers of siege, position, and coast-defense artillery.

Technical Troops — Pioneers.— Each Army Corps has a battalion of pioneers (4 companies); three of the corps have two battalions each. Each company has 4 officers and 154 men in peace, 6 officers and 200 men in war.

Cavalry divisions have pioneer detachments of 1 officer and 30 men.

Railway Troops.— There are 7 battalions of railway troops (4 companies each). A company consists of 5 officers and 151 men. In time of war the companies are expanded into construction companies, operating companies, and companies of laborers.

The Train.— In time of peace there are 23 skeleton battalions of the train, one for each army crops. In time of war these are expanded so that each provides transport for 6 provision columns, 7 wagon park columns, 1 field bakery column, 3 bearer companies, 1 horse depot, 1 reserve bakery column, and 1 reserve column for line of communications.

Medical Units.— There is one bearer company for each division and an additional one for each army corps. Each company has 3 officers, 8 medical officers, 2 officials, 39 men of the train and 210 bearers, nurses, etc., with 46 horses and 13 vehicles.

The Infantry Division.— This unit consists of: The staff of the Division; 2 brigades of infantry; 2 or 3 squadrons of cavalry; 1 brigade of field artillery; 1 or 2 companies of pioneers; 1 divisional brigade train; 1 bearer company.

Its fighting strength is 12,000 rifles, 300 to 450 lances, and 72 guns.

The Cavalry Division.— As a rule it consists of: The staff of the Division: 3 brigades of cavalry; 2 batteries of horse artillery with light ammunition column: 1 pioneer detachment.

Its fighting strength is 3,600 lances, 30 rifles, and 12 guns.

The Army Corps.— This unit forms a small army complete in all its parts. It is composed of: The staff of the Army Corps; 2 infantry divisions; 1 battalion of rifles; 1 telegraph section, and the corps trains.

Fighting strength — 25,000 rifles, 900 lances, and 144 guns.

Arms and Equipment — Infantry and Pioneers.— Magazine rifle, model 1898, caliber 7.9

mm. Ammunition: 120 cartridges on the person, 72 in the company wagon, a reserve in the ammunition column, total, about 300 rounds per man. Bayonet (*Seitengewehr*) new model.

Equipped for the field each soldier carries a pack (*tornister*) and in its compartments or attached thereto the following articles: 1 shelter tent and three-jointed pole; 1 pair of lace shoes; cleaning, polishing, washing, and sewing materials; 1 pair of stockings or foot cloths; 1 handkerchief; 1 shirt; 1 pair of drawers; 1 cap; 1 cooking utensil (of aluminum) with one ration; three iron rations; 1 handbook; and 1 song book.

The soldier also carries a felt-covered canteen of aluminum and a haversack containing 1 helmet cover, 1 knife, 1 fork, 1 spoon, and one ration of bread (26 2/5 oz.) for the journey by rail.

The overcoat and shelter tent in a roll surround the pack. The total load, including clothing on the person, arms and ammunition, is 58 3/4 lbs.

Cavalry.— The weapons of the German cavalry are (1) the lance, which is a hollow steel shaft 10 feet 6 inches long; (2) the cavalry sword or saber; and (3) the carbine, which is simply a short rifle and uses infantry ammunition. Officers and noncommissioned officers carry saber and revolver.

Artillery.—The field and horse batteries have the rapid-fire field gun of nickel steel, caliber 7.7 cm. The howitzer batteries have the field howitzer, model 1898, caliber 10.5 cm. Officers and mounted men carry swords and revolvers; men on foot carry sword bayonets and revolvers — in the ammunition columns, carbines and sword bayonets. The foot artillery have guns of various calibers, 3.7 cm to 21 cm, depending upon whether they belong to siege, fortress, or coast-defense artillery. The men were armed with carbine and sword bayonet.

Uniform.— The uniform of the German soldier is required to conform in cut and general appearance to that of the Prussian army.

Infantry.— Dark blue tunic, with scarlet trimmings; dark blue blouse (litewka); dark grey trousers with red piping; light grey overcoat; black leather helmet, with ornaments; short boots. The 108th (Saxon) regiment and the rifles wear dark green tunics; the Bavarians, light blue tunics.

Artillery.—General appearance of uniform, same as infantry; cuffs are black.

Cavalry.—Cuirassiers, white; dragoons, light blue; lancers, dark blue; hussars, various colors.

The combinations of colors in cuffs, collars, pipings, belts, plumes, etc., are so numerous on account of regimental traditions and the colors and coats of arms of the many minor states forming the empire, that recourse must be had to books of reference for detailed information.

Bibliography.— Deutschland, 'Die Heere und Flotten der Gegenwart' (1903); Edmonds, 'Handbook of the German Army' (1900); Lehnert's, 'Handbuch für den Truppenführer'; Drill Regulations of the different arms and other service manuals. J. T. Dickman,
Captain, General Staff U. S. A.

16. **Germany — The German Navy.** *Historical Outline.*— In the latter part of the 17th century, after the Thirty Years' War, the state of Brandenburg started a small fleet with three Dutch ships hired for operations against the Swedes in the Baltic. This was eventually increased to 12 ships; but later it fell into decay, and after the death of the Great Elector, disappeared entirely. Frederick the Great also maintained for a time some armed vessels for use against Sweden, but for over a century Germany was not represented on the high seas by a navy. In the early part of the 19th century numerous recommendations and projects were put forward, but nothing substantial resulted therefrom. In 1825 the first small gunboat was launched. In 1835 the Prussian government declared its determination to protect the Baltic shore, and a commission arranged for the establishment of a small coast fleet. The Amazone, acquired in 1841, may be regarded as the first coast defense vessel.

In 1848 a Danish fleet blockaded the ports and inflicted considerable damage on German commerce. In consequence, a small "Parliamentary" fleet was established, but afterward merged with the Prussian fleet organized at the same time. This fleet in 1864 fought the Danes at Jasmund, preventing a blockade of the German coasts. On the termination of the war it became the fleet of the North German Confederation. Construction under a program for a large increase had hardly begun when war broke out with France. The fleet then consisted of 37 ships, all told, of which only five were armored; it was limited to a purely defensive attitude during that war.

Under the empire, the fleet became the Imperial German Navy; its growth was slow but steady. A systematic scheme for obtaining a large fleet was not worked out until 1897, and adopted by the Reichstag in 1898. This plan was enlarged by the law of 1900, which provided for two double squadrons, each to consist of 17 battleships (one flagship and two squadrons of eight ships grouped in two divisions), four large and twelve small cruisers, and 40 destroyers (divided into eight flotillas). By 1920 the German fleet will consist of:

	Battleships.	Armored Cruisers.	Small cruisers (as scouts).	Destroyers.
Two double squadrons for home service	34	8	24	80
For foreign service	......	3	10	......
In reserve	4	3	......	16
Total	38	14	34	96

An important feature of the law stipulated that substitutes were to be laid down for old ships to be discarded on the age basis of 25 years for battleships and coast defense vessels, 20 years for large cruisers, and 15 years for small cruisers.

The development of the German Navy will continue to be a rapid one, the construction from 1901 to 1917 being on an average of nearly 2 battleships, 1 large cruiser, 2 small cruisers, and 6 destroyers for each year.

Present Strength.— The following is a list of the effective ships of the German Navy, 1 Jan. 1905:

BATTLESHIPS (35).

1st Class (22).

	Displacement.
"P"	12,992
"O"	12,992
Deutschland	12,992
Lothringen	12,992
Preussen	12,992
Hessen	12,992
Elsass	12,992
Braunschweig	12,992
Mecklenburg	11,613
Schwaben	11,613
Zähringen	11,613
Wettin	11,613
Wittelsbach	11,613
Kaiser Barbarossa	10,976
Kaiser Karl der Grosse	10,976
Kaiser Wilhelm der Grosse	10,976
Kaiser Wilhelm II	10,976
Kaiser Friedrich III	10,976
Wörth	9,874
Brandenburg	9,874
Kurfürst Friedrich Wilhelm	9,874
Weissenburg	9,874

2nd Class (5).

	Displacement.
Oldenburg	5,140
Baden	7,252
Württemberg	7,252
Sachsen	7,252
Bayern	7,252

3d Class (8).

Coast-Defense Ships.

	Displacement.
Hagen	4,049
Heimdal	4,049
Hildebrand	4,049
Odin	4,084
Aegir	4,084
Frithjof	4,049
Beowulf	4,049
Siegfried	4,049

Average age, counting from year in which laid down, 1st class, 7 years; 2d class, 28 years; 3d class, 12½ years.

ARMORED CRUISERS (7).

	Displacement.
"C"	11,319
Yorck	9,350
Roon	9,350
Friedrich Carl	8,858
Prinz Adalbert	8,858
Prinz Heinrich	8,759
Fürst Bismarck	10,570

Average age, 14 years.

PROTECTED CRUISERS (6).

	Displacement.
Hansa	5,791
Vineta	5,791
Freya	5,569
Hertha	5,569
Victoria Luise	5,569
Kaiserin Augusta	5,960

Average age, 10½ years.

SMALL CRUISERS (35).

Protected (24).

	Displacement.
Leipzig	3,200
Alexandrine	3,200
Meteor	3,200
München	3,200
Lübeck	3,200
Berlin	3,200
Hamburg	3,200
Bremen	3,200
Undine	2,657
Arcona	2,657
Frauenlob	2,657
Modusa	2,618
Amazone	2,618
Ariadne	2,618
Thetis	2,618
Nymphe	2,618
Niobe	2,603
Gazelle	2,603
Hela	2,004
Gefion	3,705
Comet	971
Prinzess Wilhelm	4,224
Irene	4,224
Jagd	1,230

Average age, 6 years.

With the exception of battleships of the second class, the Imperial German Navy may be considered as practically new.

Personnel.— The officers consist of:

1. Admiral of the Fleet (Gross-Admiral), namely, the Kaiser.

2. Twenty-seven flag officers,—5 Admirals (Admirale); 6 Vice-Admirals (Vize-Admirale); 16 Rear-Admirals (Kontre-Admirale).

3. Five hundred and fourteen staff officers,—67 Captains (Kapitäne zur See); 447 Commanders (Fregatten-Kapitäne) and Lieutenant-Commanders (Korvetten-Kapitäne).

4. Eight hundred and eighty-three Senior Lieutenants, Lieutenants, and Sub-Lieutenants (Kapitän-Leutnants, over eight years' service; Ober-Leutnants zur See, less than eight years' service; Leutnants zur See).

The entire naval personnel in 1905 consisted of 1832 officers, 208 doctors, 271 paymasters, 1762 warrant officers, 8461 petty officers, 27,302 seamen, 1109 ships' boys; aggregate 2311 officers and officials, and 38,632 men.

The officers are drawn from the naval cadets, the latter being selected from young men of approved origin and education. The recruits are taken from sailors, fishermen, sailmakers, ships' stewards, cooks, and waiters; also from men employed on rivers and canals, and from non-seafaring people, such as firemen, machinists, painters, etc.

The period of duty is divided into the active period and the furlough period. The active period is for three years; the furlough period is divided as follows:

Reserve	4 years.
Seewehr,— corresponding to Landwehr:	
1st Levy	5 years.
2d Levy	To end of 39th year.
Naval Ersatz (Supernumeraries) men of seafaring or quasi-seafaring population	12 years.

In extraordinary cases use is made of the Landsturm — same as in the Army — all seafaring and river people not in the Navy; first levy, 17th to 39th year; second levy, 39th to 45th year.

Bibliography.— Ferber, 'Organization und Dienstbetrieb der Kaiserlichen Marine'; Brassey, 'The Naval Annual'; Jane, 'Fighting Ships, 1905-6.'

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17. Germany — Agriculture and Forestry. At the last German Census of trades and callings (1895) the number of persons engaged chiefly in agriculture and forestry was 8,300,000, or about 37½ per cent of the total productive population. This is about the same percentage shown by the U. S. census of 1900, which was 35.9 per cent; but this latter figure would be increased by the large number of land labourers counted simply as laborers. At the same census of 1895 the number of individual agricultural undertakings was 5,500,000, with an area of 43,-200,000 hectares (1 hectare = 2½ acres). Of this total "agricultural" area 7,600,000 hectares are woods, to which must be added 6,100,000 hectares of timber-land devoted purely to forestry. The greater part of the forests, about 7,000,000 hectares, is in the possession of the German states, especially Prussia and Bavaria, and of the local parishes and municipalities; though many forests are owned by large landed proprietors and by private foundations and associations. In strong contrast to the primitive forestry conditions that prevail in the United States, German forests, usually even those owned privately, are nurtured with all the care that the highly developed technic of forestry has made possible, the period of cultivation not seldom being 100 years. In this way 11,000,000 hectares were devoted to the cultivation of high timber, *i. e.*, 2,600,000 hectares to leaf-bearing trees, 8,400,000 hectares to pines and firs. The yield of lumber in 1900 was 20,000,000, of firewood, 18,000,000, of stumps and brushwood, 10,-500,000 cubic meters, besides the byproducts, especially tan-bark. Yet this yield does not supply the demand for wood in Germany. In 1904 lumber and building timber were imported to the extent of $20,000,000.

Division of Land and Kinds of Production.— Of the total agricultural area in 1904, 26 per cent was woodland, 49 per cent arable land, including gardens and vineyards, 11 per cent meadows, and five per cent pasture-land. Of the arable land, 61 per cent was planted with grain and leguminous crops, 17½ per cent with chopped crops, especially with potatoes and sugar-beets, 10 per cent with forage, 2.6 per cent with fruit and garden vegetables, and 8.7 per cent remained fallow. As regards grain, the dependence of Germany on foreign imports has not increased essentially in recent years. At times it has even decreased. On an average the yearly imports of grain exceed the exports by 2,000,000,000 kilograms, worth $125,000,000; *i. e.*, as to value, about 1-6 or 1-7 of the German yield, or, as to quantity, about 1-5. In live stock, Germany imports horses, oxen, and cows for $45,000,000; also hogs, but to a limited extent, owing to the restrictive hygienic (in reality protective) measures; further, hides and guts. On account of the ever-increasing intensity in the cultivation of the soil, the number of sheep in Germany has decreased from 28,000,000 in 1860 to 9,700,000 at present (U. S. 62,000,000). On the other hand, from 1873 to 1900 the number of horses increased from 3,300,000 to 4,200,000 (U. S. 16,000,000), the number of cattle from 15,700,000 to 19,000,000 (U. S. 61,400,000), and the number of hogs from 7,000,000 to 17,000,000 (U. S. 48,600,000). In 1900 for every 100 inhabitants there were 7.5 horses (U. S. 22), 33.6 head of cattle (U. S. 81), and 30 hogs (U. S. 82). From the high and increasing prices of land alone one could infer that in Germany there has been a considerably greater increase in weight and quantity than in quality. In 1900 the sale-value of horses was $575,000,000, of cattle more than $1,000,000,000, and of hogs, $250,-000,000. As to the number of horses and cattle per hectare, Germany and England are about equal; but Germany is far ahead in hogs, and England in sheep. In all these categories, except sheep, Germany is ahead of France.

Of the great staple side-products of German agriculture, sugar and alcohol are by far the most important. Sugar-beets utilize the best German soils, while Irish potatoes for spirits make profitable the cultivation of the worst, especially the sandy soils in east Germany. In the form of alcohol the bulky crop, which could not be shipped profitably, is made easily transportable, and thus this soil is brought into cultivation. Both these industries have been nurtured up to their present importance by certain protective measures, and have been kept in immediate connection with the production of the raw material. Alcohol-distilleries owned by farmers, especially the smaller ones, have been favored in the way of taxation. Such a distillery is allowed to produce a certain fixed quantity of alcohol on the payment of the minimum of revenue. Accordingly, of the 13,200 grain and potato distilleries in Germany in 1900 there were less than a thousand that were not owned by farmers. Besides both industries are strongly organized into trade unions — ("Kartellē"). The total product of all alcohol distilleries in 1903–1904 amounted to 3,850,000 hectoliters of pure alcohol, of which 3,330,000 was distilled from grain and Irish potatoes. Of potatoes, 2,660,000,000 kilograms were used; of grain, 380,000,000 kilograms.

The total yield of Irish potatoes in Germany in 1904 was 36,330,000,000 kilograms. As a food-product, potatoes play a larger part in Germany than anywhere else; and in the production of potatoes Germany trebles the United States and is equaled only by Russia. Sweet potatoes are not raised in Germany. As to other products, the German climate prohibits the production of cotton and, practically, of Indian corn. The cultivation of tropical fruits is likewise excluded. As to other fruits, Germany and the United States are favored, each for special sorts. In the cultivation of grapes, for fine wines, Germany has a considerable advantage, owing to the age of this industry and the care that has been bestowed upon it. Of the world's total yield of grain, (wheat, rye, barley, oats) in 1903, which was estimated at 285,000,000,000 kilograms, Germany produced 24,500,000,000 kilograms, the United States 91,100,000,000 kilograms, or three and seven-tenths times as much as Germany. However, it is claimed that the estimate for Germany is too low. In 1903 Germany had 1,800,000 hectares in wheat, less than one-eleventh as much as the United States had; though the yield in the latter country was only four and eight-tenths times greater. In 1903 the yield of wheat per hectare in Germany was 1650 kilograms (U. S. 850 kilograms), in 1902 it was 1540; and in 1904 it was again 1650. On the better soils the average yield is often more than double this amount. The yield of rye was 10,-000,000,000 kilograms (U. S. 750,000,000 kilograms); of barley 3,300,000,000 kilograms (U. S. 3,000,000,000); and of oats 7,900,000,000 kilograms (U. S. 12,400,000,000). The money value of the American yield of 1903 is estimated at $1,740,000,000 (1902: $1,720,000,000), *i. e.*, only somewhat more than double the value of the German yield, if we apply here the same method of valuation. This is explained by the fact that for grain Germany is import-territory, and especially by the fact of the agrarian protective tariff.

Land Holdings and Indebtedness.— The superiority of Germany as regards the yield of grain per hectare is due to the more intensive cultivation of the soil, and particularly to the more general use of fertilizers. In this respect Germany would be even further ahead, if the size of the farms had been developed from a technical point of view, as has been the case in England and America. In contrast to the American farmer, who lives isolated in the midst of his broad acres, from time immemorial the small German husbandman has been a villager. This custom of settling in villages has perpetuated a system of piece-meal farming in Germany, which makes impossible the most economic utilization of the soil. On the other hand, large landed proprietors are not infrequently prevented from disposing of superfluous and outlying land by mortgages held on their estates; or their property may be entailed. In contrast to such estates as are too large to be farmed profitably, on account of the lack of capital on the part of their aristocratic owners, there is a very much larger class of holdings which are too small to permit the use of machinery. Both kinds, which are of impracticable size, diminish the average yield. This is especially true of the peasant-farms. But both classes show no inclination to adapt themselves to economic conditions,— the first, because their owners believe their social position of their family is determined by the limits of their real estate; the second, partly because of the usually equal division of land among the heirs, on the death of an incumbent, as opposed to the English common law, partly because the desire to be independent of the uncertainty of wages makes these small owners hold their land with great tenacity and even acquire more when this is possible, because in this way they have an opportunity to enjoy the fruits of their labor, of which no one can deprive them. From a business point of view, such piece-meal farming is unprofitable, but since practically no new land is to be had, except by reclaiming moors and swamps at great expense, this demand for small farms has run up the price very considerably. After deducting for wages and expenses even the larger farms net their owners only from one and one-half to two and one-half per cent. On account of the high price of land, the indebtedness is large. This has also been largely increased by the very favorable German laws regulating mortgages, which have, in fact, made mortgages one of the safest forms of investment. Consequently, credit is easy; and there are a number of public and private mortgage-banks, which lend money on real estate, up to a fixed part of its assessed valuation. These mortgages have a regular negotiable form and are handled on the stock exchange. On first mortgages the rate is low, being always under four per cent. Many of these mortgage-banks will liquidate the indebtedness in consideration of the payment of an additional interest; and recently the suggestion has been made to meet in this way also a life insurance premium, so that on the death of the debtor the obligation ceases. The total amount of such mortgage-indebtedness in Germany has not been determined statistically. The most recent assessments in Prussia, for purposes of taxation, show that here the indebtedness of those engaged chiefly in farming amounts to 26.4 per cent of their entire property, real and personal, and to 31.1 per cent of the value of their realty. Further, farms and parcels of agricultural land have been classified and graduated according to extent and yield; and on this basis it has been found that an indebtedness of 18.6 per cent in case of the small parcels averaging eight hectares each, increases to 33.1 per cent and more, in the case of the large rural estates. This is accounted for largely by the fact that such large holdings are regarded as a luxury and are subject to frequent transfer. In the northeast of Prussia, where there are few industries, in one district the indebtedness runs up to from 53 to 58 per cent, on an average, for all classes of freeholders; and in the Königsberg district the indebtedness of the second largest class of holdings (200 hectares average) is 67.3 per cent (entire property) and 73.5 per cent (real p.). In the district of Coblenz, Rhine, where small holdings are the custom, the indebtedness sinks as low as 2.4 per cent of the entire, 2.9 of the real estate. This is due to the fact that small lots, not offering a suitable opportunity for investment, are sold for cash. In Hanover and Westphalia, where holdings are of moderate size, the indebtedness fluctuates from 14 to 15 per cent (and from 23 to 28 per cent of real property). So far as there are any reliable statistics on these matters for America, it would seem that those farmers in the grain-states, for instance Nebraska, who have bought their land privately, instead of from the state, are more heavily in debt than the average German farmer, certainly than the small German farmer. But there is this difference: The failure of a German farmer means a much greater catastrophe than the failure of an American farmer. In the first place, there is proportionately more capital invested in buildings and equipment, and a failure involves a greater number of creditors. In the second place, class distinctions are rigid in Germany; there is a sharp differentiation between town and country, between farming and business. When the German farmer fails, there is nothing else for him to do. As compared with American conditions, the large amount of capital invested in buildings, as barns, sheds, etc., is especially noteworthy. This fact is explained by the climate and the more highly developed condition of the country. Despite the high price of land and the relatively backward condition of east Germany, the value of buildings in the extreme east is from 30 to 50 per cent of the value of the property; and even in the case of large estates the incumbrance of buildings amounts to from \$60 to \$75 per hectare of land, occasionally as much as \$175 per hectare (in England under \$50). In the east the value of tools and implements per hectare is only about \$12; in the west and southwest as much as \$65. In east Prussia the value of live stock per hectare varies from \$15 to \$100 for the different classes of farms; though of course in the case of regular stock-farms the figures are larger. In a large number of cases observed in east Germany the investment was, on an average, apportioned as follows: Land 49 per cent, buildings 24 per cent, live stock 13.6 per cent, tools, implements, etc., 4.4 per cent, supplies 9 per cent.

Considering the climate, the possible relations would be about thus: Land 30 per cent, buildings 23 per cent, live stock 20 per cent, tools, machinery, etc., 12 per cent, supplies 15 per cent. Deviations from this form are due to those social conditions which diminish the working capital by running up the cost of the land and of the dwelling-house.

Rotation in Crops.— On account of the exceedingly varied and manifold system of rotation in crops, it is impossible to lay down any universal principles regarding this feature of agriculture in Germany. On the best soils, i. e., in middle and western Germany, there is free succession in crops; but on many large estates in the east field-grass farming is the rule (Feldgraswirtschaft); but this is greatly modified and complicated by the cultivation of potatoes and sugar-beets. Stock-farms, pure and simple, are possible only here and there. The sowing of grain on the same land year after year, as it is done on the virgin soils of America, is regarded as a sort of agricultural robbery, and is practised only by farmers in reduced circumstances. For the rest, the living-conditions of the German husbandman are in many respects quite different from those of the American farmer:

Taxation.— In most of the German states, the old state tax on realty has been turned over to the local parishes and municipalities, and this has lightened greatly for the farmer the burden of taxation. For instance, a small husbandman in Prussia (which has assumed a very considerable part of the expenses of schools for the local communities pays to the state one-half per mille on his property and three per cent of his income. To this must be added the taxes for the parish, district, and province. As compared with an American farmer in a grain state, the total taxes of a German farmer are much lower, principally because the American method of taxation places a much heavier burden on realty.

Railways: In this connection the German system of state railways deserves mention. These not only surpass the American lines in cheapness and effectiveness of service, meeting especially the needs of the large middle class, but their management warrants a permanent and uniform tariff policy. A system of district railway councils makes possible the adaptation of the service to the needs of all interests.

Insurance (fire, hail, cattle): More than one-third of the fire insurance in Germany is in the hands of public societies ($12,000,000,000 against $23,500,000,000 in private companies), and is largely compulsory insurance. The advantage of this is that risks which are not first-class find a relatively cheap opportunity for insurance. Insurance against hail (about $625,000,000) is mostly mutual (about two-thirds), but has not yet become general by any means. There is also compulsory insurance against certain epidemics in cattle; but for the rest insurance on live stock is mostly local and mutual.

Agricultural Associations.—Next to Denmark Germany has the most highly developed system of agricultural associations, or alliances. The most important form, and the first to appear in Germany, is that created by Raiffeisen. The Schulze-Delitzsch system also plays a considerable part. Of such societies there are more than 23,000, with a membership of about 3,500,000. There are 4,200 credit-societies, with 2,000,000 members, for the purpose of securing credit otherwise than on mortgages; 1,600 for the mutual buying of raw materials; more than 3,000 for mutual production, the most important being the creamery associations (2,700, with 200,000 members); and the associations for pressing grapes, with a membership of 10,000. The system of credit-associations created by Raiffeisen, though somewhat variable, depends in general on the payment by the member of a relatively small amount in cash (under $2.50 in almost half of the associations), and the assumption on his part of the obligation to pay further sums in case of necessity, such sums being either unlimited or else fixed by a maximum, or to furnish security to the creditors for the said amount. Of a total membership of 3,500,000 the obligation is unlimited for 1,750,000. Loans are made to the members on notes, and the safety of the transaction depends mostly on the personal knowledge the cashier has of the financial responsibility of the members. He is often a preacher or a teacher, and his position is usually an honorary one. Accordingly, all these associations are in small districts, being usually limited to a single village. Still, they are combined into larger unions to make their cash money more elastic, in that thereby the surplus of one association is used to fill the deficit of another. Such organization also makes possible the mutual inspection of books. Recently the Prussian government has formed a special department for credit-associations and has provided capital to be lent to such associations, at a low rate of interest, after an investigation of their financial responsibility has been made.

The Economic Structure.— The economic structure of agricultural Germany, with this mixture of self-reliance, co-operative societies, and state aid, forms an artificial and perhaps complicated system; but only such a system has made it possible for Germany to achieve such conspicuous success in the face of the manifest great disadvantage of the country, as compared with most other lands, in the matter of climate and soil, and in the irrational manner in which land has been cut up. What has been achieved has been the result of hard conscientious work, supported from the technical side by the agricultural academies and higher institutions of learning, by the agricultural schools (22), with courses of study extending over several years, by the winter schools for agriculture (128), and by the finishing schools (about 3,000). This splendid technical education, however, does not imply any particular business qualities. The German farmer of small, or even moderate, means cannot be chiefly a business man, like the American farmer; because for him there is no chance of speculative gains. On the other hand, the large landed proprietor does not want to be a business man, because he belongs to the privileged class: if his superior social position is no longer secured by law, as formerly, it is none the less a fact. This class has just begun to develop in America. In order to understand these facts and their bearing on the peculiar political conditions in Germany, it is necessary to take a glance at the social structure of the country population. While on the one hand England, with her large country estates, where landlord and renter are sharply distinguished from the farm-hand, is the typical land of aristocratic ownership, France on the other hand, with her great number of miniature farms, where landlord and farm-hand are one, is the typical land of democracy as regards the distribution of farm-lands.

Now, in this respect, Germany shows characteristic antitheses. Of the total number of individual farming industries in Germany 58 per cent have an area of less than two hectares, and only nine-twentieths per cent have more than 100 hectares. But these last cover almost one-fourth of the total area. While east of the River Elbe farms of 100 hectares each, or more, cover 44 per cent of the area, in the Rhine country they seldom cover five per cent. (On account of the lack of a uniform basis in the statistics, it is impossible to make any comparison with the corresponding conditions in America.) West and southwest Germany resemble France in the matter of agricultural holdings and social conditions. Farming-lands are cut up into fragments, which are usually further divided in succession by inheritance, and farms, as a rule, have a small extent; social inequalities within the country population are slight; and the distinction between the country and the town population is also slight. For the rest, the rural population is very dense, and agricultural products are of the most varied nature. On the other hand, east of the Elbe and the Saale large estates and large farming industries are the rule. Owners of manor estates, or "Rittergüter" (which are mostly separated from the village communities and administered by the lord of the manor) are engaged chiefly in raising grain and feeding cattle. Only about half of them belong to the nobility; but the important part they play in local political bodies in the east, and in the Prussian House of Lords, and, together with the Clericals, in the Prussian Diet (which is elected by the three-class system of voting), explains the domination of Prussia by this feudal class. They furnish the army its officers, as did once the planters in the southern states of the United States. Their views dominate officialdom and diplomacy. In the past they were indispensable to the Prussian state, because they provided military and civil administration at the least expense. Even till now it is this historical rôle that assures them their preponderating influence in the Prussian government. These large land-owners have dwelling-houses for their workmen, who, with their families, are under contract, usually for a year. In consideration for their work they receive: A house, with garden, and sometimes a strip of land; a part of the yield of grain, or a certain fixed allowance; also fire-wood, and the right to graze a cow on the pasture; and finally a small cash-wage. This class of laborers, which forms a mean between the small peasantry and the proletarians, begins recently to be pushed away by laborers from Russia and Galicia. These last are crowded into large sleeping-houses and are dismissed after the harvest. On account of the specialization in the cultivation of sugar-beets, farming has come to be more and more a matter of a short season. The work is compressed into a few months; and it no longer pays to keep a large force of farm-hands the year round. Thus the workmen become proletarians, just as in the manufacturing industries. The powerful attraction of the cities and of the high wages paid in the industries, and also, in many cases, the prospect of becoming independent in some foreign country, make the strongest appeal to farm-hands on the large estates in east Prussia, just where the population is thinnest. Naturally, this has increased the price of farm-labor; and the effect upon smaller farmers has been to cause them to limit their farming in such a way as to be able to do all their own work and thus make themselves independent of the labor-market. The competition of foreign grain has had a similar effect on production. In seeking to make themselves independent of the grain-market farmers have cut down their production of grain to an amount not much in excess of their own needs. These conditions, and the fact of division of land in succession by inheritance, caused an increase in the number of small peasant holdings at the expense of the larger and medium-sized farms. In this way, in the east, the number of small Polish farmers has multiplied. Their mode of life is so simple that they require only the smallest area. On the other hand, the large landed proprietors have been driven over to the side of protection. They brought about the great change from liberalism to protection and conservatism in 1878; and without them a majority for protection would be impossible in the German Reichstag. In connection with the rapid growth of capital of the country the agrarian crisis also manifests itself in the increasing number of enfeoffments in trust. Such entailed estates cannot incur debt and cannot be sold outside of the family; and there is the further proviso that they must pass to a single heir, usually the eldest son. In Prussia these estates cover about one-sixteenth of the area of the state and are half woodland. An increasing part of them represent complexes of land that have been bought up by men of wealth, who, for securing some title of nobility, have entailed the land in this manner. It is the same development that has crowded out the old resident squire in England, who corresponded to the German "Junker," and placed the landlord, a renter, in his stead — a development that America will not escape. Such large monoplies of land make possible, in the form of a lease, the separation of ownership from management and secure an elasticity against crises that is impossible for a capitalist farming his own land, especially in a country where the population is increasing and land becoming more expensive. Such an owner has to expend all his capital in buying land, or perhaps in paying off the claims of other heirs, or in paying interest on such claims. Thus, the agricultural development of Germany seems to tend, on the one hand, toward a multiplication of the smallest peasant holdings, and, on the other hand, toward an increase in the number of large monopolistic holdings.

The present government, which is strongly under the influence of the agrarian and related interests, has in view a change in the right of inheritance, intending to decrease the portions of the younger heirs, to fix a legal limit to indebtedness, and to provide for the liquidation of such indebtedness with the co-operation of the state. The change of the rules concerning the valuation of real estates in cases of inheritance might be a useful provision; but it would be of no basal significance. If the attempt to limit indebtedness by law did not prove an economic impossibility, it would only increase the buying up of land by monopolists, especially as the formation of enfeoffments is at the same time to be made easier. This last measure is in open contradiction to the plan of inner colonisation, which Prussia especially has taken up in a large way. On the one hand, the government would like to increase the number of the country population, and on the other secure stability of ownership without servitude to debt, and at the same time make Germany independent of foreign countries in the matter of food-stuffs. But it must be recognized that a reconciliation of these three conflicting ideals is impossible. From the technical view-point of the maximum of production, especially of grain — for the conditions are essentially different for stock-farming — the only possible way to attain to this is by decreasing the country population, *i. e.*, by doing away with small peasant husbandry entirely and extending large capitalistic farming. But the country population is greatest and most stable where ownership is least stable, namely, in west and southwest Germany; because here where the custom of small holdings prevails and ownership is fluent, there is the best opportunity to secure a bit of ground. The watchword, that Germany shall eat only her own bread, means a sharpening of the present social antithesis in the country, and therefore, under existing conditions of labor, the denationalization of east Germany. The domination of capitalistic farming favors the cheapest farm-hands, *i. e.*, the Poles, and means nomadism for the agricultural laboring class.

Problems.— The fact must not be lost sight of that, as a nation, Germany is surrounded by enemies and can maintain her position only by the military service of a maximum of strong and healthy men. The population is increasing rapidly; but so is the deteriorating influence of the large cities. What, then, should be the aim of the agrarian policy? Certainly not the greatest amount of agricultural products, but the greatest number of agricultural producers. The present high agrarian protective tariff, however, is exactly opposed to the interests of the small producer. The high tariff on grain accrues, in an increasing measure, to the advantage of the large capitalistic farmer. Certainly, so long as the period of land-robbing agriculture ("Raubbau") continues in foreign countries, it is impossible to put agricultural products on the free-list. Since, however, under the tariff-programme formerly in force, there had not been any appreciable falling off either in the extent of farming or in intensity of methods of cultivation, it is clear that the rate was high enough to protect the German husbandman against the temporary effects of the opening up of foreign virgin soils; and it was not necessary at all to increase the tariff on agricultural products. However, a new agrarian tariff-schedule, providing for higher rates, was put through,— in violation of the interests of the great majority of the population.

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18. **Germany — Industries.** No general statistics regarding industrial products are published in Germany. True, such material is carefully collected, but it is placed exclusively at the disposal of the government, to be used in considering the commercial policy of the nation toward foreign countries. It is impossible to give exact statistics, except for the products of mines and foundries; further, for beer, alcohol, and sugar.

For the greater part, the coal and iron deposits of Germany are already in permanent ownership and are being worked. In 1903, a year of depression, the production of coal was 162,500,000 tons, worth $275,000,000; *i. e.*, 18 per cent of the world's output, or just half as much as the production in the United States, and about two thirds as much as the production in Great Britain. The production of iron ore was 21,200,000 tons (United States, 35,500,000); of pig-iron, 10,000,000 tons, or 21½ per cent of the world's output (United States, 18,300,000; Great Britain, 8,900,000 tons); of steel, 8,800,000 tons (United States, 14,700,000; Great Britain, 8,900,000). The exports of coal and other mineral combustibles exceeded the imports by only 5,000,000 tons (export principally to Belgium and Austria, import chiefly from Great Britain), so that the home-consumption was about 157,000,000 tons. In this respect Germany is in contrast to Great Britain, which exports a large part of her coal production. The exports of iron ore exceeded the imports by about 2,000,000 tons, so that about 23,200,000 tons were reduced in German furnaces. According to conservative estimates, the coal beds of Germany contain 120,000,000,000 tons of minable coal. It is further estimated that the coal beds of Upper Silesia, and especially those of Westphalia and the Rhine country, will outlast those of England by five centuries, taking into account the technical mining capacity of the coal and supposing the same rate of progress in both cases. No other country in Europe has similarly lasting coal deposits, except Belgium. In all other European countries the coal-fields are considerably less extensive, as, for instance, in France, Russia, and Austria; and they will be more rapidly exhausted than those of Germany. The consumption of coal per head is considerably less than in England, and also less than in Belgium or in the United States, but it is greater than in the other European states. The home-consumption of pig-iron was only 98.1 kilograms per head, as against 235 in the United States and 137 in England. These low figures for Germany are accounted for by the fact that in Germany the railway system is essentially already built; though the production of pig-iron per head in Germany has increased more rapidly in recent years than in the United States. In the depression-year of 1903 the production per head was 173.0 kilograms; so that four-ninths of this amount had to find a foreign market. In 1904 imports of iron ore increased; but exports of pig-iron decreased, showing an increase in home-consumption. The ratio of the production of steel to pig-iron in Germany was greatest in 1903, the proportion being 87.3 to 100 (United States, 80.7 to 100; Great Britain, 57.1 to 100). In recent years this proportion has increased more rapidly than in the United States, or in Great Britain.

Thus, as regards coal and the raw materials of the iron industry, Germany does not have to rely upon imports from foreign countries. For the most part, further, Germany consumes such raw materials, instead of exporting them. Only on the coasts and borders is there any exchange with foreign nations. As to the geographical relation of the coal mines and the iron mines to each other, it cannot be said that this is as favorable in every respect as in England or in certain parts of the United States. But since the discovery of the Thomas Martin method of reduction the large percentage of phosphorus contained in many German iron ores rather gives Germany the advantage in this respect, and is even one of the reasons for the rapid development of the iron industry in Germany. Besides, the phosphorus in the slag makes this an excellent fertilizer. Of the other non-precious metals, only copper is principally imported. The imports amount to three fourths of the amount consumed in manufactures, and of this, eleven twelfths come from the United States. Accordingly, the metal industry is an important export industry, especially as regards finished products. Not counting machines, wares, and ships, the exports of semi-manufactured materials in 1903 exceeded the imports by $46,750,000; but the exports of manufactured articles exceeded the imports by $104,000,000. The trade-balance against Germany on ores and metals, including precious metals, is almost wiped out by the excess in exports of combustibles alone.

In all modern civilized countries the second typical large industry, next to iron manufactures, is the textile industry. In Germany this industry rests upon a basis quite different from that of the iron industry. In the manufacture of cotton Germany takes the third place, with 8,500,000 spindles, being led by Great Britain, with 47,000,000, and by the United States, with 22,000,000 spindles. The exports of textiles amounted to $125,000,000, though this was not sufficient to cover the corresponding imports of raw material, which were $193,750,000. In 1903 Germany imported 344,000 tons of raw cotton, worth $88,750,000; and in 1904, 357,000 tons, worth $104,475000. Between two thirds and three fourths of this came from the United States. The cultivation of flax in Germany has continually decreased, owing to the superiority of the Russian article, which is due to the more favorable conditions of climate in Russia. In 1904 Germany imported 24,000 tons of flax, which is about the average for recent years. Four fifths of this came from Russia. Jute is imported annually to the extent of about 100,000 tons, almost all of it coming from British India; and the annual imports of hemp are from 26,000 to 30,000 tons. As to wool, the excess of imports over exports in 1904 were: raw wool, 138,000 tons; bleached wool, 9,000 tons, and combed wool, 13,000 tons. About half of this came from Argentine, and a third from Australia. Even in 1900 the home production had gone down to about 12,000 tons. The annual imports of raw silk are some 5,300 tons. Despite the limited use of silk in Germany, this is an amount that has been exceeded by the United States only in late years.

In spite of the very considerable stock-raising in Germany, the leather industry is on about the same basis as textile manufactures. In 1904 the imports of hides and skins were 108,000 tons, worth $50,000,000. To a great extent the wood-working industries have to rely upon foreign material, although Germany has considerable timber-lands. The imports of wood and lumber of all kinds in 1904 amounted to $30,000,000. In certain industries caonchac and gutta-percha are found indispensable and are imported to the extent of $20,000,000. Most of the entrails used in putting up sausage, and in other industries, are imported, such imports being 21,000 tons annually, of which 9,000 tons come from the United States. Though tobacco is raised in Germany to a large extent, the tobacco industry has to rely on foreign countries for certain kinds of tobacco. The annual imports of leaf tobacco are some $22,500,000. Petroleum is likewise imported for about $22,500,000, partly from Russia, partly from the United States. Leaving out of account tobacco and other luxuries, we can see that even if German agriculture could supply the demand for bread and meat, Germany would still be dependent upon imports of raw material to supply the demands for clothing, and, in part, the needs of the household in the way of lighting, utensils, etc.

Given the raw material, the next necessary condition for the existence of the German industries is the possibility of the exploitation of labor, such possibility depending upon social conditions, of course. For a long time the opinion was held, and is still held by some persons, that the important position occupied by German industries in the markets of the world was due to cheap labor, which was identified with low wages. The view that low wages is identical with cheap production has long since been refuted, as regards highly developed industrial countries. In Germany the time when articles made by cheap, poorly paid labor formed the chief part of German exports is already some decades in the past. The standard items of German export which in the last decade have in an increasing degree come to make up the volume of exports are, on the contrary, the products of the most highly paid working-classes to be found in Germany. To be sure, the scale of wages, all the way through, is lower in Germany than in the United States, and in the case of skilled laborers about 50 per cent lower on an average. This is true not only of the amount of money paid, but of the real wage, at least so far as the necessities of life are concerned. Accordingly, the position of the skilled laborer is much more favorable in the United States, certainly in the Northern States. The position of the unskilled laborer in America varies, of course; but in cities like Chicago, and other cities, his position is no better than in Germany. It is sometimes worse;

and it is very much more unstable. Emigration of German laborers to America has greatly decreased, and to-day it is very small, and, on the other hand, Germany employs several hundred thousand Italian, Polish, and other foreign laborers. The effect of low wages on the cost of production in Germany is offset by deficiencies in the individual laborer. Through inheritance and training, the German workman has acquired habits of eating and drinking less conducive to health and strength than those of the American workman; and his excessive use of alcohol particularly diminishes his efficiency for intensive and heavy work. Though, to be sure, the training of the German workman, which is not easily duplicated elsewhere, makes him far more careful and economical in his work than the American. On the whole, the relative cheapness of labor has not by any means always stimulated the technical development of German industries. On the contrary, the opposite is true, since cheap labor sets a smaller premium on labor-saving machinery. In 1895 the total horse-power of such machinery in Germany was only 3,427,000, or 33.4 horse-power for every 100 persons engaged in general industries, and 42 horse-power for every 100 persons engaged in industry in the narrow sense of the word. Since then these figures have been greatly increased: *f. i.* in Prussia, in 1904, the steam-engines had 4,700,000 horse-power (ship-machinery excluded). But they are still too low, and in comparison with England and America this showing is poor. American industries have an advantage over the German in that they do not have to carry the burden of social compulsory insurance, and in that there the possibility of exploiting labor is not so sharply restricted by labor laws as in Germany. When the maximum quota has been reached the annual cost of insurance against sickness, accident, infirmity, and old age will amount to about $175,000,000 for the manufacturing industries, agriculture, and domestic service. This expense is met largely by compulsory contributions from the employers and the laborers. The care of widows and orphans has been proposed. The existing laws for the protection of workmen are very much more effective than are such laws in America. The honesty and pedantry of German officialdom guarantee the execution of all laws in Germany, whether they be good or bad; and, further, there is a unity in labor legislation for the empire which is in sharp contrast to factory legislation in America, where uniformity is made impossible by the legislative powers vested in the individual States. And, too, the German laws are more rigid in their nature than the American laws. The employment of child-labor in Germany, in the manner followed in the Southern States, would be out of the question; no less so the absolute disregard for the life and health of the laborer, which is made possible by law in American factories. On the whole, the German employer has the support of the government organs against the laborer, and his position is further made more comfortable than that of the American manufacturer by the fact that order is strictly maintained; but this does not mean necessarily greater production on the part of the German laborer. On the whole, the work-day in Germany is 10 hours, in some trades nine hours, and in others even more than 10 hours; but it has been observed that long hours are by no means identical with increased production. The development of labor unions of late has been rapid, and it is expected that shortly as many as 2,000,000 workmen will be organized. All in all, the present physical capacity of the German laborer is not so great as that of the American; and labor laws prevent as high a degree of exploitation of labor in Germany as is possible in America. In opportunities for special technical education Germany has a decided advantage; and, thanks to the development of technical schools and colleges, the standard of education in the industries is higher than in America. The significance of these facts can be observed especially in the chemical industry.

Such are the conditions of labor and production in Germany; and German industries have been developed accordingly. Naturally, the most significant industries of Germany, those upon which the future of the country depends in the world-market, are not those which are devoted to the manufacture of heavy staple products, as is the case in America. In 1903 the excess of imports of raw materials for industrial purposes were $405,000,000; and that of exports of manufactured articles amounted to $515,000,000. The statistics for exports, however, show that more than one third of the entire exports, viz., $437,500,000, was divided among over a hundred different classes of articles, of which the most important class was represented by less than $4,500,000, *i. e.*, less than .3 per cent of the total exports, which were $1,226,000,000. In general, these are products of a large number of factories making finished articles, in which the cost of the raw material becomes insignificant in comparison with the value added to the articles by carefully trained and conscientious workmen. High-priced manufactured goods preponderate, too, in the large export items. To be mentioned especially: silk, wool, and cotton manufactures, clothing and millinery, machines and fine hardware, books and maps, gold and silver-ware, and coloring materials, these items together making up $275,000,000 in exports. Despite the mineral treasures of Germany, the economic importance of the country depends upon labor; and in the future this will be even more true than it is at present. Those numerous individual classes included in the one third mentioned above vary greatly in importance, owing to changing tariff legislation in foreign countries; but if markets are lost for these articles by protection, they are usually regained in a short time. The latest statistics show that the higher the specific value of the article and the more work there is in it, the quicker the lost market is regained. In such cases the protective tariff only becomes, in the long run, a burden for the consumer in the foreign country. Exports are either to countries with which Germany has commercial treaties, or to such as allow Germany the rights of a most favored nation, or to countries with which Germany has no kind of agreement whatever. Now, statistics show that, disregarding individual differences, exports in these three cases vary with great regularity, going up and down according to the ups and downs of the general business situation in the world. Of course, the influence of foreign duties on exports is considerable, especially when a new tariff schedule first goes into operation; and for wares of low specific value the effect of such tariff continues. On the other hand, the influence of foreign tariff legislation on those articles which are really the most important for Germany's commercial future has been much overestimated.

In view of the nature of German manufactures and the intensive work involved, the method of inner organization of German industry acquires a character which is not altogether favorable for further development along all lines. Corresponding to the trust movement in America, Germany has had the development of the kartell, a trade-union similar to, but different from, the trust. Economically speaking, the kartell is "conservative." By fixing prices, it attempts to maintain *not* only undertakings of the highest rate of output. The trust, on the other hand, is economically revolutionary, in that it aims to crowd out less profitable businesses and maintain only those that pay the best profit. The kartell seeks to protect the income of invested capital; the trust seeks to utilize floating capital by organizing production. However, the difference is only relative, and it is well known that within our largest kartell a trust movement on a large scale is now in progress. But the formation of large trusts on the American style is difficult in Germany. The railway lines are owned by the state; and lately the state has begun to retain a monopoly of shipping on proposed new canals. Therefore, in Germany it is impossible to establish a community of interest between industrial monopolies and transportation, as is done in the United States. The state is a large mine-owner and is increasing its possessions; it is the largest employer and a greater consumer than in any other country. At present the state is just about to join the largest of the German syndicates. If, on the one hand, German industry is more dependent on the state, on the other it is less dependent upon the power of the banks and the Stock Exchange than is American industry. Speculation in futures in industrial stocks is prohibited in Germany by law; but this fact is not decisive, as it only increases the power of the large bankers at the expense of the smaller ones. What is really decisive here is the rigorous law regulating the formation of joint-stock companies, which offers, in a way, a guarantee for the solidity of a company and makes impossible the issue of common shares, as is done in America. This has greatly retarded the development of stock companies. The total capitalization of stock companies of all kinds amounts to only $3,600,000,000, which is a small sum, considering the highly developed German industries. This makes it difficult to reorganize ownership in whole branches of industry merely by transactions on the Stock Exchange, though, of course, such a thing is not entirely impossible. The more conservative nature of the kartell gives greater stability to prices, thus making more certain the conditions of the further manufacture of a given material in other industries. But the higher prices of raw materials resulting from the effort to preserve less profitable plants in a given industry decreases the competing power of that industry in the markets of the world. The result has been that large mixed works have come into existence, which produce the raw material and then manufacture it into the finished article, whereby in some kartells a violent conflict has broken out between the "pure" and the "mixed" works. Another result has been the allowing of export-rebates to manufacturing exporters. This last remedy bears the defect of every premium-system: it endangers the elasticity of the industry in adapting itself to the market. The finishing manufacturers, of course, have now formed kartells of their own. In fact, in the several hundred kartells into which industrial Germany is organized almost every industry producing staple articles is included. But the power of these numerous individual kartells in the market is usually less than that of the large trade-unions which produce the raw materials. It is the numerous small specialized industries that are most important for Germany's commercial position, in which highly skilled labor and personal initiative and special training on the part of the manufacturer himself play the principal rôle. But just these have to bear the expense of kartellizing. It must be added that the large industries for raw materials and staples are in a better position to effect strong coalitions for influencing the press, public opinion, and the government, and this fact gives them predominant power in determining the commercial policy of the empire. In co-operation with the large landed proprietors the 'Centralverband Deutscher Industrieller,' into which large manufacturers of raw materials, iron, and textiles are organized, brought about the present system of protective tariff, which is against the interests of all manufacturers, except those producing massive and staple articles. This organization is further allied with the landed interests in the social-political reaction, and in its opposition to labor-unions and labor-protection.

The most recent available figures regarding the number of persons engaged in industrial pursuits are found in the census of special industries for the year 1895. At that time which was 11 years ago and before the recent tremendous advances in industrial progress, the number of persons engaged in the industries was 8,000,000. These figures include mining and building, but exclude transportation. From 1882 to 1895 the number of persons engaged in industry, trade, and transportation increased 40 per cent; those in the industries alone increased 31 per cent; at the same time the increase in population was 14 per cent. Most of this increase has been in the larger factories, the force of those employing over 50 persons being increased by 89 per cent, those employing over 1,000 persons being increased by 110½ per cent. Still, for every 100 industrial workers 46 (60 in 1882) are working in small shops of less than five persons, and of this number 16.7 work alone. Further, out of every 100 such persons 24 (19 in 1882) are working in shops of from six to 50 people, and only 30 (22 in 1882) are in factories employing more than 50 people. Owing to the force of tradition the old and long-established hand-industries persist and are only slowly transformed, in various ways, on modern capitalistic lines. One development has been the home industry, which is almost seven centuries old in Europe. It is mostly country people who are engaged in these home-industries; and by reason of training from early childhood they are able to produce valuable wares; but such production is decreasing rapidly and is being superseded by factory products. On the other hand, the modern development in Germany has created the house-work "Heimarbeit," especially in textiles and in clothing, since certain heavy articles can be manufactured cheapest in this way. Such work is done in large cities, in densely populated country districts, and in places where the small wages of the men compel the women to work. Often such work is organized into a complex system, with many middle-persons. Especially noteworthy for this sort of work are: Berlin (clothing and men's furnishings, women's wearing apparel, leather goods, jewelry and ornaments, embroideries), Danzig, Cologne, Bielefeld (linen and wash-articles), and other cities. The woodland and mountainous districts of middle and southwest Germany are the principal strongholds of household industry. Here are made wooden articles knit-goods, brushes, toys, embroideries; and in the Black Forest clocks are made. Besides the mining and foundry industries, the modern factory system dominates the chemical industry (in 1895 53 per cent of all works had more than 100 employes); machinery manufacturers (likewise 53 per cent); the paper industry (similarly 40 per cent); and also the textile industry, especially spinning (38 per cent with over 100 workmen), though here there has also been a strong development of home-work. There is scarcely a guild-trade of the old régime that has not already a considerable, and an increasing number of large modern factories. In 69 of the various kinds of industries employing at least 10,000 persons, in 1895, the majority of the laborers were in establishments of over 50 workmen; and in only 33 were a majority in establishments having from six to 50 workmen.

The geographical distribution of German industries is uneven, and this has been increased by the decay of home-manufactures among the country people, mentioned above. This has made the contrast sharper between the agrarian districts on the one side, and the great industrial centres on the other. To the first belong the greater part of Prussia east of the Elbe, considerable parts of Bavaria, and numerous smaller agricultural areas. To the second belong the kingdom of Saxony, the lower Rhine-Westphalia country, the Saar district, the upper Rhine-Main plain, northern Bavaria, parts of Württenberg, and all the large cities. It is in these industrial centres that there has been the greatest increase in population; but, since the old system of voting-districts remains unchanged, these populous centres gain no additional representation, and their increased democratic population does not mean any increase in political influence. Thus we have the opposition between the industrial and the strongly organized agrarian interests, between a progressive economy and a reactionary policy. The tariff-schedule of the conservative parties is the only thing that can endanger Germany's commercial power. Foreign duties, let them be ever so high, injure least of all those lines of merchandise which will in the future determine the position of Germany in the markets of the world. Any increase in the purchasing power of a foreign nation would even help exchange of wares with Germany, as is proved by the commercial-political significance of the most highly developed industrial countries. A successful attack against Germany on the sea could not hurt German industries any more than could high foreign duties. A small group of English interests have been dreaming of such a method of disposing of their inconvenient competitor, and they have kept up a tremendous campaign through the press in order to mould public sentiment; but in case of a war, even if they were victorious, they would be disappointed by the outcome. Since the offensive economic strength of Germany does not depend upon ships, but upon things which can neither be confiscated nor destroyed by gunnery, shortly after the war the same conditions would prevail as before — except that England, against the wishes of all German friends to English culture, and in the interest of a few selfish promoters, would have made for herself an irreconcilable enemy. The risk, too, would be much greater for England than for Germany, since the receipts of Germany depend much less upon exports and maritime trade than do those of England. The increase of the strength of Germany in the world-market is only a relatively slight concomitant of the rise of German industries. From the figures showing the increase in Germany's productive power a constant and strong decrease in the relative importance of exports has even been deduced; but this is not quite correct, since the growth of the large industries depends in part upon the suppression of smaller industrial forms. But it must be admitted that the bulk of the increase in trade certainly does rest upon the development of the domestic market. Now, it is just the strength of the domestic market that is endangered by the uselessly increased duties on agricultural products. Such duties only swell the revenue of the producer without increasing production, and compel the masses to spend a greater part of their income for provisions. Similarly, excessive duties on staple products of the heavy industries diverts production from those highly specialized individual articles, which form the economic strength of Germany, and hasten unnecessarily the exhaustion of mines. In creating artificial profits for the producer they hurt initiative and adaptability to the market; and, in strengthening the position of the ultra-conservative or feudal class, they accentuate social antitheses. The result has been a rapid growth of the social-democratic movement, which has led the government to endanger the productivity of German labor by trying in all sorts of artificial ways to prop up the "middle class," *i. e.* the handicraftsmen. Protection, if increased abnormally, will breed a feudalistic spirit such as that which dominates France, and thus weaken the intellectual impetus of industrial development. We reject such a political programme, therefore, because it would threaten the unique character of German culture and power, and because it contradicts the daring spirit of the Germanic peoples, but not because Germany must at all hazards export goods to foreign countries. Such is not the case. Germany would probably be able to meet increasing needs for raw materials with her even more rapidly increasing commercial revenues. It is to be hoped that, when the present existing commercial treaties have expired, the political situation, both within and without Germany, will be more favorable for a moderate form of protection. Those branches of German industry that decide the commercial importance of Germany in the world-market no longer need any protection, though of course absolute free trade with protective neighbors would not be welcomed in Germany. All that German industry needs is the «open door.»

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19. Germany—Commerce and Trade. The dissolution of the Holy Roman Empire in 1803 indicated only the end of a political but not an economic union. Its more than a hundred commonwealths had been completely independent of each other from the economic point of view and nearly so from the political. Germany emerged from the Napoleonic wars as a confederation of about 40 sovereign states, in which trade and commerce were the concern of each individual state. «Thirty-eight tariff lines paralyze domestic trade and produce almost the same effect as if every limb in the human body were bound-up,» wrote Frederick List in 1819. Although in the following period some progress was made, the decisive step was the founding of the German Zollverein (Customs-Union) in 1833, which was joined by most of the German states in the following decades, until the adhesion of Hanover and Oldenburg in the fifties, it possessed no port on the North Sea.

The wars of 1864, '66, and '70, gave Germany a territory unified and rounded off for trade. The formation of the North German League and of the German Empire created a central force for the weightiest legislative functions in the field of trade and foreign commerce, while domestic trade for the two largest waterways which flowed through many states, was already regulated in the days of the Confederation by the Rhine and Elbe Transportation Laws (*Akten*). For the natural and artificial waterways through individual states, for the roads and railways, legislation is still to-day enacted by the individual states. The Empire, however, according to the Constitution, has the right of supervision and of control for the general interests of trade and commerce.

Almost contemporaneously with the founding of the German Empire, there occurred an event of decisive significance for trade and commerce—the country's transition from an exporting to an importing nation. The population of the present Empire from 1815 to 1870 increased from 24,800,000 to 40,800,000. Railway construction, which began in the thirties, made particularly rapid progress since the fifties, and there gradually arose larger and modern industrial establishments well-equipped with machinery, in which the increasing population found employment. Agricultural production, it is true, developed steadily, but the then conditions did not suffice to maintain the largely increasing population on the soil, without exporting any grain surplus—especially as American competition now setting in was lowering grain prices in the world market and hence rendering here more unprofitable the cultivation of corn.

The industrial development was largely promoted by the wars and by France's prompt payment of 5,000 million francs indemnity. Interrupted by the crisis in the seventies, a remarkable industrial movement began which has steadily continued. In the magnificent opportunity for employment an army of industrial workmen rapidly sprang into life. While in the beginning of the century, more than three-fourths of the population took to agricultural pursuits, in 1895, out of a population of 51,800,000 only 18,500,000 were agriculturists, while 20,300,000 were engaged in the industries and building construction, and 6,900,000 in commerce and trade. Of the present population of 62,000,000, not less than 35,000,000 are active in the four pursuits just mentioned, while the agricultural population is not larger, but perhaps less than in 1860. Naturally the demand for food, as well as industrial raw materials, developed enormously and, indeed, not only in comparison to the growing population, but out of all proportion, considering the increasing prosperity and rate of consumption. Thus Germany become one of those Western European lands that needed in an increasing degree for the support and employment of its inhabitants the importation of food and industrial raw products which out-balances the export of manufactures and the income from capital invested in foreign lands, and which makes return on the profits of transportation and insurance enterprises. In these so-called industrial states the interest in the increasing imports for support and employment of the population is decisive, while it must be the task of a prudent economic policy so to provide for the production of the home demand for food material, and the acquisition at home of as many industrial raw materials as possible, so that an all-too-rapid growth of the need of imports be checked. The steady passive balance of trade was a healthy sign, for it shows that the foreign trade capital employed in foreign undertakings supply good results for the agricultural life of the German people. But an all-too-rapid increase of the import surplus would check the further flow of capital, and besides would endanger particularly the German Empire, which is exposed to attacks on all sides through its position in Central Europe. An all-too-rapid dependence on foreign supply of food products might easily weaken its political power of resistance.

From these considerations the tendency of recent German economics has gradually shaped itself. On its foundation the Zollverein assumed the principle of the liberal Prussian trade policy, which, in 1818, arranged the first liberal tariff of duties in Europe influenced by Adam Smith's doctrine. The history of the Zollverein is essentially then the history of further progress in the direction of free trade. In the fifties this tendency was strengthened by the commercial treaties concluded with France, England, etc., on the most favored nation basis. The free trade policy continued also the first years after the foundation of the Empire, and found its culmination in the removal of the duties on iron in the middle of the seventies. In the following period, however, the increasing financial needs of the Empire, which would base its income, like the United States, essentially on duties and indirect taxes, necessitated the introduction of a number of revenue duties. The protective policy of many lands, the increasing American competition in the world market for agrarian products, which made itself noticeable in Germany after the middle of the seventies, and the increasing competition of industrial countries of Western Europe in the world market for metals, textiles, etc., together with the latent ecomonic crisis since 1873, gave further impetus to the movement again in favor of a stronger protective tariff. Under the auspices of Bismarck, the agrarian and industrial interests were united, and in 1879 there took place a reform of the German tariff legislation which, by moderate agricultural and industrial tariff measures met the needs of the time. The principle of moderate duties since that date has been abundantly maintained, while the tendencies of agriculture with increasing force in the past 28 years have brought about a marked increase and extension of an agrarian protective tariff. In the course of the eighties certain duties, particularly for agricultural products were largely raised. In the beginning of the nineties arose the project of a Central European Zollverein, as protection against the prohibitive measures of the McKinley Tariff. This project did not succeed; but a number of custom regulations were adopted by Germany, Austria, Italy, Switzerland, Belgium, Rumania, and Servia, the so-called Caprivi Commercial Treaty. By according the most favored nation clause to the United States, and granting similar treaty privileges to Russia, the original idea was completely extended. A number of reciprocal tariff regulations of a moderating character led anew to a lowering of the protective tariff. The continued low price of grain in the world, unfavorable conditions in finance and trade, however, intensified the agricultural crises and an active optation began to raise the agrarian duties, which the commercial duties had lowered—formerly a metric ton of wheat brought in 50 mark, now it had been lowered to 35 mark. The still higher protective regulations of the Dingley Tariff in the United States made the conditions for competition in Germany as well as other parts of Europe steadily more difficult, even if Germany, on account of its good technical development and organization, due essentially to the former protective tariff showed good results, and at the end of the nineties assumed a degree of development which was never anticipated. To make allowance for the wishes of the agrarians, without endangering them, it was resolved on the work of tariff revision, then in progress, to apply in the care of industries in many lines a moderately increasing rate of protection while grain duties should again be raised — wheat from 35 to 65 mark per metric ton.

In 1904 a new tariff system was adopted as preparation for the commercial treaties which were soon after to expire. After this preparation new commercial arrangements were adopted, and to the states already mentioned, who had adopted tariff agreements on the basis of reciprocity, Bulgaria, Greece, and Sweden were added. Their number has been further increased with most of the remaining countries of the world, except Brazil, China, Cuba, Portugal, Venezuela, the Congo State, Portuguese, West Africa, and some smaller territories. Germany is bound by treaties with the most favored nation clause. Commercial relations with the United States, which in earlier years were regulated by similar treaties with Prussia, and the Hanseatic cities from 1828, and after the founding of the Empire, and continues on the basis of the most favored nation clause, were controlled since the nineties by the Saratoga convention, and then by the reciprocity convention of 1900. The last had to become void with the expiration of existing tariff treaties with Germany, and it was replaced in the spring of 1905 by a definite provisional reciprocity agreement until 1 July 1907, which ought to give ample time for the conclusion of a new treaty. The same conditions exist as to the Argentine Republic.

The character of grain duties appears from the following table:

IN MARKS PER DOZEN.

Grains—Varieties	Old General Tariff of 1885-7	Commercial Treaty of 1892-4	New General Tariff of 1902	Additional Treaties of 1905	
Rye	5	3.50	7		5
Wheat and spelt	5	3.50	7.50		5.50
Barley	2.25	2	7	Malt barley	4
				Other barley	1.30
Oats	4	2.80	7		5
Maize	2	1.60	5		3

Since the introduction of the Caprivi Commercial Treaties the average receipts from duties for the years 1892–94 amounted to 380,000,000 mark; for 1898–1900, 514,000,000 mark; for 1902–4, 549,000,000 mark, of which the preponderating receipts came from breadstuff and cattle, 398,000,000.

The distribution of imports free and dutiable for 1902–4 was as follows:

Year	Imports in General		Food		Raw Material for Industries		Manufactures	
	Free	Dutiable	Free	Dutiable	Free	Dutiable	Free	Dutiable
1902	5,806	2,833	1,969	1,845	2,560	359	1,208	689
1903	6,321	2,896	1,952	1,774	2,843	384	1,220	738
1904	6,854	2,949	1,956	1,790	3,181	410	1,390	749

In the new German Empire foreign trade has begun to play another role than in the past It is to-day an integral part of the entire economic life, while formerly it did little else than to import all kinds of luxuries and food together with a few raw materials, and to export certain surplus products of agriculture and some industries. Without its aid a full third of the population of the Empire would find no support. In reference to the development of custom-duties in the Empire since its founding, we have the statistics, but until 1888, the Hanseatic cities did not belong to the same territory, and the number for the former period are not comparable to those of the later. Yet the following table shows something. According to government statistics, the special foreign trade was as follows:

The entire value of German foreign commerce has risen since 1872 to seven and one-third milliards or 120 per cent., the weight to 70 1-2 million tons or 300 per cent., while the population increased at less than 50 per cent. In 1872 the proportion per capita of the population in the tariff-covered territory was 145.6 mark; in 1889, 150.5 mark per capita of the population of the Empire; in 1905, 219.8 mark. The proportion of tonnage in 1872 was 0.56 in 1905 it had increased to 157 tons.

Year	Imports		Exports		Total	
	Thous. tons	Thous. mark	Thous. tons	Thous. mark	Thous. tons	Thous. mark
1872	13.4	3,465	10.0	2,492	23.4	5,954
1887	14.8	2,990	16.7	3,040	31.5	6,030
1889	26.6	4,087	18.3	3,256	40.9	7,343
1891	29.0	4,403	26.1	3,339	19.1	7,742
1896	36.4	4,558	25.7	3,754	62.1	8,312
1897	40.2	4,865	28.0	3,786	68.2	8,651
1898	42.7	5,440	30.1	4,011	72.8	9,451
1899	41.7	5,784	30.4	4,368	75.1	10,152
1900	45.9	6,043	32.7	4,753	78.6	10,796
1901	44.3	5,710	32.4	4,513	76.7	10,223
1902	43.3	5,306	35.	4,813	78.3	10,619
1903	47.0	6,321	38.3	5,130	85.3	11,451
1904	48.9	6,864	38.9	5,315	87.7	12,170
1905	54.3	7,436	40.6	5,842	94.9	13,278

Until 1889, as Hamburg and Bremen are not included, the figures for imports appear too low, for exports too high. In any event, the centre of gravity of the upward movement is in recent years—foreign commerce since 1889 has increased six milliard marks or 50 million tonnage—a larger mass than it amounted to in 1889. Since then the proportion to the population per capita is as follows:

	Imports.	Exports.
1890	86.4	69.0
1891	81.3	65.5
1900	107.4	84.5
1905	123.1	96.7

In the meanwhile the negative character of the balance of trade has steadily increased. The excess of imports in millions of marks averaged for the years 1890–1895, 991; for 1896–1900, 1,003, and for 1901–5, 1,086. Only in the year of the panic, 1902, after German consumption had strongly diminished, while the exports had increased, did the export balance in the course of the last nine years sink below 1,000 million mark. Germany is hence compelled in payment to utilize in increasing extent its income from its marine transportation agencies, cable stock, foreign insurance enterprises and banks, industrial, mercantile, and financial concerns. It is estimated that perhaps one-third of the negative trade balance is covered by profits in trade and navigation, while of the German working capital in foreign lands, between 30 and 40 milliard mark, one milliard serves to cover the deficit, a further part is consumed by the Germans in foreign countries, and the remainder is employed for new investments.

The character of the foreign trade becomes clearer when we divide it into its chief divisions:

IN MILLION MARK.

Year.	Food		Cattle	Raw material for industries, exclusive of precious metal			Manufactures		
	Imports	Exports	Excess of imports	Imports	Exports	Excess of imports	Imports	Exports	Excess of imports
1890	1,397	471	926	1,767	708	1,059	981	2,148	1,167
1895	1,390	416	974	1,805	722	1,083	926	2,180	1,254
1900	1,763	518	1,245	2,803	1,111	1,692	1,200	2,932	1,782
1905	2,344	507	1,837	3,395	1,181	2,214	1,390	4,043	2,653

Food imports increased more than four-fifths; exports remain somewhat fixed; the importation of industrial raw material almost doubled, while the exports increased fully half. The imports of manufactures, however, rose less than 50 per cent.; on the other hand their exportation almost doubled. An excess on imports of food and industrial raw materials, in value three milliard mark, is met by an excess in exports of manufactures in value more than two and one-half milliard mark. The 12 most important wares in imports, apart from gold, are cotton, wool, wheat, coffee, barley, copper, hides, lumber, timber, eggs, caoutchouc, silk, coal, which together represented more than thirty per cent. of the income. The corresponding 12 most important wares for export are cotton goods, machines, woolens, coal, sugar, common iron-ware, silk goods, fine iron-ware, gold and silverware, clothing and finery, books, cards, and music, aniline, and other tar dye-stuff, which together form about 40 per cent. of the exports.

The complete transformation which German foreign trade has assumed is clearly shown as well in its lines of direction. In former years trade was restricted practically to neighboring lands. The past generation has witnessed a much rapider increase of maritime trade than inland trade. The former today includes 70 per cent. of the entire German foreign trade—that is more than 73 per cent. of imports and about 65 per cent. of exports. As Germany had no colonies of its own it was limited in its transmarine undertakings to carrying trade with the colonies of Western Europe. After the independence of the United States and the rest of America, there developed some transatlantic trade for Hamburg and Bremen; but the English carrying-trade had long the preponderance. Until the founding of the German Empire every seaboard state had its own flag; but it was only after that event that an effective merchant-fleet developed under German colors, and as quickly direct maritime trade assumed marked development. But maritime trade extends beyond the German coast. Germany's convenient position in Central Europe, permits a small portion of its southern trade to extend over Austrian, Italian, and French ports; and as harbors which lie on the important rivers Rhine and Maas don't belong to the German Empire, a considerable amount of imports and exports of the most prominent branches of industry passes through these foreign points. For 1903, for example, it appears that at least 24 per cent. of special German imports and 14 per cent. of exports go by way of Belgium and Holland, so that the German foreign trade can thus be exhibited:

DIRECT MARITIME.

Imports ....50 per cent.
Exports ....50 per cent.

INDIRECT MARITIME.

Imports (lowest)..........................24 per cent.
Exports (lowest)..........................14 per cent.

RAILROADS AND INLAND WATERWAYS.

Imports (highest)...................below 26 per cent.
Exports (highest)...................above 35 per cent.

The geographical distribution of foreign trade was as follows:

Localities	In thousand marks		In ratio to total	
	Imports	Exports	Imports	Exports
Europe	4,633	4,380	62.3	75.
America..........	1,897	957	25.5	16.4
Asia	508	317	6.8	5.4
Africa...........	228	124	3.1	2.1
Australia........	164	53	2.2	0.9
Not given........	6	12	0.1	9.2
Total.........	7,436	5,842	100	100

The eleven most important countries, according to rank, that participated in German foreign trade are as follows:

Countries	In thousand marks		In ratio to total	
	Imports	Exports	Imports	Exports
Great Britain.....	784	1,058	11	18
United States and Porto Rico	1,004	543	14	9
Russia	1,961	368	15	15
Austria-Hungary.	773	595	10	10
Netherlands	257	449	4	4
France	409	293	6	5
Belgium..........	278	312	4	5
Switzerland	190	370	3	6
Italy	216	175	3	3
Denmark	124	186	2	3
Sweden	119	159	2	3

The percentage of the total German foreign trade is thus computed:

American Tariff Treaty—States		Great Britain and Colonies		United States and Colonies	
Imports	Exports	Imports	Exports	Imports	Exports
32.7	35	18.7	22.5	13.5	9.4

However rapid has been the development of German foreign commerce, it gives by no means a satisfactory picture of the measure of German inner development. In connection with the census of trades and professions for 1882 and 1895, investigations have shown that the capacity of working people and machines employed in the industries has risen considerably higher than the foreign trade figures. This process of development may continue in similar fashion, so that foreign trade statistics give no perfect indication of the increase in the capacity of German consumption or production. The inner prosperity and buying capacity have increased out of proportion to the foreign trade. The coasting-trade also will, accordingly, show at any rate, a stronger growth than the foreign commerce. Trustworthy figures are not at our command, but statistics of the movement of traffic on the inland water ways and the railroads are confirmatory.

In olden days the German railroads had much to suffer from the land's dismemberment. No united system could be constructed. In the thirties private initiative took the first steps. In the forties some railroad companies received state subvention, and when not enough private capital was at hand some states began to construct roads. Since the fifties, however, the *laisser fairé* policy gave opportunity to favor private initiative, until after the middle of the seventies the advantages of management by the state appeared superior and the leading states of the Confederation, already to a small degree railroad owners, bought up the entire railroad system of the country; its development is thus seen:

1840	1860	1870	1890	1900	1905
469	11,088	18,450	42,869	49,878	55,000

The total length of the state railroads was:

	1871	1881	1891	1901	1903
Km.	9902	22325	37476	46550	48784
Per cent.	46.1	66.2	89.6	91.3	92.4

The capital invested reached in thousand million marks,

1871	1881	1891	1901	1903
4.3	8.9	10.5	13.1	13.8

Of railroads that are private property, about 200 km. are under government control. In 1880, to every 100 square miles of territory 6.23, and to every 10,000 inhabitants, 7.44 km. railroads. In 1900 the figures had risen to 9.22 and 8.91 respectively; in 1903 to 9.77 and 9.02.

The following table gives the number of

	1880	1890	1900	1903
Locomotives	10,86[illegible]	14,188	19,069	20,845
		In millions		
Passengers carried	215	426	848	949
		In million km.		
Passengers, mileage km.	6,479	11,224	19,999	22,431
		In million tons		
Freight carried	165	218	359	391
		In million km.		
Mileage tonnage km	13,487	22,411	36,911	39,073

In 1890 the combined receipts of all German railroads amounted to 2,031,000,000 mark; expenses, 1,290,000,000 mark. In 1903, the receipts reached 2,161,000,000; the expenses, 1,357,000,000. The surplus of the combined capital stock bears interest at almost 6 per cent. It is, of course, not to be forgotten that the lion's share of the surplus falls entirely to the largest railroad organization—the Prussian-Hessian railroad system, which in 1903, out of a total of 52,814 km. locomotives possessed 31,813 km., while the smaller railroad systems are less favorably funded. The railroad employees numbered in 1900, 536,000 persons, of whom 315,000 were workmen, 221,000 officials. The relation of inland to foreign trade can be shown by these statistics: In 1890, out of 151,700,000 tonnage, 128.4 or 84.6 per cent. belonged to inland traffic, 11,000,000 went abroad; 10,200,000 entered entered from abroad, 3,300,000 crossed in transit. In 1903, out of a tonnage of 290,100,000, 248,800,000 or 85.8 per cent. belonged to inland traffic, 23,000,000 tons went abroad, 15,900,000 tons entered from abroad, 3,300000 crossed in transit. Of this there was maritime trade from seaports of 5,800,000 tonnage, and to seaports went 3,300,000 tonnage.

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20. Germany — Home and Foreign Commercial Intercourse. The river traffic was the most voluminous at the great Channel Station Emmerich an the Rhein, where in 1904 17½ million tons merchandise were registered, in juxtaposition to which Hamburg-Enterwärder only registered 5–6 million tons, and Rûhrort and Berlin each 6–7 million tons.

Of great significance are the recent establishments of special Inland ports on all rivers west of the Oder, in many instances in connection with industrial ports, that were erected to fill the requirements of the environs. A comparison of the achievements of the railroad and inland water streets, shows the following:

Sea Intercourse.— The upward trend in the German sea intercourse also first dates back since the founding of the empire. Scarce a shadow of the oldtime commercial greatness was reflected by the maritime traffic of the individual German States, with their manifold flags, up to the seventies of the 19th century. Hereto came the fact that the few steamships, in their possession, were mostly built in England. Since then a lively increase in maritime traffic took place, and shipbuilding also showed an upward tendency in the eighties.

On an average, the traffic in the years 1873–75 amounted to 91,100 ships, with 13,000,000 registered tons, of which 67,400 ships were laden with 10,000,000 registered tons. In 1904 the traffic amounted to 191,000, with 45,000,000 registered tons, and of that number 15,400 ships were laden with 36,000,000 tons. The number of steamships among the above has increased from 17,500 ships, with 7,000,000 tons, to 114,000 ships with 39,000,000 tons. Therefore, while the traffic has doubled, and the capacity been trebled, the number of steamships have increased nearly seven-fold, and space capacity 5½ times as much. The intercourse in 1873 and 1904 is given in table on next page.

It will, therefore, be observed that the volume of the intercourse of ships, along the German coast, has increased five-fold, the non-German European trips trebled, and the trans-continental voyages increased five-fold.

The tonnage of the laden vessels, amongst the above, was as follows: 1904.— In the German commerce, 8,000,000 tons. It has increased 6½ times, as compared to 1873. 1904.— In the non-German European commerce, 17.2 million tons. It has increased 2⅔ times, as compared to 1873. 1904.— In the non-European trips, 10.5 million tons. It has increased 5¼ times, as compared to 1873.

Transcontinental traffic has increased the most in volume and the European the least. This makes manifest the fact that the German sea interests are taking on a more transcontinental character and tendency, while the strong increase of the coast commerce is but a reflex of the intensive impetus of the German railroad and river traffic, and conclusively proves how the commercial centres of the transcontinental intercourse equally distribute along the coast the importations and also attract the exportations. This picture though, as well as that of the German sea commerce, is inadequate and incomplete on account of the fact that the Belgian and Hollandish ports, which in truth

Year.	Length of		Average length of transport.		Average compactness per km.		Total traffic achievements.		Increase total traffic achievements compared to 1875.	
	Railroads.	Water streets.	Railroads.	Water streets.	Railroads.	Water streets.	Railroads.	Water streets.	Railroads.	Water streets.
	Km.		Km.		Thousand tons.		Million tons kilometer.		Percent.	
1875	26,500	10,000	125	280	410	290	10,900	2,900		
1900	49,600	10,000	152	315	740	1,150	36,900	11,500	239	297

It will, therefore, be seen that the inland water-streets, in competition with the railroads, have more rapidly increased their powers of achievement than the latter.

serve the German intercourse, are not included in same.

As heretofore, Germany holds by far the strongest commercial intercourse with the

United Kingdom. In 1904 it amounted to 11,000,000 tons. Next on the list comes the United States, with 4,600,000 tons. The English traffic, however, was 4.2 million tons, or two-fifths unladen while the intercourse with the United States there were but 0.2 million tons, or two-thirds unladen, so that in reality to-day the volume of the traffic with the United States is nearly two-thirds that of England.

At the present time the whole tendency of the development has been to change the commercial centre of shipbuilding and maritime intercourse which, at the beginning of the 18th century was mainly located on the Ostsee, which in 1871 claimed nearly half of the ocean vessel space as her own, to that of the North Sea in an overwhelming manner, the latter now practically calling four-fifths of the vessels and nearly nine-tenths of the net vessel space her own. (In 1874 there arrived in the ports of the Ostsee tributaries 3.6 million ship tons, against 3,000,000 tons in the North Sea region, whereas in 1904 there arrived in the Ostsee 7.0 million tons, against 15.4 million tons in the North Sea, an increase which would be still larger if the German intercourse via Rotterdam and Antwerp were taken into consideration.)

YEAR.	GERMAN PORTS. IN MILLIONS.		NON-GERMAN EUROPEAN PORTS. IN MILLIONS.		NON-EUROPEAN PORTS. IN MILLIONS.	
	REGISTERED TONS.	NUMBER OF STEAMSHIPS.	REGISTERED TONS.	NUMBER OF STEAMSHIPS.	REGISTERED TONS.	NUMBER OF STEAMSHIPS.
1873	1.9	0.6	8.2	4.8	2.2	1.0
1904	9.7	6.8	24.2	22.1	10.8	10.2

Of the ships of commerce in German ports, in 1873, there were 3,000,000 tons under the German flag, and 3.2 million tons under foreign flags. In 1904 there were 13.0 million tons under German and 9.2 million tons under foreign flags. From being a participant of less than 48 per cent the German flag has increased to 58 per cent.

Herein lies a reflex, in part, of the development of the German commerce. In 1871 the commercial fleet was composed of the following: 4,519 ships, with 1,000,000 tons, and with a crew comprising 39,000 men. Amongst this number were 147 steamships, with less than 0.1 million tons, with a crew of 4,700 men. Although up to 1905 the number of ships had decreased to 4,224, the tonnage had increased to 2.4 million and the crew to 61,000. Amongst this number were 1,657 steamships, with 1.8 million tons and a crew composed of 47,000 men.

If we figure the working capacity of a steamship in 1873 to be three, and in 1905 to be four sailing-vessel tons, it shows an increase in the working capacity of the German commercial fleet, in this period of time, to be from 1.2 million tons to 7.7 million tons, nearly 6½ times as much.

This development not only benefits the intercourse of the German ports, but the connecting of foreign places amongst themselves as well, who, hitherto, were served by England, to a great extent, even through the medium of a third country.

To-day Germany commands over more than 10 per cent. of the entire international commercial fleet, and has thereby become the second greatest seafaring nation of the world, although England, which is the first in rank, is 4½ times as large.

As per the figures shown, the intercourse has also developed its organization to a great extent. Large and gigantic organized enterprises have replaced the smaller ones. To-day even the coast traffic is served by large stock companies. In the European commercial intercourse the small enterprises have also been replaced by the larger companies, and a few gigantic enterprises now practically control the transcontinental intercourse, notably the Hamburg-American line and the North German Lloyd. The stupendous number of transports of which Germany is in need are carried out in perfect harmony by tremendous enterprises.

Comparison of the Intercourse Resources.— A comparison of the disposible intercourse space shows that in 1902 the German inland vessels possessed over 4.7 million tons packing space, the German ocean ships 3.31 million tons, and the German freight cars of the railroad over 5.23 million tons packing space.

The achievements of the freight German commercial fleet, in the intercourse between German and non-German ports in 1903, was estimated at 53 milliard sea-miles tons, a much larger figure than the total intercourse achievements of the combined German inland water-streets and railroads.

To this, of course, must be added the transportation of passengers, which is not a material factor in the inland water-streets, but which plays an important part with the railroads, and thus the latter, to a great extent, excels the achievements of the sea traffic, in spite of the strong increase of the former in the last year.

The most characteristic feature in regard to the German intercourse development is the rapidly growing intensity of all internal traffic, offset by the constantly rapid growing intensity and extensiveness of the outside intercourse; in the growing rigidity of concentration of the railroad intercourse, governed harmoniously by the State, with the river traffic's former free operating private initiative of all natural, and with the moderate taxation of royalties of granted franchises, also private initiatives on all artificial water-streets, the last named will experience an active development on account of the building of the Middleland canal.

In connection with this canal a new era will dawn, inasmuch as a governmental transport service must be inaugurated, and a freight tariff system for the entire water-street net must be sought for.

In the sea traffic complete operating freedom, so far as the governmental control is concerned, but increasing concentration of the management through capitalistic organization.

and beginning of negotiations between the interested enterprises for the purpose of regulating intercourse, and the development of a net, which would meet with the demands of the ever-increasing intercourse and commerce, and fill the requirements of the populace in the most efficient manner.

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21. **Germany.— Money, Bank, and Exchange System.**— *Metal Currency.*— Under the same political disadvantages of breaking into shives, which the German livelihood life was subject to, the people suffered in regard to the money systems until the founding of the German Empire. The various issues which existed created undue complications and hardships. After the founding of the Tax Society this existence of the various issues continued, and only slowly was a unity of currency prepared, through the medium of several treaties, the most important of which were concluded in the years of 1838 and 1857. After many simplifications practically but two money systems remained, namely, that of the Thaler issue of North Germany and the Golden issue of South Germany. For both of these the Society Thaler of 1857 was supposed to serve the purpose of a connecting link. There yet remained in a few commercial sea cities some special currency issues, the principal one being the old Hamburg Bank issue, which was of great importance to the international commercial intercourse.

With few exceptions, the basis of the currency issue in Germany was silver. In the sixties a tendency manifested itself in Germany, as well as in other countries, to introduce a gold currency issue, but the establishment of the German Empire first brought with it the possibility of a unity in the currency issue, and the payment of the French war indemnity sum of five milliard francs was the basis of the rapid and pronounced growth of the gold basis in the German Empire.

The laws of 4 Dec. 1871; 9 July 1873; 1 April, 1886, and 1 June, 1900, enacted for the purpose of regulating the currency issue, developed in the following manner:

The lawful currency consisted of the gold coin of the Empire and the one-thaler pieces that were in circulation. The latter, however, will be gradually withdrawn, and will have entirely disappeared in about 1910, thus making it possible for Germany to possess a true gold basis. From the latter part of 1871 until the end of March, 1906, the following became lawful currency:

Furthermore, certain designated classes of bank notes, to be used as a circulating medium, but not as a legal tender, and until 1905 a limited number of German Empire bank notes.

From 1880 to 1900 the estimated Thaler fund diminished from 475,000,000 to 300,000,000 mark, and during the same period of time the number of circulating bank notes decreased from 159,000,000 to 120,000,000 mark.

They have fallen away somewhat of late since the right to issue small notes to the sum of 20 and 50 marks has been transferred to the state bank. The confusion, already great in the monetary system in the German Confederation, was considerably increased after the fifties by the establishment in the smaller German confederate states of numerous banks having the right to issue notes. In 1873, 140 different kinds of bank notes and paper money were in circulation in the country. One of the first measures to alleviate this condition was undertaken through the restricting law of 27 March 1870, for the prevention of the establishment of new note issuing banks. By the law regarding the establishment of the state bank of 1876, the right to issue notes was restricted to the new state bank and to the 32 note-issuing banks already in existence. A regulation was made to the effect that an unlimited amount of notes, covered by a full gold deposit, might be issued by these institutions and in addition notes to the amount of 385 million marks, distributed among the 33 institutions. Of this sum 250 million marks were allotted to the state bank. Beyond this sum notes could be issued to any desired amount, but subject to a tax of 5 per cent. Up to the banking law of 1899, 25 institutions had already relinquished their right to issue notes. In that year the untaxed amount of notes not covered by a gold deposit was raised to 541.6 millions, of which 450 millions could be issued by the state bank. Since that time, two more banks have relinquished their right, which has raised the contingent of the state bank to 470 millions, and, according to the amount in deposit, to 590 million marks. It is probable that within a short time only two note-issuing banks will remain besides the state bank.

Banking.— The banking system in its present organization is a child of modern times. It is true that Germany has long had some celebrated banks. The Hamburg and Nuremburg banks were two of the four celebrated European circulation banks which date from the 17th century. Individual state banks were founded in the 18th century, such as the Prussian bank by Frederick the Great. Their number increased, particularly

	GOLD COINS.		SILVER COINS.				ALLOY COIN.				SUM.
							NICKEL COINS.		COPPER COINS.		
	DOUBLE KRONEN.	KRONEN.	5 MK.	2 MK.	1 MK.	½ MK.	10 PF.	5 PF.	2 PF.	1 PF.	
	PIECES.		PIECES.				PIECES.		PIECES.		
	IN MILLION MARK.										
Issued	3,575.4	709.7	202.9	245.4	244.2	118.0	50.5	25.1	6.7	11.0	5,188.0
Withdrawn	18.6	33.3	0.1	0.2	0.1	26.1	0.3	0.0	0.0	0.0	78.8

Treasury Notes.— Besides these German Empire coins there are still in circulation over 250,000,000 Thaler (metal currency) which will remain legal tenders until their final withdrawal.

in the fifties of the 19th century. Besides there were reputable banking houses in the chief commercial towns; thus, after the downfall of the Augsbuerm and Nuremburg bankers, in the fair town places like Leipsig and Frankfort-on-Main, in the Hansa towns, chiefly Hamburg and in the other sea ports, chief commercial centres and governmental seats. At the beginning of the 19th century Frankfort and Hamburg were the centers for the large money and loan transactions, and for credit transactions connected with the trading of goods respectively. In the former place especially were concentrated the state local transactions, supported by the rising house of Rothschild, and Frankfort became with Paris, Vienna, Amsterdam, and London, the centre of the growing stock exchange business. When, in the face of the large money advances needed by railroads and industries after the forties and fifties, greater demands were made on the financial capabilities of the bank systems, the private banks, despite the fact that they had been gradually growing stronger, proved not to have enough capital, while the mercantile loans for the foreign trade were taken up abroad, chiefly in London, and there began the establishment of stock banks, partly with the restriction of their note issue to their business territory, partly without. In the individual German states, however, the right to establish anonymous companies with limited security was dependent on special concessions, down to the introduction of freedom of industry and of general German commerce and stock rights. As the oldest of the modern non-issuing banking enterprises was the Bank of Commerce and Industry; then followed the Diskontogesellschaft, the Berliner Handelsgesekschaft, the Norddeusche Bank, and finally as the last of the "concession" banks, the Deutsche Bank. The free establishment of a considerable number of additional stock banks in the period of speculation following 1873 and the crowning of the structure by the fusion of the Prussian bank into the German state bank furnished the kernel to that organization of loan transactions, as it obtains in the German banking system of today. This state bank itself was from the very beginning established as a central institution with a network of numerous branches covering the whole country. The operations allotted to it by the banking law were: trade in precious metals and coin; trade in short exchanges; furnishing short term loans in return for secure deposits with strict limitation of the loan system; buying and selling of government, confederate states, and railroad bonds and those of real estate loan institutions; taking in and paying out cash and issuing certificates on branch institutions; buying and selling of stocks and precious metals on commission; acceptance of deposits and the carrying on of an endorsement business. The bank was furthermore to serve as a receiving and paying station free of charge for the state, and might do so for the confderate states.

Its development then proceeded as follows: In the year 1876 it opened with 182 establishments, whose number increased to 330 in 1001, and to a round 400 in 1906. The total exchanges amounted in millions of marks during the period 1876–1880 to 45.626.6; from 1886–1890 to 89.802.2; from 1896–1900 to 161.145.8; and to 1905, 251.267. The growth of the business transacted in the deposit account was as follows: from 1876–1880, 27.333.9; from 1886–1890, 67,064.7; from 1896–1900, 117,928.1; to 1905, 178,572.6. The estimated total sums were: 1896–1890, 15.823.7; 1896–1900, 26,957.8.

The tendency toward bank centralization, emanating from this primary bank organization influenced in special fashion the remaining banking institutions of the country. With the growth in importance of Berlin as a financial, commercial, and industrial center, the central seat of the state bank quickly won first place in the German loan business and the majority of the large banks subsequently established took up their chief domicle in that city. The tendency to spread out, emanating from the state bank, led them, however, before long to establish branches in other German cities and as a result to set foot over the sea and in London.

In this process a bank sometimes founded its own branches, sometimes bought out the existing business of private or stock banks, or took a majority interest in them so that the central bank controlled them, sometimes bought out the local institutions within the sphere of power of the central institution either through the creation of a community of interest or finally through the giving of credit. There are then to-day about 18 large banking institutions besides the central bank, eight of which control the business of the institution and the policy of their groups from their chief seat in Berlin; further 8 or 10, in individual parts of the country, which have a local influence extending over an extensive territory. The most important are the so-called D-banks Deutsche Bank, Diskontogesellschaft, Dresdener Bank (with a community of interest with the Schaafhausenscher Bank verein) and Darmstadter Bank which exercise by far the greater influence. In 1905 the total circulation of the largest banks in million marks was as follows: Deutsche Bank, 77.206; Diskonto Gesellschaft, 34.154; Dresdener Bank, 53.211; Schaaffhausenscher, ?; Bank-verein, ?; Darmstädter Bank, ? Besides these the remaining large stock banks and a small number of large private banks play an important role. The Handelgeschaft reports over 10¼, and the National bank over 10¾ million marks exchange for the year 1905. Since the exchange of the independent provincial banks are not contained in the above figures it appears that their united exchange is not less than that of the state bank. In the year 1896 the 10 central banks controlled 69, in 1902 over 185, and to-day nearly 250 establishments and institutions connected with it by continuous intercourse.

The number of independent bankers is constantly diminishing, but there must nevertheless be a dozen private banks in the country which do not stand second to the large banks in the extent of business while the total number of persons calling themselves bankers in Germany amounts to about 1,500.

At the end of 1902, 122 German banks controlled 7.085 million marks of their own and foreign capital. to-day the amount is not less than 10.000 millions.

The capital stock and reserves of the chief banks in 1905 were:

	Capital.	Reserve
	In Million Marks..	
Deutsche Bank	180.9	176.7
Diskonto-Gesellschaft	170	*75.6
Dresdener Bank	160	141.5
Schaafhausenscher Bank verein	125	24.7
Bank of Commerce and Industry..	154	29.5

	Capital. In Million Marks.	Reserve.
Berliner Handelsgesellschaft	100	*29
National Bank	80	11.2

*Capital stock.

Another important manifestation in the German banking system besides this concentration is that in Germany the so-called purely banking business is not separate from the trade in stocks and state bonds, as in England and America; on the contrary in the large German banks the interests are often united which in America are divided among the banks and bankers, the trust companies, the promoters, the stock dealers and brokers. The large German banks accept deposits on the one hand, carry on a circulation and check business, and give credit for exchange, mercantile and other securities as in the ordinary bank routine, while on the other hand they buy and sell stocks for others and on their own account, engage in all sorts of financial, industrial and mercantile undertakings, promote the establishment or development of industrial enterprises, and undertake the flotation of public and industrial loans of every kind. They are thus central institutions for loan transactions in the broadest sense which are regulated in their administration by the general stock exchange law but not by a special banking law, deposit law and check law. They are purely private undertakings which are under no state control.

Real Estate Loan Institutions.— Besides the above named institutions and private bankers which look out for the business of loans on movables there are a large number of institutions which serve the real estate business. In 1903 there were 40 mortgages banks with a capital of 663.5 and reserve funds of 239.5 million marks. They had placed in circulation mortgage bonds to the amount of 7,491 million marks. These institutions give loans on city property. For rural property there are further from 3 to 3½ million marks of agricultural real estate loan institutions, which occupy either a state official or a publicly regulated position.

Stocks.— In the 15 years from 1887–1902 Germany issued stocks to the sum of 20–25 billion marks. About a third of the annual property increase, amounting to from 6–7 billions of the German people is invested in stocks and more than a fourth of German capital is employed in the stock markets. From 1884–1893, there were 8.7 billions, from 1895–1905 19.3 billions, in 1905 a total of 3.1 billion marks paid out according to the issue list, of which 5 or 3.9 billions were in foreign stocks. The amount of foreign stocks in the possession of the Germans was estimated in 1892 at 10, and is to-day calculated at 16 billion marks.

The stock transactions take place mostly in the stock exchanges of which there are 30 in all, in Germany; two-thirds of them carry on a stock business, the others deal exclusively in wares and produce. A farther part of the exchange of stocks takes place without the intervention of the stock exchanges through the banks, another part has gone out of the country on account of the stamp tax on stocks in Germany, and the limitations of the stock exchange law. The Berlin stock list notes about 700–800 valuations.

The transformation of private undertakings into stock companies is being accomplished in quick time, whereby one form of undertakings plays an important part, viz., the stock companies, with limited rights. There are anonymous stock companies with limited rights of the capitalists concerned, which in many respects exercise the same functions as the other stock companies, although from the fact that they are not subject to certain restrictions of the stock law as regards publicity and the stamp tax on stocks, they offer special advantages, whereas on the other hand their stocks are not so easily sold because they are not publicly listed. Originally intended only for smaller undertakings and family establishments, some of them now have a capital running as high as 90 million marks, and an active unofficial trade in their loans. From 1901–1904 there were 5,520 companies with this restricted scope founded; in October 1904 there were in all a total of 8,000 with a business capital of 1,960 million marks. In the year 1905 there were 1,800 companies created with a capital of 300 million marks. It is evident that an increasingly large part of German capital is to-day being invested in stocks and an increasingly large number of companies in the form of anonymous undertakings are being established. The tendancy which appeared earlier in other countries is now being manifested in Germany in an increasing degree and has already won an important position in spite of the comparatively short period of unhindered opportunity for modern enterprises and in spite of the difficulties offered by the legislation of the nineties, which was hostile to movable capital. The strong concentration and the comprehensive organization of the banking system have rendered valuable service in this connection. The comparatively small capital with which Germany began the race was used in the most effective way imaginable and in a short period of time has been turned into productive enterprises.

Imperial and State Finances.—The Imperial Government meets its obligations in three ways: (1) Indirectly by raising duties and taxes on the sale and consumption of certain commodities (salt, sugar and tobacco are taxed uniformly throughout the empire, whereas the taxation of beer and brandy is carried out by the states of Bavaria and Wurtemberg on their own account); (2) directly by raising duties and fees and from the proceeds of the various fiscal enterprises; and (3) by holding the states responsible for any deficits arising unless they be the result of loans. The states, however, divide among themselves any surplus accruing from certain sources of revenue. In 1902 the gross Imperial receipts were 2,441 million marks, and the expenditures the same. The state receipts aggregated 4,356 million marks, and the expenditures 4,375 million; Prussia's receipts were balanced by expenditures, 2,622 million marks. In 1902 the Imperial debt amounted to 2,734 million marks, of which 146 million was expended for railways. The state debts aggregated 11,216 million marks, of which 7,404 million was for railways. Of the state debts Prussia held 6,720 million marks, and Bavaria 1,460 million marks.

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22. **Germany — The Colonies.** The German colonies were acquired in 1884–1899. Their combined area reaches 2,604,775 sq. km. In the tropics are situated Togo, Kamerun, East Africa, and the South Sea possessions, Samoa, Emperor William's Land, Bismarck Archipelago, Marshall Islands, Mariana, Pelew, Caroline, halfway in the tropics, and halfway in the southern tropics of Southwest Africa; in the northern temperate zone Kiautschou. The territory under protection is German as far as the international status is concerned, as the German Empire alone represents it against foreign states. On the other hand the Empire's commercial treaties do not extend over the colonies and the extradition treaties are valid for them only where this is expressly stated. According to the state law, they are regarded mostly as a foreign country; for instance, in reference to the custom laws (also among each other). The rights of the people and the administration is subordinate to the commands of the Emperor (that is, his representative) in finances, with the co-operation of the Confederate Council and Parliament. The Imperial Chancellor is the responsible head of the Imperial officials. The highest civil authority for the colonies of Africa and the South Sea is exercised by the Colonial branch of the Foreign Office, which is directly subordinate to the Imperial Chancellor; the administration of the Kiautschou territory, on the other hand, is in the hands of the Imperial naval office. At the head of the local jurisdiction in every independent colony is a Governor, subordinate to whom are the district officials (and of the military stations). The colonies have no autonomy as yet; government and district associates have only an advisory voice.

A line of troops to protect the African territories has been formed, whose supreme head is the Emperor. Next to him is the Imperial Chancellor, under whom the commanding general of such constabulary control the military, and the colonial division the civil affairs. In the separate protectorates the Governor represents the highest military power, while the direction proper is transferred to the commander of the constabulary concerned. Such troops are independent next to the army and the navy.

In Togo and the South Sea the police are wholly blacks. The force of Kiautschou form a portion of the active navy and are under control, after the Emperor, of the Secretary of State for the Imperial Navy. The Governor (a superior naval officer) is the chief commander in the colony, both for military and civil affairs. The financial administration is also under control of the Emperor; but this is regulated by the imperial laws, in reference to receipts and expenses of dependent colonies. The receipts consist of the imperial surplus and the receipts proper — customs, taxes, and duties. Every colony forms its own customs territory — Kiautschou is a free port. Each colony has a special establishment of its own — to which, the expenses for the military constabulary (Schutztruppe) are charged — which is opposed to the general customs of other nations toward their colonies. The administration of justice for the white population of the colonies rests on the decisions of the consular jurisdiction. There are two courts of resort. In civil and commercial disputes a single judge decides; in difficult cases two laymen act as his associates. In criminal actions, almost all matters are brought before an associate bench, a judge with two laymen in the lighter, and with four in more difficult cases. As a second court of resort is a special upper tribunal for every colony. In civil cases, where the value of the object concerned is not above 300 marks, and in criminal processes where the damage is less, no suits will be admitted. Lawyers and notaries are taken care of, but are not yet provided in every colony. Law for the native is differently treated in the different colonies. A certain consideration for old tribal law is encountered very widely — the administration is carried on partly by whites and partly by native officials. The death penalty can be given only by the governor. Civil law follows in the colonies the decisions of the German, that is, the Prussian statutes. For commercial law colonial commercial customs are given the preference. Only such marriages are valid as are executed under registrar's seal. Slave-stealing and slave-traffic are forbidden in the German colonies. Household slavery, where it existed, has not been abolished; but there appear certain regulations whose aim is its gradual extinction. Labor contracts with natives are partly regulated by due provisions. Lawyers and notaries are admitted to all German forums of law. Especially created for the colonies are the "German Colonial Societies." A regular system of bookkeeping is introduced, but for Kiautschou there are special rules. The mining rights of the various colonies are different — in some societies have still the mining rights.

The German colonies belong to the World Postal Union. There is the same rate of postage for letters, papers, etc., sent to Germany and to each colony as within the German Empire. Postal parcels are received to weight of 5 kg.; postal orders and money-letters to value of 800 marks. All the colonies on the mainland, are connected with the submarine cable. Further communication follows on land as far as the telegraph lines extend, otherwise by post. The African colonies and Kiautschou have direct steamship connection for passengers and freight with Hamburg and Bremen. There is only indirect communication with the South Sea colonies, for the South Sea by German branch lines from Sydney, by way of Hongkong; for Samoa by American lines. A number of railroads, whose construction in recent years receives at least proper attention, provide for trade within the African colonies and Kiautschou. Let us now describe the colonies in detail:

Southwest Africa, acquired 24 April 1884, 835,100 sq. km. in size, is a terrace-formed territory with extensive plateaus and mountain ranges and separate hills to the height of 2,680 m., composed of primitive rock, partly of sandstone, and with a cross-formation of volcanic rock. The rivers are cut in deeply, flowing only in rainy season, excepting the border rivers Kunene in north, Orange in south, which are not navigable by ships. The largest are: In the west, Omaruru, Swakop, Kuiseb; in the east, Omurambo, ua Matuko, Eupkiro, Fish river. The climate shows great differences in the day but none in the seasons, less collective rainfall from the northeast quarter in the months February to April. The western and southern sections are least rainy. The natural precipitation of rain is scanty. The plant-life is of the nature of prairies; forests wind along the rivers; in the north the woods are tropical in their foliage; the coast is more like a desert. The animal world is rich in antelopes and prairie birds. The population numbers about 110,000 persons, of whom 80,000 are Ovambo, 14,000 Hercoro, 4,000 Hottentots, and Damara hillmen, bushmen, and bastards, 2,000 each. There are now about 4,500 white settlers, besides soldiers, with their white and black attendants, about 20,000. The cattle industry is the leading trade. Agriculture is almost exclusively on irrigated land and for certain south tropical products very advantageous. Industries are beginning. Mining for the present restricts itself to copper, which exists in large quantities. In addition, iron-ore, and marble (coal?) are found extensively. Means of communication are: Railroad, Swakopmund-Windhuk, Swakopmund-Otavi (almost completed), Lüderitzbecht-Kubub (in construction); otherwise the Cape colony ox-carts, horses, and mules. Connection is maintained with Germany and Cape Town by means of the Woermann Line twice monthly. The harbors are Swakopmund and Lüderitz Bay. The capital, with the seat of government, is Windhuk; the chief district towns are Keetmannshoop, Gibeon, Windhuk, Gobabis, Outjo. Swakopmund is connected with the Cape Town cable. There are some land telegraph lines. Postal facilities, in the absence of railroads, are maintained with the postal steamers by means of ox-carts and messengers. Imperial currency is used. The circulation of money is facilitated by postal orders, the large mercantile houses, and the bank of Swakopmund. Exports consist of oxen and small cattle, wool, skins, horns, ostrich feathers, rosins, dyestuffs, guano, copper. Imports consist of beverages, necessaries of life, tobacco, clothing, furniture, etc. Complete statistics could not be furnished on account of the war of 1903. Exports 3,540,000; imports, 8,300,000 m. Everything points to a healthy development.

Togo, acquired 5 July 1884, 87,200 sq. km. in size, on the northern bank of the Guinea basin, a flat rising tropical territory well wooded until it rises in the interior mountain 900 m. in altitude. The flat sandy coast is about 50 km. long, without harbors, and with strong breakers. The rivers Mono and Volta which are navigable in their course flow freely the entire year, but discharge into English and French territory. The Haho which runs into the Togo is only for canoes. The climate is tropical, with two rainy seasons, from the end of April to the middle of August, and from the middle of October to the middle of November. The rain-winds come from the southwest. From December to the middle of January the stormy, dry Harmattan rages from the northeastern quarter. There are 1,500,000 natives, on the coast the heathen Bantus, in the deeper interior Mohammedan Soudan tribes. There are only 224 whites. The natives are industrious agriculturists and skillful artisans. The plant-life is only rich on the mountains. Plants for food and use are constructed in extended masses naturally as in plantations (palm-oil, cotton, maize, cassada, etc.) Caoutchouc is gathered from the woods. Cocoa and cola cultivation is possible only in some places. Cattle flourish in the interior, but their breeding is often hindered by the pest (tsets). At Lome (seat of the Governor), a bridge is built far out over the breakers, which is well kept, and joined therewith is a road to Nuecho and Palime. Sea-traffic is provided for every two weeks by the Woermann Line. Lome is connected with West African cable. Trade in the interior is conducted by carriers. The currency is that of the Empire. Exports, palm oil, palm seed, cotton, maize, caoutchouc, ivory, living animals, 1903, 3,616,061; 1904, 3,551,358 m. Imports: Beverages, preserves, cotton goods, colonial ware, tobacco, wood, and woodenware. 1903, 6,104,863; 1904, 6,898,323 m. Government districts are: Lome, Anecho, Misahöhe, Atakpame, Kete-Kraschi, Sokode, Mangu-Jendi.

Kamerun, acquired 14 July 1884, area 495,-600 sq. km. has its highest elevations on the coast, the Kamerun mountain range, volcanic (4,070 m. in altitude), and connecting mountains (Bakoss, etc.). For the rest it rises terrace-shaped and forms in the interior great plateaus, with mountains in the east and northeast. The rivers flow the entire year and have far-extended, marshy estuaries, lined with mango forests. The most important from the north to the south are: Rio del Rey, Kamerun river, Sanaga (not navigable), Njongo (in upper stream navigable); in the interior, (Adamaua), the navigable Benue, the Niger's largest neighboring river; in the southeast the Gsanga (the Congo's supply), with the Dscha; in the northeast the navigable Schari which discharges into the Tsad lake. The climate is very tropical, particularly on the coast. February is the warmest, July the coolest month. The two strong downpours especially on the coast (Kamerun to 7,000 mm.) fall in the south in two rainy seasons; in the northern section, only in one from May to October. The interior and south (perhaps from 4° N.) have much scantier rainfall than particularly the north coast, which accordingly is very unhealthy. A primeval forest (from 130 to 300 km. in breadth) skirts the coast and lines the mountain. In the grass prairies of the highlands it disappears in a wilderness of wooded thickets. The animal world is very varied, with elephants, buffaloes, etc., in large numbers. The cattle industry has much to contend with in many neighborhoods by reason of pest (Tsetse), and Texas fever, etc. The natives number about 3,500,000, and consist on the coast, in the west, south, and northwest of Bantus, in the northeast and north of Fellah and Soudan tribes. While the negroes on the coast are now only agents, the other tribes carry on agriculture in large degree, with the oil-palm and the cola tree as special articles of trade. In 1904, 826 whites lived in Kamerun, chiefly on the coast, as officials, traders, and plantation builders. Of minerals, petroleum and tin are found profusely on the coast. Exports: Palm seed, palm oil, cocoa, cola nuts, caoutchouc, timber, copal, cattle, ivory; value, 1903, 7,564,512; 1904, 8,020,731 marks. Imports: Manufactured goods, beverages, colonial wares, salt, wood, woodenware, ironware, tobacco, rice, etc.; value, 1903, 9,637,939; 1904, 9,378,283 marks. The currency is that of the Empire. English gold is taken in payment. Inland expended in turn. The north and Kamerun main line of the Woermann Line provide steamship communication, twice together monthly. There are many harbors. In Duala is a swimming dock of 1,200 tons carrying capacity. Trade in the interior is undertaken through carriers and boats. A railroad from Duala to the Manenguba mountains is in course of construction; besides, there are country roads in the large plantation along the stretch of coast. District officials are in Victoria, Duala, Edea and Kribi. Other administrative districts are Bamenda, Banjo, Buëa, Campo, Ebolowa, Fontem, Jabassi, Johann-Albrechtshohe, Joko, Lolodorf, Ossidinge, Rio de Rey, Molunda, Lomie, Jaúnde. Seat of the Governor is Buëa.

German East Africa, acquired 25 Feb. 1885, with area of 995,000 sq. km., has a very mixed geological formation and just as peculiar land surface, as the large North African ditch crosses it. Broad, undulating plains vary with the mighty mountain ranges, single heights, jagged precipices. Old and still active volcanoes are found in greater number; for instance Kilimandscharo on the northern border 6,010 m. in altitude. Richly watered fields alternate with barren plains, which indicate in part salt deposits. Accordingly the downpours, the climate, the plant and animal world vary in the different parts of the country. In general the plateaus have a scanty rainfall, the sea and inland coasts as well as the mountains (on the side of the wind bringing rain) have copious rains. The rains come with the southeast tradewind, which, however, in some places can be very much averted and thus distributed into two rainy seasons; the longer March and April, and the other in November. The height of downpour even in the localities where the rain is copious does not exceed 3,000 mm., but varies very strongly according to the years. On the western border lie the large inland lakes, Victoria-Nyanza (66,000 sq. km.), Tanganyika (35,000), Nyassa (27,000),—only in part on German territory. Of the rivers there empty into the Indian Ocean (from north to south) the following: The Umba (not navigable in its lower course), the Pangani, Wami, Kingari, Rufiji, Mbemkuru, and the southern boundary river Rowuma; in the Tanganyika the Mlagarassi; in the Cictoria-Nyanza the Kagera. In the low-lying localities the climate is genuinely tropical: in the mountains and plateaus it is very much cooler. In Uhehe, for instance, throughout the cold season night-frosts are not infrequent. The plant-life varies between impassable primitive forest, bush, and grassy prairie, to the barrenness of the wilderness; similarly the fauna. The population shows similar variety; in the more favored regions it is comparatively dense; but the poorest stretches one can consider almost uninhabited. It is estimated at 7,000,000 and consists chiefly of Bantu tribes. In the north live the (Presemitic?) Massai; in the south genuine Zulus. Principally on the coast but also in the interior are found Arabs, much blended with the negro, who have emigrated thither, and Indians. Besides there are to be met in smaller number representatives of all the tribes possible of Asia, South and North Africa. In 1905 the census of whites gave 1,324, mostly officers, officials, and traders, but with an increasing number of men engaged in industries, plantations, and even agriculture. Exports: Ivory, hippopotamus teeth, caoutchouc, copal, petrified and resinous wood, timber, mangrove bark, sesame, negro peas (chiroko), negro millet, maize, cocoanuts, copra, coffee, negro butter, some cotton, manilla hemp, horns, live cattle, mats, grass-woven articles, etc. Exports, forwarded also over the inland boundaries in the north (Uganda road), and the south, not only by sea, were valued, 1903, 7,054,207; in 1904, 8,950,565 marks. Of which goods to the value of 1,284,280 marks were conveyed across the inland boundaries. Imports were: Cotton goods, shelled rice, iron and ironware, wine, beer, butter, grease, cheese, ham, bacon, preserves, petroleum, fruit, meal, tobacco, etc.; value, 1903, 11,188,052; 1904, 14,338,880 marks, of which the value of goods transported over the inland boundary reached 1,448,307 marks. Of the minerals, gold is found in good quantity in Abbau; also graphite, mica, garnet, together with workable layers of coal.

East Africa has safe harbors, the best of which are Tanga, Daressalam (swimming dock), Kilwa, Mikindani. The German East African line maintains a 14 days' connection from Hamburg via Naples, through the Suez canal, besides a monthly trip around the Cape of Good Hope; and it has, also, a branch line from Bombay via the German East African ports to Cape Town, which makes the journey in both directions every month. In addition is a monthly connection through the Messagieres Maritimes (Marseilles), the Austrian Lloyd (Brindisi), and monthly from Aden by the British India line (in connection with the P. & O. steamships. The German steamboat *Ukerewe* plies on the Victoria-Nyanza; on the Tanganyika the *Hedwig von Wissmann;* on the Nyassa the *Hermann von Wissmann.* Of existing railroads, there can be mentioned the line from Tanga to Mombo, 126 km. in length (further construction is in progress), the line from Daressalam to Mrgoro, whose entire construction is planned, and part already completed; and a third railroad is being financed in the south from Kilwa to Wiedhafen. Otherwise trade is arranged by carriers. The stations in part are connected by very good roads. The customs-territory is joined to the Zanzibar cable; in the interior there are numerous telegraph lines. Apart from the railroads, postal communication is carefully provided for by messengers and carriers. The official currency is the German imperial rupee of 100 heller, equalling 1⅓ marks. The German East African Bank at Daressalam and the large commercial houses provide for the exchange of money. In the interior barter continues almost exclusively. Daressalam is the seat of government. The protectorate is divided into 22 administrative districts, of which hitherto 16 are under civil authority; the introduction of a purely civil administration is being undertaken. The most important places are: Daressalam, Tanga-Wilhelmstal, Pangani, Kilwa, Morogoro, Upapua, Tabora, Moschi, Muansa, Langenburg, Bismarckburg.

Kaiser Wilhelmsland, the German portion of

New Guinea, was placed under German protection 15 May 1885. Of an area of 179,000 sq. km., it is a distinctly tropical country, with a narrow coast 800 km. in length rich in inlets, and with mountain ridges rising to height of 4,300 m. in the still unknown interior. Coral reefs are deposited before the coast. The climate is hot — on the coast a yearly average of 26° C.— and damp; the downpours occur during the entire year. The localities exposed to the southeast tradewinds which blow during the entire year enjoy more frequent rains. The sections reached by the northwest monsoon from October to March have less rains. Of the numerous, rapidly-flowing rivers, the Kaiserin Augusta, the Ramee, the Gogol, and the Markham are navigable for large vessels. The plant-life is exceedingly luxuriant, originally primeval forests everywhere, with lofty trees. The population consists of Melanesians and Papuans, who together number about 100,000. In 1905 there were 128 Europeans in the colony. Exports are: Copra, timber, cotton, tortoise-shell, mother-of-pearl, etc., whose value in 1903 reached 243,645, and in 1904 54,272 marks. Imports were chiefly food, tobacco, ironware, textiles, whose value in 1903 was 798,857, and in 1904 566,503 marks. The steamship connections are the Imperial Steamship line via Hongkong, and the Australian-Japanese line from Sydney, both monthly. There is also connection with the Netherland-Indian cable. Friedrich Wilhelmshafen is seat of the district administration.

Bismarck Archipelago, acquired 15 May 1885, consists of New Pommerania, New Mecklenburg, the Admiralty Isles, New Langeburg, New Hanover, the Solomon Isles, Birka, and Bougainville, with a number or smaller islands, with total area of about 61,000 sq. km. All the islands are mountainous — the Kaiserberg in Bougainville is 3,067 m. in altitude. A tropical ocean climate prevails, with the least rainfall in July–October. The population consists of Melanesians and Papuans. In 1905 there were 335 whites. Exports were chiefly copra, mother-of-pearl, tortoise-shell, coffee; value, 1903, 963,-066 marks; 1904, 1,210,071 marks. The imports consisted mainly of meat, fish, textiles, tobacco, and metalware; value, 1903, 2,114,957 marks; 1904, 1,759,156 m. The currency is German imperial — in the interior shell-money (Dewarra). Steamer and cable connection exists with Kaiser Wilhelmsland. A place of settlement is at Simpson harbor in New Pommerania. There is now the office of the district. Seat of the Governor (for German New Guinea, Bismarck Archipelago, and Kaiser Wilhelmsland) is Herbertshöhe in New Pommerania.

The Carolines, Pelew Isles, and Mariana, were acquired by purchase from Spain in 1899, and have a combined size of 2,676 sq. km. The most of these islands are mountainous, of volcanic origin; the others, especially the eastern, are coral islands. Extended reefs surround also the mountainous islands, upon which the plant-life is very luxuriant, while in the low-lying islands it is very scanty. Fountains and brooks are found only in the mountainous islands. The climate is in general tropically damp, rich or poor in downpours according to the direction of the monsoon or tradewind. The territory is divided into three districts of government — West Caroline (Jap.), East Caroline (Ponape), and Mariana (Saipan). The first has 13,264 natives, and 47 Europeans; the second, 25,000 natives, and 92 Europeans; the third, 2,508 natives, 31 Japanese, and 22 Europeans. Exports consisted of copra, tortoise-shell, mother-of-pearl; value, 1903, 870,375 m.; 1904, 479,990 m. Imports were: Woven-goods, tobacco, food, etc.; value, 1903, 852,848; 1904, 710,140 m.

Marshall Islands, acquired 15 Oct. 1885, about 400 sq. km. in area, consist of 33 separate coral isles and atolls in two rows — the eastern chain with 15, and the western with 18 atolls. The climate is very warm and damp — uniformerly tropical (27°C.) with 300 rainy days and a precipitation of 465,000 mm. The pure Mikranesian population is about 15,000 in number — 84 whites lived there in 1904. The chief exports are copra, mother-of-pearl; its value, 1903, 522,210 m.; 1904, 583,353 m. Imports are chiefly woven-goods, tobacco, and ironware; value, 1903, 497,792 m.; 1904, 444,198 m. The imperial steamer *Oceana* of the Jaluit line makes the passage at six weeks' interval. There is a postal agency at Jaluit, on which island Jabor is the seat of the chief of the country and Nauru of the district head.

Samoa (Navigator's Islands). The islands Sawaii (1,691, sq. km.), Upolu (868), Manono (8.5), Apolima (4.7), together 2,572 sq. km., were conceded to Germany on 2 Dec. 1899, by treaty with England and the United States. They are all of possible volcanic origin. Sawaii and Upolu have still active volcanoes (1,646 and 975 m. in altitude). The climate is tropical. The rains are brought in the summer months by the northwest wind and reach a precipitation of 3,400 mm. From May to September the southeast tradewind blows, which produces little rain. The wealth of water in the brooks is hence very changeable. The coast is surrounded by coral reefs; there are no good harbors. The construction of plantations (cocoa and caoutchouc) increases of late years, so that Chinese laborers must be introduced. Exports chiefly copra, fruits, and lately, also, cocoa; value, 1903, 1,384,507 m.; 1904, 1,674,881 m. Imports are: Articles of clothing, biscuits, meat, etc.; value, 1903, 2,681,405 m.; 1904, 2,306,878 m. Steamers of the Oceanic Steamship Company arrive every three weeks from San Francisco via Pago-Pago (Tutuila) to Sydney. Direct connection is made from Pago-Pago to Apia by the *Maori*. The Governor's seat is at Apia on Upolu.

Kiautschou. Occupied 14 Nov. 1897 (treaty compact of 6 March 1898 for 99 years), embraces only the Bay of Kiautschou with islands, tongues of land, and bordering hills, together about 551.7 sq. km. in area. In a zone or circuit of 50 km. further landwards is the consent of the German government necessary for all measures. The bay, deeply indented and commodious as a harbor, is surrounded by a jagged bare chain of hills, the forerunners of the Schantung mountains. The climate is considered the healthiest in China. The winter is dry and moderately cold; the summer warm and very damp. There are no navigable rivers. The hills are bare, but only through Chinese mismanagement. The rear country is rich in coal, which will be exploited. It is also said to contain gold, mica, and iron. The population of treaty land in 1905 was in the city limits of Tsingtan 28,477 Chinese, 207 Japanese, 1,225 Europeans (besides the military, 1,879 whites and 67 Chinese). The population of the suburban territory is computed at 100,000 — that of the 50 km. zone is not known. There are large harbor buildings and on the site of the Chinese town was built the city of Tsingtau, seat of the government. The Schantung railroad leads therefrom to Tsinanfu, 45 km. Exports: Chiefly straw mats and silk pongees from 1 Oct. 1903 to 30 Sept. 1904, in value 14,700,000 m. In the same period 1904–05 they reached 20,000,000 m. Imports consist mainly of goods in transit. Those not of Chinese origin were valued, without the railroad and mining materials, in 1903–04 at 24,000,000 marks, and a year later at 37,000,000. The value of imported goods of Chinese origin for 1904–05 reached over 12,000,000 marks. Schantung taels and Mexican dollars are currency. The German East Asian Bank has the right to issue its own paper money. Direct connection with Germany is made by the Hamburg-American line, and the Imperial Steamship line. L. SANDER,

Secretary of the German Colonial Association, Berlin.

23. Germany — The Germans in the United States. *Some Statistics* — The Federal Census of 1900 places the number of persons living in the United States and born in Germany (more correctly the German Empire) at 2,663,418 among a total white population of 66,809,196. But the term German being not a political, but rather a racial one, the Germans from other sources (Austria-Hungary, Switzerland, Russia) are to be included. A conservative estimate fixes their number so as to swell the immigrated German population in the United States to 3,060,186. As to the number of persons of German blood in the United States Emil Mannhardt (in Deutsch-Amerikanische Geschichtsblätter, October 1903) makes the following estimate: German immigration and their offspring before 1830, 12,046,919; immigration during the 19th century and first generation of their offspring, 8,714,233; the following generations, 4,716,431; making a total of 25,477,583. The 'Handbuch des Deutschtums im Auslande' (Berlin 1904) arrives at a figure of about 11,000,000 persons in the United States speaking the German language, which is probably too high, considering the rapidity with which the generations born in this country adopt the English language as a principal if not exclusive means of expression.

History — The history of the Germans in the United States is first of all the history of their immigration. The characters of and the motives actuating the German immigrants to leave their native land may be largely inferred from the political, religious, and economic history of the countries they came from notably of the states now forming the federation of the German Empire. It has been said (by Friedrich Kapp) that in the cultural and political conquest of the new continent the Latin races (notably the French) fought with officers having no army to back them, that the English had both officers and army, but that the Germans had the army but lacked the officers. While the history of the United States is largely the history of the expansion and constructive adaptation of Anglo-Saxon institutions to new environments, one looks in vain for a similar process with regard to German ones. Indeed there were none to expand, since the German body politic after the Reformation had proved to be sick and decayed, crumbling into ruins, and totally unable to hold the civilization and culture of a great modern nation. From a people without a great concerted national life, without vigorous national policy nor even a national consciousness, no constructive political ideas were to be expected, and when, during the 19th century the German immigrants had political ideas and ideals, these were entirely untried, unpractical, and unable to generate a strong political and social life, especially in competition with Anglo-Saxon law and statecraft.

In the beginning of the 17th century we find traces of larger bodies of German Protestants being settled in Virginia. Conspicuous as individuals we note Peter Minuit from Wesel, Governor-General of New Netherlands and founder of New Amsterdam (later New York) in 1626, and Jakob Leisler from Frankfurt a/M, the martyred forerunner of a republic free from English rule. Yet the German-Americans rightfully date the beginning of their history on American ground from the 6th day of October, 1683, when, from the good ship *Concord*, 13 Quaker and Mennonite families from Crefeld headed by the learned lawyer, Franz Daniel Pastorius from Frankfurt, landed in Philadelphia. The 6th day of October has, since 1883, become the festival *German day*, so regarded by an ever-increasing number of German-Americans. These settlers had bought land from William Penn, on whose solicitation they came, and settled in Germantown, near Philadelphia, as the nucleus of the vast German population of the State of Pennsylvania, which for some time was in danger to become German in language, officially and otherwise. These Pietists (the German species of Puritans) emigrated, like the so-called pilgrim fathers of New England, for religious reasons, but with no political-theoretical aspirations nor with despotic intolerance toward others. Besides their various forms of religion they brought their skill as farmers and craftsmen ("vinum, linum et textrinum," says the seal of Germantown). Christopher Saur, the printer, published his first German Bible at Germantown in 1743, the first Bible in a European language printed on the western hemisphere. And, also, from the midst of these German sectarians, came the first documentary protest against negro slavery.

From this beginning the German immigration may be divided into four distinct periods: the first from 1683–1820, the second from 1830–1871, the third from 1871–1894, the fourth up to date. The economic cause, of course, has been present and even prevalent in all of the four periods, as with the other races, prompting Germans to come from overcrowded conditions into a land with vast resources, with abundant land to colonize and prosper upon, into a country with greatly superior chances for a living not only, but for rising in the social scale. It is in the concomitant causes that the four periods differ Up to the Napoleonic wars the German people as such had hardly any political life or concepts or ideals at all; what drove them across the Atlantic, beside famine, calamities of war and peace, was the oppression of their religious and social individuality, the despotism over soul and body. But even during the 19th century German Protestants, Lutherans or others, have sought refuge in the United States from State interference with their religious views. Yet this religious motive ceased to be a decisive one after the war of liberation had engendered political aspirations and national ideals, and the second period is clearly characterized by a desire to escape the reactionary Metternich system at home and the persecutions resulting from the failure of the German revolution, as well as to participate and even to improve upon political conditions and social ideals of the native American people. Conditions in the newly-founded German Empire sent forth, in the third period, the vast overflow population, actuated, secondarily, not by doctrines of a republican democracy but by the international, Marxistic dogmas of socialism. The German anti-socialist legislation during the eighties, no doubt, influenced countless numbers of socialistic workingmen to seek the other shore. Socialism in the United States may be traced principally to this German influx. The marvelous growth of prosperity, of industrial and commercial efficiency, under the regime of William II, has resulted, in the fourth period (1895 to the present time), in an emigration from the Empire comparatively very insignificant, the 30,000 mark of annual German immigrants into the United States, never having been attained again since 1897. It may be inferred that these latter-day crossers of the Atlantic, aside from the numbers shunning military and other civil duties in the realm of the Emperor, as contemporaries of their vigorous-minded ruler and belonging to the post-bellum generation of proudly self-conscious and patriotic Neo-Germans, are far less prone to hail the United States as the Mecca of political and social freedom, such as did the generations before them. It is very likely that a great number of these late comers have not come to stay, but only to gather information and experience, and finally to repatriate themselves. The German vital statistics for the period of 1895–1900 seem to point in this direction, since they record, for those five years, a surplus of nearly 100,000 of immigration over emigration for the Empire. In all probability the great immigration of Germans into the United States has ceased never to be revived.

The ups and downs in industrial prosperity of the two countries involved are clearly mirrored in the statistical tables. So German immigration is at a low-water mark during the war of secession, as well as during the great business depression from 1873–1879, which partly coincided with an unprecedented business boom in the Empire. The succeeding turn in the scales then, in the years 1880–1894, brought over two millions of Germans into the United States.

Politics and War.— The Germans in America, from causes connected with their history in Europe, never took such an important part in the shaping of American institutions as the Anglo-Saxons, or even the Irish. Compared with the latter they are too highly individualistic ever to submit to such clannish party allegiance constituting the strength of the Irish people and making for their success in politics. The failure of the German Revolution of 1848 led an unusually large number of educated Germans into the American republic, but with the one exception of the late Carl Schurz (q.v.), politician, reformer, statesman, diplomatist, writer, general, and journalist combined, none of them rose to a position of first rank in American history. Their doctrinarianism, which they liked to call idealism, condemned so many of their good intentions to remain fruitless, at least to take no direct practical shape. It remains to be shown by historical investigation how much, indirectly, they contributed to form modern American policy. It stands though to their credit that no race stood more loyally, and more solidly to the cause of the Union, in peace as in war. Lincoln's coming to the foreground was greatly due to their assistance. The army lists of the war of secession include over 180,000 Germans, among whom Franz Sigel, Peter Osterhaus, and Willich are conspicuous as generals, and the resolute military action of German 'Turner'-soldiers saved Missouri for the Union cause at the beginning of the conflict. Nor will the names of Mühlenberg, Herkheimer, de Kalb, and Steuben ever be forgotten in the history of the War of the Revolution. The school- and text-book invective, though, against the Hessian mercenaries, who, by the way, fought very bravely, might well be toned down to tally with the appreciation of Scotch, Irish, or other mercenaries pressed into the service by the well-known British recruiting methods of that time. As to the 'Winning of the West,' President Roosevelt's essay on the subject needs less a revision than an important addition relating the paramount importance of the German pioneer farmer. There is a task for a historian to decipher correctly the frequently obliterated documents of German beginnings and achievements. The loss of the language has proved, no doubt, also a loss, sometimes irretrievable, to correct historical statement.

Social Life.— As a race the Germans (from the standpoint of Völkerpsychologie as Wundt conceives it) brought with them their language, their religion, and their customs (Sitte). The struggle to retain their language as a dear inheritance was and is fought by them with varied success. On the whole, fought against so great odds, it is far from being lost. May there be, with the declining immigration, no doubt, a loss numerically, as each succeeding generation is less prone to cherish this greatest national shibboleth, the rest, and they are likely to be the best, will loyally stick to the vernacular. In the family, partly in the schools (Catholic and Lutheran Germans are equally tenacious in this respect), in the churches, and in their countless clubs (athletic, singing, benevolent, military, etc.) the German language has her sway. In the farming districts of the West as well as in the large cities with a considerable German population the language is handed from generation to generation, a language, moreover, which many of the immigrants, by intermingling with representatives of all the German tribes, learn only in this country to assimilate to the literary language, the "Schriftdeutsch.." As both a linguistic and an ethnographic curiosity the so-called Pennsylvania-Dutch dialect of several counties in Pennsylvania deserves mention, with its interesting admixture of English to an essentially Rhenish-Franconian structure.

But even here we have no record of higher or highest achievements. The non-sectarian German schools, founded by the "forty-eighters," have gone out of existence. Lutherans and other German sects still maintain a number of secondary schools and theological colleges. but have been unwilling or unable to develop them into real colleges with a distinctly German culture. The dream of a German university on American ground was never realized. The German-American Teachers' College in Milwaukee, founded by German freethinkers (non-religious persons, organized or not) is something of a German 'Lehrerseminar' without its theological accessories.

Countless is the number of clubs in this country in which Germans organize on the lines of provincial, tribal, dialectal requirements. In this they now outdo, from the immanent stagnation of German life in this country, their countrymen in Europe. But more amiable, directly or indirectly influencing American life around them, they become in their singing, rifle, military, and athletic societies. Addicted, almost as a body, to the moderate use of stimulants, nicotine or alcoholic, the latter in the form of wine or beer, they have materially contributed towards making popular life and enjoyment in America less stern, less rigidly puritanic, less dull, and have added color and music to it. Their Sängerbünde, Männerchöre and Sängerfeste are a decided gain for American life, combining, for the average man, most felicitously, thoughtful practice of art, which is always a refining element, with social enjoyment. The peculiarly German form of athletics represented by the 'Nordamerikanischer Turnerbund' is perhaps too military in its discipline to suit the Anglo-Saxon taste. This association, spread all over the United States, has well deserved, however, of the country by its agitation for introducing physical culture into the public schools. Otherwise this organization, taking up the ideas of the German Liberals of '48 and, of late, combining them with radical and socialistic tendencies, stands in glaring contrast to its sister organization in the German Empire and Austria, which demonstrates and practices more strictly the patriotic and godfearing spirit of its founder, the venerable Ludwig Jahn.

Cultural Activity.— The Germans as a race, collateral with their lack of constructive political ability, have evidenced no genius for civic organization, none of the great American centres of industrial and commercial life owing its origin to Germans, excepting Peter Minuit who acted in the interests of Holland and Sweden. Yet, individually, they take their full share not only in the development of agriculture and industries, but also as inventors, business organizers, engineers, etc. Mergenthaler, the inventor of the linotype, may stand for a host of names, demonstrating that the inventive genius of the race that gave the world the art of typesetting and gunpowder, has not disappeared. Jakob Astor, the founder of the business dynasty bearing his name, set the pace for many more captains of industry. Bridge-building, the refining of sugar, and the brewing industry may be called pre-eminently, if not exclusively, the work of Germans, and the names of Röbling, Havemeyer, Spreckels, Pabst, Annhäuser-Busch will be forever connected with their history. Science and scholarship, of course, have had and still have many able German representatives in the American colleges and universities and elsewhere, but none to compare with the splendid array of geniuses in the old countries. It seems that the higher productive power of the scientific intellect did not come over with the immigrants. But here, referring to President Schurman's (of Cornell University) statement, the Anglo-Saxon elements, with the possible exception of one or two minds, have by no means shown up more efficient or more productive. To enumerate a list of names, therefore, appears to be unnecessary.

More nationally the genius of a people expresses itself in literature, art, and music. There is, however, no Emerson, no Whitman, no Poe, no Hawthorne in German-American literature. Much has been written, in prose and in verse, but very little, if anything, rises above mediocrity or will stand as a lasting acquisition in German literature. The novels of Sealsfield-Postl of course hold their distinctive rank in the history of the German novel, but the poems of Solger, Nies, Castelhun, Krez, Edna Fern, the essays and feuilletons of Carl Schurz, Holls, Robert Reitzel, and many others will soon have none but historical interest. German, as the medium of all these literary products, seems to have no intrinsic formative powers in America, for reasons not far to seek. Moreover, it is perfectly obvious to the close observer that the real genius and spirit of German classical literature and philosophy was alive and bearing fruit in Emerson and the other New England Transcendentalists, while the literature of German America was steeped in the shallow insipidities of the 'Force and Matter'— philosophy of Büchner, Vogt, and Moleschott, winning for the Germans from Americans the reputation of being gross materialists. The bulk of literature, periodicals not books, coming from the German presses in the United States is quite considerable, but the quality does not at all tally. Of the German-American newspapers the 'New Yorker Staatszeitung,' with its excellent literary Sunday paper of partly original contributions, can best claim any eminence, politically, as a literary sheet, or as a newspaper.

Playwrighting there has been none to speak of for the German-American stage. While the history of the German drama during the 19th century was more brilliant, as a whole, than that of any other literature, the German stages in this country felt satisfied in reproducing the plays written in the mother country. But the efforts of the New York Irving Place Theatre, under Heinrich Conried's management, have been a model for the whole country to show what can be done, even with modest means, not only in the art of skillful and artistic ensemble play, but also in serving the people with a repertory of serious dramatic art. The stage as an institution of æsthetic and ethical culture, such as Schiller wanted it, will perhaps take permanent form, under the stimulus of German influence, in the proposed National Theatre at New York.

Music, although universal in its means of expression, this truly divine art, enters into the life of every German, unless he be completely anglosaxonized. It is undisputed that the Germans have performed a mission, and are still doing so, in bringing with them what is perhaps the most adequate expression of the German soul, German love of music. This expresses itself at every step where Germans are gathered. But, and this is the greatest, above the layer of popular music practice rises the cultivation of the classical in this art, symphonic or operatic, the rise and history of which is forever connected with the lives of Theodore Thomas, Anton Seidl, Walter Damrosch, to name only the most eminent of bygone times. But even here the productive power lags far behind the reproductive; the Germans have produced no composer on this soil, even none to compare with MacDowell.

To enter into the causes of the failure, not only of Germans, but also to some degree of Anglo-Saxons coming here, to furnish the world with genius of the high creative order, is not the task. The leveling influence of democratic doctrine, which best befits mediocrity, certainly has something to do with it. Nor must it be overlooked, that much of the higher service done by Germans in this country came from such as would strenuously object to being classed as German-Americans, they are and remain Germans. The German-American, on the other hand, of the more or less anglosaxonized type, has yielded, as facts demonstrate, nearly always just those elements of his racial soul from which spring forth the most excellent cultural achievements of the race. The question, if Germans in the United States will obtain a stronger beneficial influence on American civilization, rests on the determination and on the possibility of drawing new, refreshing, and strengthening currents from the great mainspring of German culture; currents of quality, not of quantity, *i. e.*, ideas and ideals. Only then will they have reason to be proud of what Richard Wagner conceived to be the essential German characteristic. "To be German," he said, "means to do things on account of their intrinsic values."

Bibliography.— An excellent guide (catalogue raisonné) to the literature on the subject is contained in Dr. Julius Goebel, 'Das Deutschtum in den Vereinigten Staaten von Nord-Amerika' (München 1904). This pamphlet is a spirited introduction into the whole subject written from a moderately Pan-German point of view. Merely bibliographical in character is 'A List of Works Relating to the Germans in the United States,' compiled under the direction of A. P. C. Griffin, chief bibliographer of the Library of Congress. This list represents the contents of the Library of Congress on the subject, but is far from being complete or even from containing the more important literature with reasonable completeness. For a negative statement, *i. e.*, what the Germans have failed to accomplish in America, see the chapter 'Die Amerikaner und die Deutschen' (pp. 1–51) in 'Hugo Münsterberg, Die Amerikaner' (Berlin 1904). Of the periodicals devoted to the study of the history and influence of Germans in the United States th 'German American Annals' (succeeding the 'Americana Germanica') flourishes beside the excellent 'Deutsch-Amerikanische Geschichtsblätter,' a quarterly edited by the 'Deutsch-Amerikanische Historische Gesellschaft von Illinois.' Of the older writers on German-Americans, Friedrich Kapp, Oswald Seidensticker, and H. A. Rattermann rank highest.

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Germany, Weights and Measures. Since 1 Jan. 1872 the French metrical system of weights and measures has been in force throughout the German empire. It had previously been adopted by a law of the diet of the North German Confederation, and under the constitution of the new German empire the new system of weights and measures was introduced into the south German states according to the terms of separate treaties previously concluded by them with the North German Confederation. The following are the German names of the various denominations of the metric system:

Measures of Length —

Das Millimeter or Der Strich	=	the Fr.	Millimètre.
" Centimeter or " Neuzoll	=	"	Centimètre.
" Decimeter	=	"	Décimètre.
" Meter or Der Stab......	=	"	Mètre.
" Dekameter or Die Kette	=	"	Decamètre.
" Kilometer	=	"	Kilomètre.

The new German mile is equal to 7,500 metres.

Measures of Surface —

Das Quadratmeter or Der Quadratstab	=	the Fr. sq.	Mètre.
" Ar	=	"	Are.
" Hektar	=	"	Hectare.

The unit of the measures of capacity is *das Kubikmeter* or *der Kubikstab* — the French *stère*.

In liquid measure the following terms are used:

Das Liter or Die Kanne......	=	the Fr.	Litre.
" Hektoliter or Das Fass..	=	"	Hectolitre.

A measure equal to half a liter is called a *Schoppen*, and one equal to 50 liters a *Scheffel*.

Measures of Weight —

Das Milligramm	=	the Fr.	Milligramme.
" Decigramm	=	"	Centigramme.
" Centigramm	=	"	Décigramme.
" Gramm	=	"	Gramme.
" Dekagramm	=	"	Décagramme
" Kilogramm	=	"	Kilogramme.

Half a kilogramm is one *Pfund*; 50 kilogramms, or 100 *Pfund*, make one *Centner*; and 1,000 kilogramms one *Tonne*. See WEIGHTS AND MEASURES; METRIC SYSTEM.

Ger'micides, agents used to destroy or to hinder the growth of microscopical forms of plant and animal life.

Germicides may be grouped under three general heads, those that act mechanically, those that destroy life by physical means, and those whose action is chemical. Inasmuch as each particular germ is an individual with its own particular characters, definite methods for its killing must be devised. Thus it is well known that quinine, for instance, is very active in destroying animal parasites, such as the malarial organism, but it is practically of no service in combating a large number of vegetable forms; and *vice versa*, many substances which are capable of destroying plant germs are inefficient when applied to animals.

Of the physical agents, heat, light, cold, and electricity, heat is the most satisfactory. High degrees of temperature will destroy all forms of parasitic life. The animal forms succumb very readily to the influence of heat, and most of the plant parasites are destroyed by it; but whereas heat may be applied with great success as a germicide in general disinfection, it naturally cannot be used as a general agent on the body. The red-hot iron in the form of a galvanocautery, or a heated wire, makes a most efficient form of cautery to destroy the poison of dog-bite, or to destroy localized forms of tuberculosis, etc., but heat is thus limited in its application.

Cold is not an efficient germicide. Ordinary freezing temperature (32° F.) kills but very few forms of either plant or animal organisms. Even the extreme cold of liquid air does not kill bacterial spores.

Light, especially sunlight, is a very efficient germicide, but the exposure must be continued for an appreciable length of time. Sunlight is nature's great germicide. Within recent years the light given by the Röntgen ray (X-ray), by radium, polonium, thorium, and similar agents, has been used with great success in the treatment of certain parasitic skin-diseases, but whether the effects are due to any germicidal action of the light, or to a normal tissue stimulation, is not decided. It seems from experiments thus far recorded that these forms of light are not definite germicides. Various colored lights, particularly red and amber, are known to restrict the growth of certain forms of bacteria. They do not, however, destroy them. This principle is made use of in smallpox hospitals and similar institutions, but it does not seem that the results are sufficiently striking to base any general deductions thereon. Electricity is not an efficient germicide. The passage of electrical currents through water does not necessarily kill the bacteria contained therein, notwithstanding the many claims made by enterprising manufacturers of electrified water, said to be made germ-free by the electrical current. What the future may reveal along this line of experimentation it is impossible to prophesy, but thus far satisfactory evidence of the germicidal effects of electricity are lacking.

Chemical germicides are numerous, both for external and internal use, although intracellular germicides, or those that can be used within the tissues of the body, are much to be desired. The list of chemical germicides is enormous. Thousands of different agents have been used and these exhibit varying degrees of germicidal activity. As has already been said, each form of germ possesses its own powers of resistance, and each germicide its ability to kill in varying degrees of strength. The germicides in popular use are chlorinated lime, carbolic acid, creosote, alcohol, boracic acid, ammonia, formaldehyde, hydrogen peroxide, iodine and its preparations, mercury and its preparations, volatile oils of cinnamon, mustard, peppermint, turpentine, pennyroyal, oxygen, quinine, salicylic acid and its derivatives. Of these for external use, for use in closets, in bedding, for linen, etc., carbolic acid in the percentage of 1 to 50 of water, formaldehyde in percentage of a teaspoonful of the 40 per cent solution of the gas to a quart, bichloride of mercury in the proportion of 1 part to 1,000, are the most practical and convenient germicides. So far as is now known, quinine is about the only efficient chemical substance that can be used as an intracellular germicide. It has the singular property of poisoning the malarial parasites within the red blood-cell without poisoning the blood-cell itself, a selective property which most poisonous agents lack.


Courtesy of the Booklovers Magazine.

JEAN LÉON GÉROME.

The great germicide of the human body, and the one that protects it in its various struggles with different forms of parasites is the blood-serum. This is a very efficient germicide, a full consideration of the action of which will be taken up under the heading of IMMUNITY. Consult: Buck, ‹Reference Hand-Book of Medical Sciences› (1902), article on *Germicides;* Harrington, ‹Practical Hygiene› (1901). See BACTERICIDE; BACTERIA; DISINFECTION; GERMS; IMMUNITY.

Germinal, zhăr-mē-näl, the 7th month of the first French republican calendar, 21 March–19 April.

Germina'tion, in botany, the first act of growth which takes place in an embryo plant. See SEED.

Gernsheim, Friedrich, frēd'rĭн gĕrns'hīm, German composer: b. Worms 17 July 1839. He studied at the Leipsic Conservatory, became an instructor in the Conservatory of Cologne in 1865, and in 1873 also Kapellmeister of the theatre there. In 1874 he was appointed director of the Rotterdam school of music, and in 1890 of the Stern Choral Union of Berlin. His works include chamber-music, three symphonies, and other instrumental compositions: the song-cycle ‹Hafis,› for solo, chorus, and pianoforte; and various vocal compositions.

Gérôme, Jean Léon, zhôṅ lā-ôṅ zhā-rōm, French painter: b. Vesoul, Haute-Saône, 11 May 1824; d. Paris 10 Jan. 1904. He was a pupil of Delaroche, who early credited him with originality and style. When he exhibited his ‹Fighting Cocks› in 1847, Théophile Gautier wrote in *La Presse,* «Let us mark with white this lucky year, for unto us a painter is born.» He followed Delaroche to Rome in 1848, and visited Russia and Egypt. He first showed his power in some Egyptian studies, but only reached the level of intensity and vividness which characterized all his succeeding work in his ‹Duel after a Masked Ball.› This was followed by his ‹Death of Cæsar.› In 1855 he exhibited ‹The Age of Augustus,› a picture in which were harmoniously blended marvelous historic faithfulness with a powerful allegory by which the culmination of pagan civilization, and its gradual paling in the dawn of Christianity was finely suggested. His grasp of classic motifs was united to an extraordinary mastery of archæological detail, and his Roman ‹Gladiators in the Amphitheatre› (1859), and ‹Phryne before her Judges› (1861), are startling in the impression which they convey of antique life in its movement, sentiment, and passion. In this special department of historical genre Gérôme easily led the European painters of his century. See Claretie, ‹Peintres et sculpteurs contemporains› (1884); Cook, ‹Art and Artists of Our Time› (1888); Van Dyke, ‹Modern French Masters› (1896).

Gerona, hā-rō'nä, Spain, a city and capital of the province of Gerona; 65 miles from Barcelona. It contains a beautiful Gothic cathedral of the 14th and 15th centuries. The town has undergone several notable sieges, particularly in 1653, 1684, 1694, 1706, and 1809, on each occasion by the French. Pop. 15,407. The province of Gerona has an area of 2,264 square miles. Pop. (1900) 299,287.

Geronimo, jĕ-rŏn'ĭ-mō, Apache chief of the Chiricahua band. In 1884–6 he became noted as the ring-leader in the harrying of Arizona and New Mexico (see APACHES). Gen. Crook forced him to a stand on 25 March 1886, but Geronimo refused to surrender except for two years, the band to be sent East with their families and then replaced on the old reservation. Crook accepted the terms and started for Fort Bowie, but on the march the entire band slipped away to the mountains and began the old forays again. The subsequent criticism of Crook, as the Indians' dupe against the protests of the settlers, caused his replacement by Gen. Nelson A. Miles, who gave the Indians no rest, till Geronimo once more surrendered, this time on condition of being sent out of Arizona. Gen. Miles ordered them sent to St. Augustine, but Geronimo and 14 others were sent to Fort Pickens, Fla., instead. He has since been held as a military prisoner at Fort Sill, Oklahoma.

Gerontes, gĕ-rŏn'tēs, in ancient Greece, a number of magistrates of Sparta who, with the ephors and kings, had the supreme power in the state. They were not eligible for election before they had attained the age of 60 years. Their number is variously stated at 20 and 32.

Gerrish, Theodore, American Methodist clergyman: b. Houlton, Maine, 19 June 1846. He served during the Civil War in the 20th Maine regiment, and was wounded four times; later entering the Methodist itinerant ministry. His publications include: ‹Reminiscences of the War,› ‹The Blue and the Gray,› ‹Life in the World's Wonderland,› etc.

Gerry, gĕr'ĭ, **Elbridge**, American statesman: b. Marblehead, Mass., 17 July 1744; d. Washington, D. C., 23 Nov. 1814. He was a member of the Continental Congress 1776–80 and 1783–5; delegate to the constitutional convention in 1789; member of Congress from Massachusetts 1789–93; commissioner to France 1797–8; governor of Massachusetts 1810–12; and Vice-President of the United States 1813–14. It was during his term as governor that an unsatisfactory redistricting of the State took place, in which he was supposed to have taken part, whence arose the term «gerrymander» (q.v.). See Austin, ‹Life of Elbridge Gerry, with Contemporary Letters› (1828–29).

Gerry, Elbridge Thomas, American lawyer and philanthropist: b. New York 25 Dec. 1837. He was graduated from Columbia in 1857, was admitted to the bar in 1860, and was a member of the State constitutional convention of New York 1867. Subsequently he became an associate of Henry Bergh in the American Society for the Prevention of Cruelty to Animals, of which he was for many years vice-president. In 1874 he was the leading organizer of the Society for the Prevention of Cruelty to Children, of which he was the president in 1876–91, and which became so closely identified with his name as often popularly to be termed the Gerry Society. He was chairman of the commission on capital punishment which substituted execution by electricity for that by hanging, in New York State (1886–8). He also held many important offices of trust, and became known for his interest in yachting affairs, having been commodore of the New York Yacht Club in 1886–93. He is a grandson of Elbridge Gerry (q.v.).

Gerrymander, gĕr'ĭ-măn-dėr (hard g: now chiefly used as a verb), the arranging of election districts by one party in a State so as to concentrate its opponent's majorities and scatter its own, thus giving itself as many with light majorities and its rival as few with heavy ones as possible. Many States are to some extent gerrymandered by nature, the heaviest vote of one party being compacted into a minor section: Indiana and New York are notable cases — the one on account of the southern agricultural population having been kept from expansion by more energetic streams of a different character, the other from the development of a vast city at political odds with the rural parts. Law usually and fairness necessarily provide that the State shall be districted in solid blocks of contiguous territory, so that (subject to the above limitation) the district elections shall correspond roughly to the popular majorities in the State. But since early in the century, all parties in turn have often violated political equity by establishing artificial gerrymanders when in power; sometimes creating a popular revolt which has cost them the object of the scheme, but the rival party has rarely learned wisdom from that result, usually reversing the gerrymander for its own profit. As counties are fair models of what election districts should be, the gerrymander is generally worked by disregarding them; but the following illustration of its working with them is the simplest form. Suppose nine counties casting 10,000 votes each, the whole lying in a block thus arranged, and the votes divided between party A and party B as indicated within:

1 A 8750 B 1250	4 A 5250 B 4750	7 A 4850 B 5150
2 A 4500 B 5500	5 A 7500 B 2500	8 A 4750 B 5250
3 A 5100 B 4900	6 A 4300 B 5700	9 A 7000 B 3000

Now let one district be formed from the diagonal counties 1, 5, and 9, and three others, respectively, from 2 and 4, 3 and 6, and 7 and 8. Party A has 52,000 against B's 48,000 altogether or a popular majority of 4,000; but it only carries one district out of four because the gerrymander has made it waste most of its votes and its rival wastes almost none. Yet the law has been observed, as all the counties in each district are contiguous. Of course, in practice such perfect cases do not occur, and towns or counties are grouped raggedly in forms often grotesque. The origin of the name was from one of these, among the earliest. Massachusetts, in 1812, had its senatorial districts identical with the counties; the State Constitution gave the legislature the power of redistricting, however, and the Republicans, carrying the legislature in that year over the Federalists, at once gerrymandered it in a very outrageous fashion. The Boston *Sentinel* published a colored map of one district in Essex County, whose sprawling towns with a huge prong to the northwest seemed like some monstrous animal of fable; and on an indignant Federalist saying that it «looked like a salamander,» another retorted, «Better call it Gerrymander,» from the Republican governor, Elbridge Gerry (q.v.), whose signature had made it law. Gilbert Stuart (q.v.), the artist, drew a completion of it into an ungainly bird, which figured largely as a campaign document. The Federalists recaptured the legislature the next year and repealed the bill. The most famous of many great gerrymanders in the United States is the «Shoe-tring District» (Sixth Congressional) of Mississippi, formed to minimize the negro vote, and consisting of all the counties in the State touching the Mississippi River; it is about 300 miles long by an average of 20 broad.

Gerster, găr'stĕr, **Etelka** (MADAME GARDINI), Hungarian singer: b. Kaschau, Hungary, 16 June 1857. She was a pupil of Madame Marchesi in Vienna, and made her first appearance in Venice in 1876, as Gilda, in 'Rigoletto.' In 1878, and also in 1883 and 1887, she made successful tours in the United States. In 1887 she married her director, Pietro Gardini, and since 1896 has been at the head of a singing school in Berlin.

Gerstle, Lewis, Californian pioneer: b. Bavaria 17 Dec. 1824; d. San Francisco, Cal., 17 Nov. 1902. Coming to the United States as a lad, he settled in Louisville, Ky., and joined the fortune-seekers in California in 1850. With Lewis Sloss he subsequently formed the Alaska Commercial Company. Their enterprises by sea and land aided largely in building up California, and Gerstle always displayed a public spirit and faith in the future of the State. He was treasurer of the University of California, and identified with many Jewish and general charities, to all of which he was a generous giver.

Gertrude of Wyoming, a narrative poem by Thomas Campbell, written at Sydenham, in 1809. He chose the Spenserian stanza for his form of verse, and for his theme the devastation by the Indians, in 1778, of the quiet valley of Wyoming, in Pennsylvania, on the Susquehanna. The poem opens with a description of «Delightful Wyoming,» which Campbell, who had never seen it, paints as a terrestrial paradise. The whole style and manner is pseudo-classic and old-fashioned; the treatment vague, unreal, and indefinite; but a certain sweetness and pathos, combined with the subject, has kept the poem alive.

Gervinus, Georg Gottfried, gā-ŏrg' gŏt-frēd gĕr-fē'noos, German historian: b. Darmstadt 20 May 1805; d. Heidelberg 18 March 1871. In 1825 he went to the University of Heidelberg, where the lectures of Schlosser inspired him with a peculiar love of historical studies. In 1831 he visited Italy, where he remained for a year collecting materials for the works he was meditating. His 'Historische Schriften,' published after his return (1833), excited the attention of scholars, and secured him in 1835 an extraordinary professorship in the University of Heidelberg, where he was in 1844 appointed to an honorary professorship. From 1845 he took an active part on the liberal side in the movements then going on in Germany. It was at this period that he wrote his 'Mission der Deutschkatholiken' and 'Die Protestantische Geistlichkeit und die Deutschkatholiken.' In 1847 he founded in Heidelberg, in conjunction with Mathy, Mittermaier, and Häussy, the 'Deutsche Zeitung,' which at once became one of the leading organs of the party which advocated a representative system for Germany and a clearly defined federal constitution. His chief works are 'Geschichte der poetischen Nationallitteratur der Deutschen' (1835–42), in which he endeavors to show how the development of German poetry is connected in all its phases with the history of the nation and other European countries; 'Shakespeare' (1849–50); 'Geschichte des neunzehnten Jahrhunderts' (1855–66). All his works, even his more purely æsthetical ones, such as that on Shakespeare, are more or less colored by his political views and aims. In the last years of his life he zealously endeavored to secure the popularity in Germany of the works of Handel, whom he regarded as the greatest genius in the musical sphere that the world had even seen. His 'Autobiography' appeared in 1893.

Geryon, jē'rĭ-ŏn, in the mythology of Greece a king of Hesperia, son of Chrysaor and Callirrhoe, a three-headed giant. He possessed numerous and fine herds, which were guarded by the two-headed dog Orthrus and the giant Eurytion. The herds were carried away, and Geryon slain by Hercules, in obedience to the command of Eurystheus.

Gesenius, Friedrich Heinrich Wilhelm, frēd'rĭн hīn'rĭн vĭl'hĕlm gā-zā'ne-oos, German Orientalist: b. Nordhausen, Saxony, 3 Feb. 1786; d. Halle, 23 Oct. 1842. He studied at Helmstedt and Göttingen, and at Halle in 1810 became extraordinary, in 1841 ordinary, professor of theology. Here he lectured for more than 30 years, broken only by the closing of the university during the War of Liberation (1813–14), and by lengthened visits to France and England in 1820, to England and Holland in 1835. His first great work was his 'Hebrew and Chaldæan Hand Dictionary.' His 'Elementary Hebrew,' consisting of the 'Hebrew Grammar,' and the 'Hebrew Reader,' has contributed enormously to the knowledge of the Hebrew language, not only in Germany, but through translations also in England and the United States. Later works are his 'Critical History of the Hebrew Language and Literature' (1815); 'On the Origin, Genius and Authority of the Samaritan Pentateuch' (1815); 'A Critical Grammatical System of the Hebrew Language' (1817), and a new translation of and commentary on Isaiah (1820–21). His greatest work is the monumental 'Critical Grammatical System of the Hebrew and Chaldæan Languages in the Old Testament,' of which the first part was published in 1829, but which was completed only in 1858 by Rödiger. See Hayne, 'Gesenius, eine Erinnerung für seine Freunde' (1842).

Gesner, Abraham, Canadian geologist: b. Cornwallis, N. S., 2 May 1797; d. Halifax, N. S., 19 April 1864. He studied medicine in London, and returned to Nova Scotia. Later he became interested in scientific researches. In 1838 he was appointed to examine and report on the geological resources of the lower provinces of British North America. Afterward he discovered how to produce oil suitable for lamps from bituminous shale and cannel coal. He thus originated the discovery of "kerosene" (which name he gave his oil) in the United States. His publications include: 'Remarks on the Geology and Mineralogy of Nova Scotia' (1837); 'Reports on the Geological Survey of the Province of New Brunswick' (1844); 'New Brunswick, with Notes for Emigrants' (1847); 'Industrial Resources of Nova Scotia' (1848); 'A Practical Treatise on Coal Petroleum and Other Distilled Oils' (1861); etc.

Gesner, Konrad von, kŏn'räd fŏn gĕs'nĕr, Swiss naturalist: b. Zürich, Switzerland, 26 March 1516; d. there 13 Dec. 1565. His early studies, in medicine, natural history, and Greek and Latin literature, were prosecuted at Zurich, Strasburg, Bourges, and Paris, and in 1537 he was appointed professor of Greek at Lausanne. This chair he exchanged four years later for that of physics and natural history at Zürich. He was an indefatigable writer of books and in the course of his life published no less than 72 works, besides leaving at his death 18 others in progress. His 'Universal Library' (1545), contained the titles of all the books then known in Hebrew, Greek, and Latin, unpublished as well as published, with criticisms and summaries of each. His next undertaking was the 'Animal History' (1551–8). The first book treats of viviparous quadrupeds, the second of oviparous animals, the third of birds, and the fourth of fishes and aquatic animals. He collected more than 500 plants undescribed by the ancients, and appears to have been the first who made the great step toward a scientific classification of distinguishing genera by the fructification. He also wrote on other branches of science, as medicine and mineralogy, and composed a great number of works dealing with the ancient classics, the 'Mithridates sive de Differentia Linguarum' (1555) being the most notable.

Gessler, gĕs'lĕr, **Albrecht**, or **Herman**, called also Gessler von Bruneck, legendary Austrian official, in 1300 appointed joint-governor with Berenger von Landenberg, of the Waldstädten or forest cantons (Schwytz, Unterwalden, and Uri), by Albrecht I. of Austria. According to the traditions connected with William Tell (q.v.), his oppressive edicts and wanton cruelty so enraged the inhabitants that a conspiracy was formed against him, and he was shot by Tell in a narrow pass near Küssnacht in 1307.

Gessner, gĕs'nĕr, **Salomon**, German poet, painter, and etcher: b. Zürich 1 April 1730; d. there 2 March 1788. In 1762 he published, in four volumes, the poems which he had previously given to the world on different occasions. In 1772 he published another volume containing a collection of poems, to which he gave the name of 'Idyllen' (idyls), a name which he had already given to a previously published volume of poems. Their quiet, amiable character pleased many in Germany; and in France, where they were translated by Huber, they were received with enthusiasm, and the author was regarded as a poet of the first rank. From France his fame spread over all Europe. The most popular of his idyls is the 'Death of Abel,' since translated into many foreign languages. In landscape painting he has merits which no age will diminish. His etching is light and powerful; his views are select, wild, and romantic; and his trees are particularly fine. Twelve engraved landscapes, published in 1770, are considered among his best works.

Gesta Romanorum, jĕs'ta rō-mä-nō'rŭm, 'Deeds of the Romans,' the title of a collection of short tales, legends, etc., in Latin, very popular in the Middle Ages. The book was probably compiled about the close of the 13th century. The separate tales making up the Gesta are of diverse contents, and belong to different times and countries, the sources from which they are derived being partly classical, partly Oriental and partly western. Whatever may have been the intention of the original compiler, they very soon were adapted to the moralizing tendencies of the time, and moral reflections and allegorical interpretations were added to them, it is said, by a Petrus Bercorius or Pierre Bercaire of Poitou, a Benedictine prior.

Gesta'tion, the period of development of the fœtus from the time of conception to birth. Even in animals, where only a single insemination is allowed, the length of the gestation cannot always be foretold with exactness. The human fœtus is carried in the uterus about 280 days. For periods of gestation in animals, see BREEDING. See also OBSTETRICS; PREGNANCY.

Geta, jē'ta, **Septimus**, Roman emperor: b. 189 A.D.; d. 211 A.D. He was the second son of the Emperor Severus, and brother of Caracalla, with whom he was associated in the empire on the death of his father. Caracalla, who envied his virtues and was jealous of his popularity, after having endeavored to effect his death by poison, murdered him, and wounded their mother, who was attempting to save him.

Gethsemane, gĕth-sĕm'a-nē, or **Gethsemani** (*Boustanez-Zeitoun*), an olive garden or orchard in the neighborhood of Jerusalem, on the road leading from the brook Kedron to the Mount of Olives. The place is noted for being the scene of "Our Lord's Agony in the Garden" (Luke xxii. 39–53). It is said that when St. Helena (q.v.), the mother of Constantine, visited the Holy Land in 425, she found abundant evidences to aid her in locating the exact site of the "Garden of Olives" or Gethsemane. The place is now in possession of the Franciscan Fathers of the Holy Land who, in 1848, built a wall around it the better to protect it. They have planted many flowers which they give gratuitously to travelers who desire some memento from this historic spot. Maudrell described the place in his day (1697) as "well planted by olive trees"; but there are now only eight trees which are supposed to have been in the grove at the time of our Lord. Some historians seek to throw doubts upon the age of these trees because of the order issued by Titus to destroy all the trees within a certain limit. These trees were so near the walls that they could not well be destroyed even if the tops were cut off. From the earliest days of the possession of Palestine by the Mohammedans every olive-tree has been taxed except these trees. In the 17th century there were nine trees, but one was destroyed by tourists. The present appearance of the garden is in accordance with the description as found in the Gospels. Another site, a little to the north, is claimed by some to be the real Gethsemane. Consult: De Hamme, 'Ancient and Modern Palestine'; Vogue, 'Les Eglises de la Terre Sainte,' p. 314; Thomson, 'The Land and the Book'; Costello, 'The Gospel Story.'

Getty, George Washington, American soldier: b. Georgetown, D. C., 2 Oct. 1819; d. Forest Glen, Md., 3 Oct. 1901. He was graduated from the United States Military Academy in 1840, fought in the Mexican and Seminole wars, in the Civil War attained the brevet rank of major-general, United States army. He subsequently was commander of numerous military districts; was transferred to the artillery in 1871 and retired from the service in 1883.

Get'tysburg, Pa., a borough and county-seat of Adams County; 35 miles southwest of Harrisburg; on the Philadelphia & R. and Western M. R.R.'s. It is the seat of a Lutheran theological seminary founded in 1826, and Pennsylvania College (Lutheran) founded 1832. One of the most famous battles of the Civil War was fought here. Pop. (1900) 3,495. See GETTYSBURG, BATTLE OF.

Gettysburg, Campaign and Battle of. After the battle of Chancellorsville (q.v.), 1–3 May 1863, the opposing armies resumed their positions on the Rappahannock, Lee's army on the south side of the river, at Fredericksburg, Hooker's on the north side, opposite. Encouraged by victory, and desiring to relieve Virginia of the presence of the Union army, Lee determined to transfer the seat of war north of the Potomac. His army, 1 June, was composed of the three corps of Longstreet, Ewell and A. P. Hill, and Stuart's cavalry force of 12,000 men, in all about 76,000 men, with 190 guns. Hooker's Union army was composed of seven corps, the First, commanded by Reynolds; Second, by Hancock; Third, by Sickles; Fifth, by Meade; Sixth, by Sedgwick; Eleventh, by Howard; and Twelfth, by Slocum; aggregating, 10 June, 82,000 infantry and artillery "present for duty and equipped," with 410 guns, to which were added Pleasonton's cavalry force of about 12,000.

Lee began his campaign 3 June by sending Longstreet and Ewell to Culpeper Court House, where the cavalry, under Stuart, was also concentrated. A. P. Hill remained at Fredericksburg to watch and detain Hooker. Hooker suspected Lee's movement and, under his direction, Sedgwick laid bridges, crossed the river, and reported that Lee's main body seemed to be still there. Pleasonton was ordered to feel the position at Culpeper. Reinforced by two infantry brigades, he crossed the Rappahannock on the morning of the 9th, encountered Stuart at Fleetwood and Brandy Station (see FLEETWOOD AND BRANDY STATION, BATTLE OF), and reported the greater part of Lee's army at Culpeper, preparing to move on Washington. Hooker sent three corps up the Rappahannock to prevent Lee's crossing. On the 10th Lee sent Ewell, preceded by two brigades of cavalry, to the Shenandoah Valley to clear it of Union troops. Ewell defeated and dispersed Milroy's command at Winchester (see WINCHESTER, BATTLE OF), took Martinsburg and cleared the valley; and on the 15th Rodes' division crossed the Potomac at Williamsport, sending Jenkins' cavalry brigade in advance to Chambersburg, and on the 19th moved to Hagerstown. Johnson's division crossed the Potomac and marched to Sharpsburg, and Early's moved to Shepherdstown to threaten Harper's Ferry. In these positions Ewell waited until the 21st for the other two corps to close up, when he advanced to Chambersburg. Longstreet moved from Culpeper on the 15th and, advancing along the east side of the Blue Ridge, occupied Ashby's and Snicker's Gaps. Stuart's cavalry was thrown out in front of Longstreet to watch Hooker, and

ENTRANCE TO NATIONAL CEMETERY, GETTYSBURG, PA.

NEW YORK STATE MONUMENT IN NATIONAL CEMETERY, GETTYSBURG, PA.

on the 17th had a severe fight with the Union cavalry at Aldie and was driven back to Middleburg. A series of cavalry combats ensued, at the end of which Stuart was driven behind the Blue Ridge. On the 24th Longstreet moved by way of Berryville, crossed the Potomac at Williamsport on the 25th and 26th, and marched to Hagerstown, thence on the 27th to Chambersburg. A. P. Hill remained at Fredericksburg until the 14th, when, Hooker having fallen back, he moved down the Shenandoah Valley, crossed the Potomac at Shepherdstown, and joined Longstreet at Chambersburg. Stuart was left to guard the passes of the Blue Ridge and watch Hooker, whom he was to harass as much as possible, should he attempt to cross the Potomac. Meanwhile Hooker, starting from the Rappahannock on the 13th, was moving cautiously back toward the Potomac and covering Washington. On the 25th, 26th and 27th he crossed the Potomac at Edward's Ferry, near Leesburg, and on the 28th his army was grouped about Frederick, with Slocum's corps on the left near Harper's Ferry. He desired to send Slocum's corps and the 10,000 men, composing the garrison at Harper's Ferry, against Lee's rear, but Gen. Halleck, commander-in-chief, refused the request for the garrison, and Hooker asked relief from command. His request was promptly granted, and 28 June Gen. George G. Meade was assigned to the command. Halleck granted Meade's request to utilize the garrison at Harper's Ferry and Meade ordered the abandonment of the place and the transfer of the garrison to Frederick and Washington.

Lee, deprived of the use of his cavalry, had been unable to get information of Hooker's movements; and to retain him on the east side of the mountains, after he had entered Maryland, Ewell had been instructed, on the 24th, to send a division across the South Mountain to threaten Baltimore. Early's division, detailed for the purpose, went as far east as York, the other two divisions of the corps marching from Chambersburg to Carlisle. Jenkins' and White's cavalry were in advance at Wrightsville and above on the Susquehanna, threatening to cross and take Harrisburg. Lee now made preparations to advance upon Harrisburg, but, on the night of the 28th received information that the Union army had crossed the Potomac and was moving northward, its head of column already at South Mountain. His communications thus menaced, Lee resolved to prevent the further progress of the Union army by concentrating his own on the east side of the mountains; accordingly Ewell was ordered to turn back from the Susquehanna, Carlisle, and York, and march for Gettysburg, and Longstreet and Hill were directed to march from Chambersburg to the same place. On the night of the 30th Rodes' division of Ewell's corps was at Heidlersburg, eight miles northeast of Gettysburg, with Early's and Johnson's divisions near. Hill was at Fayetteville and Cashtown, eight miles from Gettysburg, and Longstreet was still at Chambersburg.

On the morning of the 29th under the impression that all of Lee's army was along the Susquehanna, Meade marched by three divergent roads in that direction and on the night of the 30th his forces were thus distributed. Buford, with two brigades of cavalry, was in advance at Gettysburg; Reynolds' First corps on Marsh Creek, five miles southwest of Gettysburg; Sickles' Third corps at Taneytown, and Howard's Eleventh corps at Emmitsburg. These three corps, constituting the left wing of the army, were under command of Gen. Reynolds. Hancock's Second corps was at Uniontown; Sykes' Fifth corps at Union Mills; Sedgwick's Sixth corps at Manchester; and Slocum's Twelfth corps at Littlestown. Gregg's cavalry division was at Westminster. Kilpatrick's division, after a spirited fight with Stuart's cavalry at Hanover, bivouacked near that place. When Buford reached Gettysburg he went into camp just beyond the western limits of the town and threw out skirmishers three miles west and north.

The First Day's Battle.— Heth's division, the advance of Hill's corps, moved from Cashtown at 5 o'clock on the morning of 1 July, coming in sight of Buford's skirmishers about 9 o'clock, at which hour Buford fired his first gun as a signal for his skirmishers to open fire, and the battle of Gettysburg began. Heth advanced and Buford was slowly driven back, contesting every foot of ground, until Reynolds came up with Wadsworth's division, which became immediately and desperately engaged. During this encounter Reynolds was killed. Doubleday succeeding to the command of the First corps, continued the contest. The other two divisions of the corps came up at 11 o'clock, followed at 12.45 by Howard's corps, one division of which was placed in reserve on Cemetery Hill, the other two forming on Doubleday's right along Seminary Ridge. Meanwhile Hill had arrived with the remainder of his corps, and Ewell, arriving at 2.30 P.M. with Rodes' and Early's divisions, formed on Hill's left. Hill made successive assaults on Doubleday from the west, and Ewell upon Howard from the north, which were repulsed; but finally, after desperate fighting and great losses on both sides, Early struck Howard in flank, causing him to give way, and the entire Union line was driven back through the town to Cemetery Hill, about half a mile south, which had been chosen by Howard as a rallying point for the two corps, and upon which he had placed one of his own divisions. When Meade heard that Lee's advance had reached Gettysburg, and that Reynolds had been killed, he was at Taneytown, 14 miles away, preparing to take up a defensive line along Pipe Creek. He ordered Hancock to ride forward and take command at Gettysburg. Hancock arrived as the Union troops were retreating through the town, was struck with the advantages presented by Cemetery Ridge for a defensive battle, determined to hold it and so notified Meade, sent one of Doubleday's small brigades to hold Culp's Hill, on the right, and made an ostentatious display of Buford's cavalry on the extreme left; which show of force, and the great loss — over 7,000 — sustained by the Confederates during the day, caused Lee to defer operations. Two divisions of Sickles' corps came up at dark; Slocum's corps came about the same time, and Slocum, as ranking officer, assumed command of the field, Hancock riding back to report to Meade that Gettysburg — to which point Meade had already ordered the concentration of his army — was the proper place to fight a battle. Hill's and Ewell's

Confederate corps were all up by night, and Longstreet bivouacked four miles in rear of Hill.

The Second Day.— Gen. Meade arrived on the field at 1 o'clock on the morning of the 2d. All his troops except the Sixth corps were up by noon. The Sixth corps, having 34 miles to march from Manchester, did not come up until between 2 and 4 o'clock in the afternoon. The position on which Meade disposed his army was in the shape of a fishhook. As finally posted, the Twelfth corps was on the right at Culp's Hill, facing east; Wadsworth's division on its left, facing north; the Eleventh corps on Cemetery Hill, on the left of Wadsworth, its right facing northeast, its centre and left facing northwest, with Robinson's division of the First corps on its left. Doubleday's division in reserve. The Second corps, facing west, was on the left of Robinson; the Third corps on the left of the Second, with the Fifth, later in the day, on the extreme left. The Sixth corps was in rear of Round Top, on the left, as a reserve. Sickles, not satisfied with the position assigned the Third corps, moved to the front about three fourths of a mile, from where Meade would have recalled him, but it was too late to do so in presence of a vigilant enemy.

The main part of Lee's army was on Seminary Ridge, a short mile west of Meade's left and centre; Longstreet on the right, with Hill on his left. Ewell's corps on the left held the town, and was at right angles to Hill and Longstreet. Pickett's division of Longstreet's corps had not come up. Skirmishing began in the morning. At 4 o'clock in the afternoon the battle opened by Longstreet's advance. He attacked Sickes with great fury and, although reinforced by Caldwell's division of the Second corps, and Barnes' and Ayres' divisions of the Fifth, after heavy fighting and great losses the Third corps and its supports were driven back beyond the main line. Longstreet followed, but was checked by a charge of Crawford's division of the Fifth corps and the firm and solid appearance of the Sixth corps. On Longstreet's right Hood's division advanced to seize Round Top, but was repulsed by Vincent's and Weed's brigades of the Fifth corps. Vincent and Weed were killed, and Hood wounded. During the latter part of Longstreet's engagement with Sickles two of Hill's brigades assailed Hancock's line and broke it, but were soon driven back. At about the same time Hays' and Hoke's brigades of Early's division assaulted Howard's line on Cemetery Hill, but were driven back with the assistance of two regiments and Carroll's brigade of Hancock's corps. Still further on the Confederate left Johnson's division of Ewell's corps assaulted Culp's Hill, then held by Wadsworth's division of the First corps and Greene's small brigade of the Twelfth corps, the rest of the corps having been withdrawn and sent to the assistance of the left. Johnson's right, continuing the fight until late in the night, was repulsed, but his left entered, unopposed, the strong works thrown up by the Twelfth corps, and was perilously near the practically unguarded reserve artillery and ammunition train of the Army of the Potomac. Upon the return of the Twelfth corps during the night to its former position, finding it occupied, it waited until daylight before attempting to retake it. Meanwhile Johnson was being reinforced by three brigades, that he might hold his ground and renew his fight.

The Third Day.— The battle of the third day began by a struggle of the Twelfth corps to regain their works. At 4 A.M. the corps artillery, five batteries, opened a furious fire upon Johnson, at a range of 600 to 800 yards, other batteries followed, in the midst of which Johnson attacked the left of the Twelfth corps and the right of Wadsworth's division; the combat extended to the right, was taken up by Williams' division, and for six hours the struggle continued, at the end of which Johnson was repulsed. At 10.25 Johnson massed his forces in column of regiments and made a determined assault upon the right of Geary's division, by which, with the assistance of Shaler's brigade, he was repulsed, and driven beyond Rock Creek with a loss of nearly 2,000 killed and wounded, and three colors. At 11 o'clock the battle ceased on the Union right, with the Twelfth corps line fully re-established. There was more spectacular fighting on other parts of the field, but none more desperate and bloody than on the wooded Culp's Hill. Meanwhile Lee was preparing an attack upon the left centre of Meade's army. Pickett's division had now come up, and Longstreet was directed to form a column of assault composed of Pickett's division, Pettigrew's division, and two brigades of Pender's division, under Trimble, of Hill's corps. To prevent Meade from reinforcing the threatened point, Stuart's cavalry was ordered to go around Meade's right and attack his rear; 135 guns were disposed on Seminary Ridge; and at 1 P.M. the signal-gun was fired, and the 135 guns opened fire to crush out all opposition at the point to be attacked; the fire was replied to by 85 Union guns, and for two hours the hills shook and the earth trembled. As soon as the Union fire slackened, the great column of attack moved forward, Pickett's division on the right and Pettigrew's on the left. Pettigrew was supported by the two brigades of Trimble, and Pickett by the brigades of Wilcox and Perry. Pickett and Pettigrew, at the start from Seminary Ridge, covered a front of 1,600 yards; they had 1,400 yards of open ground to traverse before reaching the Union line; and the assaulting column numbered 14,000 men. As soon as it started, the Union artillery opened on it with shot and shell, tearing great gaps in the line; as it came nearer, canister did its deadly work; it was attacked on both flanks; and as it approached the Union line, held by Gibbons' and Hays' divisions of Hancock's corps, a flame of musketry burst forth before which nothing could live, and the men began to retreat; but, on the right, Armistead, commanding one of Pickett's brigades, broke the Union line and, with less than 100 men, crossed the Union works and seized a gun; a short hand-to-hand encounter ensued; Armistead was killed, and his small party killed or captured. Pickett saw the failure of his assault, and ordered a general retreat, after losing over 5,000 men. Wilcox's and Perry's brigades, which should have supported Pickett's right, were not prompt in starting, became separated from it and, attacking the right of the First corps, were driven back, losing many prisoners, and the battle of Gettysburg was ended. On the Union right Gregg's cavalry division, aided by Custer's brigade, defeated Stuart, after a severe fight, and thwarted his attempt on Meade's right and rear. On the left Kilpatrick, with two cavalry brigades, recklessly charged Confederate infantry in dense woods, and behind stone fences, west of Round Top, in which assault Gen. Farnsworth, commanding one of his brigades, was killed. On the morning of 4 July Lee withdrew from his advanced positions, put his trains in motion for the rear, retreated at night and, followed and harassed by the Union cavalry, reached Williamsport on the 7th; but as the pontoon bridges had been destroyed and the Potomac had risen, he was unable to cross, and so entrenched. Meade followed by a circuitous route through Frederick and, after some delay, again confronted Lee on the 13th. He was about to attack when Lee recrossed the Potomac on the night of the 14th, his rear-guard, under Gen. Pettigrew, being attacked by Kilpatrick, during which fight Pettigrew was mortally wounded and many prisoners were taken.

From first to last the Union forces on the field numbered about 88,000 effective men; the Confederate forces on the field numbered about 73,000 men. As officially reported, the Union loss was 3,072 killed, 14,497 wounded, and 5,434 missing; an aggregate of 23,003; the Confederate loss 2,592 killed, 12,709 wounded, and 5,150 missing; an aggregate of 20,451. Consult: 'Official Records,' Vol. XXVII.; Compte de Paris, 'The Battle of Gettysburg'; Bates, 'Battle of Gettysburg'; Doubleday, 'Chancellorsville and Gettysburg'; Walker, 'History of the Second Army Corps'; Powell, 'History of the Fifth Army Corps'; The Century Company's, 'Battles and Leaders of the Civil War.'

E. A. Carman.

Geulincx, hė'lĭnks or zhė-lănks, **Arnold,** Dutch philosopher: b. Antwerp, 1625; d. Leyden 1669. He was one of the disciples of Descartes (q.v.), and a leading exponent of the speculative doctrine known as Occasionalism. For 12 years, from 1646, he lectured successfully at Louvain, was then deposed for some reason not ascertained, and, after living at Leyden in great distress, was in 1665 appointed professor of philosophy there, but died four years later. His ideas are expounded in books entitled: 'Saturnalia'; 'Logica'; 'Ethica,' published in his lifetime, and in 'Annotata præcurrentia ad Cartesii Principia' (1690), and 'Metaphysica Vera' (1691), which appeared after his death. The salient point of his teaching is an endeavor to explain the relations which obtain between soul and body, the mutual interaction of which under stimulus he ascribed to divine intervention and preordained arrangement. See Grimm, 'Arnold Geulincx'; 'Erkenntnisstheorie und Occasionalismus' (1875); Pfleiderer, 'Arnold Geulincx als Hauptvertreter der Occasionalistischen Metaphysik und Ethik' (1882).

Geum, jē'ŭm, a genus of *Rosaceæ,* sub-order *Potentilleæ,* distinguished from *Potentilla* by the hardened hooked styles which crown the carpels, so that the fruit becomes a burr. They are perennial herbs with pinnate or pinnatifid leaves, and white, yellow or purple flowers. There are about 40 species, 14 being found in North America. They are commonly known as avens. The roots of *G. rivale,* purple or white avens, and of *G. urbanum* have astringent and tonic properties. The latter is used for flavoring ale. *Geum strictum* is known as chocolate-root. Many of the species are cultivated, *G. chiloense* being especially ornamental.

Geyserite, gē'sėr-īt, or **Siliceous Sinter,** is amorphous silica containing a varying amount of water. It is white or grayish in color, and is deposited about the geysers and hot springs of Wyoming, Montana, Iceland, and New Zealand as hard masses or in filamentous or cauliflower-like forms sometimes of great beauty. In the Upper Geyser Basin in the Yellowstone Park the formations of geyserite are abundant and most beautiful. The great terraces of the Mammoth Hot Springs are not geyserite, but are chiefly calcareous deposits.

Geysers, a name derived from an Icelandic word signifying "to burst forth with violence," and applied to natural springs of hot water of the kind that were first observed in Iceland, and since in Wyoming and California in the United States, and in New Zealand. They may be described as volcanoes of hot water, for they resemble volcanoes in every particular — in the vibrations of the earth and dull rumbling sounds or loud reports by which the eruptions are preceded, in the intermittence of the phenomenon, and in the form of the opening at which the eruptions take place, like an inverted cone with a deep central throat. Natural philosophers are not agreed as to the mode in which this phenomenon is to be explained, but the most generally prevailing and most probable hypothesis is that it is caused by the disengagement of large quantities of vapor, which force the water up into the air when the successive disengagements have produced a sufficient pressure.

The geysers of Iceland lie about 30 miles west of Mount Hecla, and 16 miles north of the town of Skalholt, in a plain covered by hot-springs and steaming apertures. They are nearly 100 in number, and are scattered over a surface scarcely more than two square miles in extent. The two most remarkable are the Grand Geyser and the New Geyser or *Strokkur* (churn). The Great Geyser rises from a tunnel-shaped basin, lined and edged with silicious deposits. The pipe or throat at the bottom, from which the jet issues, is about 10 feet in diameter, and the basin at its outer edge is above 70. The emissions generally take place at intervals of six hours, and last for about five minutes at a time. The column, as measured by a quadrant, has been seen to rise as high as 212 feet. It is impossible to fix the age of the Great Geyser, but that its eruptions have taken place from the most remote antiquity is proved by the fact that, although there has been no sensible increase in the depth of the silicious deposit since the earliest recorded observations, it is now more than 16 feet deep.

The geysers of Iceland, long the only ones known to exist, are surpassed by those which have been discovered in comparatively recent times in the Yellowstone National Park. The largest of them is called the Grand Geyser. It begins an eruption by filling its basin with boiling water, forming a well 20 by 25 feet in diametric measurements, and having a visible depth, when quiet, of 100 feet. The explosion is preceded by clouds of steam rushing up to a height of 500 feet; the great unbroken body of water succeeds, ascending in one gigantic column to a height of 90 feet; while from the apex of the column there radiate five great jets, which shoot up to the unparalleled height of 250 feet from the ground. Among the other remarkable geysers of this district are those named Old Faithful, the Beehive, the Giant, the Giantess, etc. The number of hot-springs in the Yellowstone is not less than 1,500, all varying in times of action, force, deposits, and color of water.

Ghaleb, gä-lēb', the last of the great poets of the old Turkish school. His 'Husn-u-Ashk' (Beauty and Love), written about 1800, has been called one of the finest productions of Ottoman genius.

Ghavial, găv'ĭ-al. See GAVIAL.

Ghee, gē, or **Ghi**, a peculiar kind of butter in use among the Hindus. It is made in the following manner: The milk when brought from the cow is poured into earthen vessels, in which it is boiled for one hour, often for two or three hours. It is then put in a cool place, and a little curdled milk is added. By the next morning the whole is converted into sour curdled milk. A layer 5 or 6 inches deep is then taken off the top of the contents of each vessel, and is put into another larger vessel, in which the whole mass is gently stirred for half an hour with a split bamboo-cane. A little warm water is then added, and the stirring is continued for another half-hour, when the butter begins to form. After being kept for three days — a period long enough for the butter to become rancid in so hot a climate — it is melted in another earthen vessel, and boiled until all the water it contains is evaporated. A little more curdled milk is then added, along with some salt or betel-leaves, and the butter, which is now ready, is then put in pots, in which it is kept till required. In this state it will keep for a long time, being sometimes used a year after it is made. This butter has naturally a very strong taste, insupportable to a European stomach, but it is in general use among the Hindus who are rich enough to buy it and is an important article of commerce.

Ghent, gĕnt, Belgium (French, Gand; Flemish, Gend or Gent, capital of the province of East Flanders, at the confluence of the Lys with the Scheldt. It is upward of six miles in circumference, and is divided by canals into a number of islands connected with each other by bridges. Except in some of the older parts, it is well built, and has a number of fine promenades and many notable buildings. Among the latter are the cathedral of St. Bavon, dating from the 13th century; the church of St. Nicholas, the oldest in Ghent; the church of St. Michael, with a celebrated Crucifixion by Van Dyck; the university, a handsome modern structure, with a library of about 100,000 volumes and 700 manuscripts; the belfry, a lofty square tower surmounted by a gilded dragon, and containing chimes of 44 bells; the Marché du Vendredi, an extensive square, interesting as the scene of many important historical events; and Les Béguinages, extensive nunneries founded in the 13th century, the principal occupation of whose members is lace-making. Ghent has long been celebrated as a manufacturing town, especially for its cotton and linen goods and lace. Other industries of importance are sugar-refining, hosiery, thread, ribbons, instruments in steel, carriages, paper, hats, delftware, and tobacco. There are also machine works, engine factories, roperies, tanneries, breweries, and distilleries. The trade is very important. A canal connects it with the Scheldt at Terneuzen. Another canal connects the Lys with the canal from Bruges to Ostend. Ghent was mentioned as a town in the 7th century. In the 9th century Baldwin, the first Count of Flanders, built a fortress here against the Normans. Under the counts of Flanders Ghent continued to increase. Two great revolts took place under the leadership of the Van Arteveldes (1338 and 1369) against Burgundy, and again in the 16th century against Charles V., and the citizens of Ghent, besides losing their privileges, had to pay for the erection of a citadel intended to keep them in bondage. In 1792 the Netherlands fell under the power of France, and Ghent became the capital of the department of Escaut (Scheldt). In 1814 it became, along with Flanders, part of the Netherlands, till the separation of Belgium and Holland. Pop. (1900) 160,949.

Ghent, Treaty of (24 Dec. 1814), the treaty which closed the War of 1812. The British advantage was enormous: the war had been discreditable and rather disastrous to America on land, and was half paralyzed by incompetent administration and dissensions among the States; while even the fleet had not maintained its early triumphs; the overthrow of Napoleon had let loose an irresistible army, and had they persevered they might almost have exacted their own terms. But the British were tired of the burdens of a 20-years war, and the ministers were anxious like them to have done with fighting and settle down to peace; and the American privateers and navy were injuring their commerce unbearably. To our good fortune, also, they had the old-fashioned British contempt for American diplomatic ability, and sent third-rate negotiators to Ghent — Lord Gambier, an ex-naval captain, a junior lord of the admiralty, entirely inexperienced in foreign affairs; Henry Goulburn, a young under-secretary of state, narrow and lacking self-control; and William Adams, an unknown lawyer. America, on the other hand, sent some of the strongest men in the country: John Quincy Adams, James A. Bayard, Henry Clay, Jonathan Russell, and Albert Gallatin, men with no superiors in the world in ability, experience, knowledge, and clearness of purpose, and three at least unsurpassed in tenacity of will. In 1813, when Russia offered mediation, Bayard and Gallatin went to St. Petersburg to negotiate, but England refused the offer. Their instructions had included an article against impressment; but as it was notorious that the Napoleonic wars alone made this a practical question, and those were now ended, the government allowed them to waive that point. The British claims at first set up were impossible: the establishment of the boundary fixed by the Indian Treaty of Greenville in 1795 (see GREENVILLE, TREATY OF), as a permanent line beyond which neither party should acquire territory, thus cutting off the entire Northwest from the United States; the cession of the mouth of the Niagara and Sackett's Harbor, in New York, prohibiting the United States from keeping land or naval forces on the Lakes; and allowing free navigation of the Mis-

OLD FAITHFUL GEYSER, IN YELLOWSTONE PARK.

sissippi to England. Finally the struggle of the entire autumn and early winter ended in this treaty, which was scarcely more than an agreement to cease hostilities and settle the disputed questions at some other time. The questions of impressment, on which the war had been opened; of the extent of the right of blockade; of the American right to fish in British waters; of the British navigation of the Mississippi, and trade with the Indians; of the armaments on the Lakes; of the American claim for British spoliations; all were silently passed over. The treaty, as ratified 17 Feb. 1815, and proclaimed on the 18th, restored the *status quo* of territorial possessions except some islands in Passamaquoddy Bay — public or private property in the surrendered places not to be destroyed or removed, provided a commission to decide on the ownership of the islands above, the matter to be referred to arbitration if they failed to agree; and other commissions to settle the boundaries provided in the Treaty of Paris (1783) — from the St. Croix to the St. Lawrence at lat. 45° N., thence to Lake Superior, and from St. Mary's River to the Lake of the Woods. The last article binds both parties to use their best endeavors to suppress the slave trade.

Ghent, University of, Belgium, founded 1816 by William I., of Holland. In 1820 an old Jesuit college was remodeled for its use. Various other schools have been merged into the university. There are 750 students, over 100 being foreigners. The institution is maintained by the state, which supports a combined library of city and university, containing over 350,000 volumes.

Gherardi, gā-rär'dē, **Bancroft,** American naval officer: b. Jackson, La., 10 Nov. 1832; d. Stratford, Conn., 10 Dec. 1903. He entered the navy in 1846, and was at the Naval Academy in 1852. He was lieutenant on the Lancaster of the Pacific squadron at the commencement of the Civil War, and in 1862 was made lieutenant-commander. During the War he commanded the Chocorua and the Port Royal, being on the latter vessel in the battle of Mobile Bay, in which he was distinguished for bravery and gallantry. He became rear-admiral in 1887; was commandant of the Brooklyn navy yard in 1887; commanded the North Atlantic squadron; and directed the Columbian naval review in New York harbor in 1893. He retired in 1894.

Ghetto, gĕt'ō, **The,** a Jewish quarter in large cities. The ghetto of Rome, instituted in 1556 by Pope Paul IV., was removed in 1885, its demolition having been rendered necessary by the new Tiber embankment. The Ghetto in New York is one of the largest and most densely populated in the world. In a single tenement building are housed as many as 600 persons and a single city block or square contains 3,000 to 5,000 population. The majority of these people are employees of the sweat-shops (q.v.). The population of the New York Ghetto is estimated at 350,000.

Ghibellines, gĭb'ĕ-lĭnz, Italian political party of the 12th to the 15th centuries. On the death of Lothaire II., emperor of Germany, 4 Dec. 1137, Conrad, Duke of Franconia and Lord of Weiblingen (which by corruption became Ghibelline), was elected his successor. His right to the imperial throne was, however, disputed by Henry the Proud, Duke of Saxony and Bavaria, who was in consequence declared an outlaw and shortly afterward died. His adherents transferred their allegiance to his son, Henry the Lion, at that time a boy of 10, and the whole empire was divided into the partisans of Conrad, who assumed the name of Ghibellines, and those of Henry, or the Guelphs. These titles were first used at the battle of Weinsberg in 1140. The strife between the two parties subsided in Germany, but continued in Italy, resulting in war in 1159. The supporters of the popes were termed Guelphs and those of the emperors Ghibellines. Charles of Anjou expelled the Ghibellines from Italy in 1268; but the contest between the two factions continued till the French invasion in 1495 united them against a common enemy.

Ghiberti, Lorenzo, lō-rĕnd'zō gē-bĕr'tē, Italian sculptor: b. Florence about 1378; d. there 1 Dec. 1455. He early learned from his stepfather Bartoluccio, an expert goldsmith, the arts of drawing and modeling, and that of casting metals. He was engaged in painting in fresco at Rimini, in the palace of Prince Pandolfo Malatesta, when the priori of the society of merchants at Florence invited artists to propose models for one of the bronze doors of the baptistry of San Giovanni. The offering up of Isaac was to be executed in gilt bronze, as a specimen of the work. The judges selected the works of Donatello and Ghiberti as the best, but the former voluntarily withdrew his claims, giving the preference to Ghiberti. After 21 years' labor Ghiberti completed the door, and, at the request of the priori, executed a second, after almost as long a period. Michelangelo said of these, that they were worthy of adorning the entrance to paradise. During these 40 years Ghiberti also completed many other important designs, such as the bronze reliquary of St. Zenobius. The dryness of the school of Giotto appears in his early works; the later are in imitation of the Greeks, and are marked by continually increasing vigor and firmness. The reliquary and the baptistery doors of San Giovanni are, to this day, among the finest specimens of art in modern Italy. Ghiberti also executed some excellent paintings on glass for the churches Or-San-Michele and Santa Maria del Fiore. His 'Commentarii,' a work on Florentine art, is still preserved in MS. See Scott, 'Ghiberti and Donatello' (1882).

Ghirlandajo, gēr-län-dä'yō, **Il** (originally **Domenico Bigordi**), Italian painter: b. Florence 1449; d. there 11 Jan. 1494. There were three brothers of this name (Davide, Benedetto, and Domenico) among Italian artists of the 15th century, and Domenico was the greatest of the three. He was thoroughly original and independent in his style and while he lived just after Masaccio and just before Michelangelo, he was distinct from either. He was skilful in portraiture and his large frescoes of religious subjects are historically interesting from the fact that he introduced as spectators of the incidents portrayed the figures of distinguished Florentines of his day. His great fresco of 'The Calling of Peter and Andrew' in the Sistine Chapel at Rome is much admired, and in his 'Last Supper' at Papignano he has introduced the portrait of Amerigo Vespucci. His finest work is the 'History of St. Francis' in the Church of The Trinity at Florence. He was also a skilful worker in mosaics, which he called "painting for eternity."

He died of the plague in his 45th year and was buried in Sta. Maria Novella, in Florence.

Ghost Dance, a religious ceremony which originated among the Piute Indians in Nevada about 1889, so named from the fact that the dancers wear a white robe over their ordinary dress. It was the outcome of a religious belief which maintained that a messiah was soon to appear, who would rid the land of the white man and restore to the Indians all their rights. A Piute Indian named Wikova and known among the whites as "Jack Wilson," claimed to be this savior and obtained a marvelous influence over not only his own tribes but those of the surrounding country, who sent their chiefs to listen to his teachings. These were very much in the same line as those of modern Spiritualists, he promising to procure them communication with the spirits of deceased friends. He advocated peace and refused to allow any references in their ceremonies to warlike subjects. The ghost dance is held at night, men and women joining hands and circling around, singing the ghost songs, which are principally chants in the form of messages from their spirit friends. Sometimes the participants appear to fall into a trance, during which they are supposed to commune with residents of the other world. The Sioux outbreak of 1890–1 was due indirectly to the ceremonies of this dance and the United States government sought to suppress it. Since that time no trouble has arisen, though it is still practised by the Indians. See INDIANS.

Ghost-moth, a British nocturnal swift-moth (*Hepialus humuli*), so called from the male being white and hovering in the twilight over one spot (often in churchyards), where the female, which has gray posterior wings and red-spotted anterior wings, is concealed. The caterpillar feeds on the hop and allied plants, and often does considerable damage to the first-named. See SWIFT-MOTHS.

Ghosts. The belief that the spirits of the departed are occasionally presented to the sight of the living, has existed in all ages and countries, and usually declines only when a people has advanced considerably in the knowledge of physical conditions and laws. We can understand the inability of the primitive man and the savage to realize death. The memory of the deceased lends power to call up his appearance. The primitive man does not observe accurately the distinction between fact and fancy — between what is seen in dream and what is seen in reality. (See DREAMS.) The belief that man has a soul capable of existing apart from the body it belongs to, and continuing to live, for a time at least, after that body is dead and buried, fits perfectly in such a mind with the fact that the shadowy forms of men and women do appear to others, when the men and women themselves are at a distance, and after they are dead. We call these apparitions dreams or phantasms, according as the person to whom they appear is asleep or awake; and when we hear of their occurrence in ordinary life, set them down as subjective processes of the mind. Among the less civilized races, the separation of subjective and objective impressions, which in this, as in several other matters, makes the most important difference between the educated man and the savage, is much less fully carried out. The Dyaks regard dreams as actual occurrences; and many savage races believe that dreams are incidents which happen to the spirit when it is wandering from the body. In sleep, the soul is supposed to leave the body and travel about. The man who fancies he sees at night the figure of a friend, or of an enemy, supposes he sees this dreamer's wandering soul. Among primitive races there is a superstitious objection to rousing a sleeper, lest he should awake before his soul has had time to return to the body. Death is regarded as another form of sleep; and during that sleep the spirit is wandering, and when wandering, may be met. See SLEEP.

Witchcraft, necromancy, has always been intimately connected with the spirits of the dead, and this is regarded as the parent of all religious worship. The savage man fears the dead and seeks to propitiate them, and gradually forgets that the ghosts are those of ancestors, and considers them as demons, a separate order of spirits; and later, as he advances in intelligence, these demons cease to be altogether demoniacal, and become gods. Be that as it may, it is certain that the propitiation and even worship of the dead has formed an integral part of all primitive religions, and has maintained its hold among the more ignorant after it has ceased to affect the more educated.

The fear of seeing something often so dazzles and bewilders the visual organ, that it sees the things that were feared. This accounts for many stories of the sight of apparitions in haunted houses. A crime is supposed to have been committed in some old house, and superstition believes that the spirit of the murderer or of the murdered person cannot rest. Whoever is nervous and timid, and visits this house at night, is predisposed to see the wandering spirit, and the fear that is present deprives the judgment of its power of taking accurate observations of what really is seen, and so superinduces a lax condition which is ready to be deceived. There may be conditions of body which allow of a sight beyond what is given to most, as it is certain that beasts see and scent and hear what our own faculties fail to perceive. But what we insist on is, that the greatest caution should be exercised in receiving stories of apparitions, and the utmost care taken to investigate every case of apparent spiritual manifestation. Before we can admit that there are genuine cases of ghosts having been seen, we must be satisfied that the observer was in full possession of his faculties, that his attention was on the alert, that he was capable of judging between subjective and objective presentments, and that he was healthy in mind and body.

In 1882 a Society for Psychical Research was founded in London for the scientific and systematic investigation of reported apparitions, clairvoyance, haunted houses, hypnotism, thought-reading, and spiritualistic phenomena; it publishes regular reports of its investigations.

The subject of ghosts is treated from other and various view points under APPARITIONS, and the reader is also referred to SPIRITUALISM and WITCHCRAFT, and the following works: Brewster, 'Natural Magic' (1832); Ingram, 'Haunted Houses' (1884); Myers, 'Phantasms of the Living' (1886); Owen, 'The Debatable Land' (1874); Stead, 'Real Ghost Stories' (1891).

Ghosts, a powerful play by Henrik Ibsen (1881), giving dramatic embodiment to the modern realization of heredity. Ibsen, treating this subject on its tragic side, considers the case of the darker passions as they are handed down from father to son. It is a Greek tragedy translated into the littleness and barrenness of modern life. ‘Ghosts’ is perhaps the most remarkable of Ibsen's dramas in its searching judgment, its recognition of terrible fact, its logical following of the merciless logic of nature.

Ghuri, goo'rē, an Asiatic dynasty who had the seat of their empire in the country of Ghur, and ruled over Persia, Afghanistan, northern Hindustan, and Transoxiana. Ghur first appears in history in connection with Mahmud of Ghazni and his son Masaud, the latter of whom subjugated the region in 1020. About a century later Malik Izzuddin made himself ruler of all the Ghur country. His son, Alauddin Jahansoz (the Burner), fell upon Ghazni, and burned it to the ground. This prince's nephews, Ghiyassuddin and Muizuddin, established their power in Khorasan and Ghazni. The latter, crossing the Indus, then conquered successively the provinces of Multan (1176), Lahore (1186), and Ajmere (1190), and, in the course of the next six years all Hindustan as far south as Nagpur and east to the Irawaddy. On the death of Muizzuddin the Indian states asserted their independence, the power of the Ghuri being confined to Ghur, Seistan, and Herât. This last feeble remnant was taken from them by the Shah of Kharezm about 1215. Some 30 years later the Ghur princes managed to revive something of their former power at Herât, which they retained by sufferance from the Mongols down to 1383, when the city was captured by Timur, and the Ghur sovereignty came to an end.

Ghurkas, goor'kaz, **Gurkahs**, or **Goorkhas**, a tribe of northern India, named from the village of Ghurkas in Nepal, formerly the capital of the Ghurkas, before the formation of the present kingdom of Nepal. The Ghurkas are the mountaineers of Nepal, and speak a Sanskritic language. The Mohammedans drove them out of Rajputana, and they migrated to Nepal, of which they took possession in 1768. When the English first invaded India, the Ghurkas were formidable opponents, but are now most friendly. A large number of them are in the Anglo-Indian army, chiefly in the infantry, as they have no regard for the cavalry service. Besides their rifle they carry a formidable short-bent sword called a koorkree, with the edge on the inside of the bend, with which at close quarters they do dreadful execution. See NEPAL.

Giacomotti, Félix Henri, fā-lēks ŏṅ-rē zhä-kō-mō-tē, French artist: b. Quingey, Doubs, 19 Nov. 1828. He was a pupil of Picot at the Beaux-Arts, Paris; obtained the Grand Prix de Rome in 1854; established his studio at Paris in 1861, and painted numerous subjects from mythology, religious works, and portraits. Among his canvases are: ‘Centaur and Nymph’; ‘Christ Teaching in the Temple’; ‘The Mount of Calvary.’ He also executed a fresco for the ceiling of one of the salons of the Luxembourg representing the apotheosis of Rubens and painting.

Giant Cells, in pathology, a form of large cells many times the size of the cells of the body with which they are associated. They very frequently have a large number of nuclei, sometimes as many as 100 or more. It is supposed that giant cells originate from a lack of cell-division, rather than by a coalescence of a number of small cells. Many giant cells are found in the neighborhood of active growing tissue, associated with infectious disease processes, such as tuberculosis and carcinoma. It is thought that the function of giant cells is protective.

Giants, people of extraordinary stature. History, both sacred and profane, makes mention of giants. The first mention of giants in the Bible is in Gen. vi. 4, where the Hebrew word used is *nephilim*, a word which occurs in only one other passage, where it is applied to the sons of Anak, who dwelt about Hebron, and who were described by the terrified spies as of such size that compared with them they appeared in their own sight as grasshoppers. A race of giants called the Rephaim is frequently mentioned in the Bible. In Gen. xiv. 5, and xv. 20, they appear as a distinct tribe, holding possessions in Canaan. At the period of the conquest of Canaan, Og, king of Bashan, who had a bedstead 9 cubits long, is said to have remained alone of this tribe, but this must be taken to mean alone on the east side of Jordan; for giants, who were probably of the same stock, are subsequently mentioned as living about Mount Ephraim (Jos. xvii. 15) and among the Philistines (2 Sam. xxi. 18). Goliath, who measured 6 cubits and a span, and who was slain by David, is the most celebrated of the giants mentioned as living among the Philistines. The other races of giants who are mentioned in the Bible (besides the sons of Anak already referred to) are the Emim, who occupied the country afterward held by the Moabites, and the Zuzim (a branch of the Rephaim), who lived on the east side of the Jordan, between the Arnon and the Jabbok. In Deut. ii. 20 they are said to have been called by the Ammonites, who conquered them, Zamzummim.

The giants of Greek mythology are believed by some to represent the struggle of the elements of nature against the gods, that is, against the order of creation. They were said to have sprung from the blood of Uranus, which fell into the lap of Ge (the earth). Their mother, indignant at the banishment of the Titans into Tartarus, excited them to revolt against the gods. They hurled mountains and forests against Olympus, disdaining the lightnings of Zeus. An oracle having declared that the gods could not conquer except by the assistance of a mortal, Athene called Heracles to their aid. He slew Alcyoneus and Porphyrion, the most formidable of the giants. Apollo and Heracles shot out the eyes of Ephialtes; Dionysus slew Eurytus with his thyrsus; Hecate and Hephæstus killed Clytius with clubs of hot iron; Poseidon hurled a part of the island of Cos on Polybotes; Athene buried Enceladus under the island of Sicily, and flayed Pallas, and made a shield of his skin. The remainder perished under the hands of other deities by the thunderbolts of Jupiter or the arrows of Heracles. This fable perhaps indicates volcanic eruptions, for which the Phlegræan fields, where the chief scene of this struggle is placed, and where the two principal giants were born, were remarkable. Cos and Sicily, which figure in this fable, are also volcanic. Ovid has described the war of the giants in the beginning of his 'Metamorphoses.'

Giants figure rather largely in Celtic and Scandinavian mythology and legends. In the legends of the Irish there are the two giants, Fingall or Finn MacCumhal and his son Ossian. The giants of the Welsh are familiar to every one through the achievements of Jack the Giant Killer, the representative of the Scandinavian Thor, the destroyer of Skrimmer, and the Swiss giants.

The following are regarded as authentic instances of giant stature: In the time of Augustus there were to be seen in the Horti Sallustiani at Rome, the bodies of a giant, Posio, and a giantess, Secundilla, each 10 feet 3 inches high. In the reign of Claudius, an Arabian giant named Gabbaras, 9 feet 4 inches high, was exhibited at Rome. The Emperor Maximin, a Thracian, was nearly 9 feet high. A Jewish giant, about 10 feet high, is mentioned by Josephus. Long Mores, an Irish giant, of the time of Edward III., was 6 feet 10½ inches high. Queen Elizabeth's Flemish porter was 7 feet 6 inches; and J. Middleton, or the Child of Hale, born in 1578, attained the height of 9 feet 3 inches. C. Munster, a yeoman of the guard in Hanover, who died in 1676, was 8 feet 6 inches high; and Cajanus, a Swedish giant, about 9 feet high, exhibited in London in 1742. C. Byrne, who died in 1783, attained the height of 8 feet 4 inches; and Patrick Cotter O'Brien, a native of Kinsale, who lived about the same time, was 8 feet 7¾ inches. In 1884 died Pauline Wedde (called Marian), a German giantess, over 8 feet 2 inches at the age of 18; and in 1887 Josef Winkelmaier, an Austrian, 8 feet 9 inches, aged 22. Anna Swan, a native of Nova Scotia, above 8 feet high; her husband, Capt. Bates, a native of Kentucky, of the same height; Chang-wu-gon, the Chinese giant, 7 feet 9 inches high; and Feeder Machow, a Russian, 7 feet 9 inches, who as late as 1900 were living in retirement, after many years of public exhibition.

Giant's Causeway, Ireland (deriving its name from a legend that it was the commencement of a road to be constructed by giants across the channel to Scotland), a natural pier or mole of columnar basalt, projecting from the north coast of Antrim, Ireland, into the North Channel, 7 miles northeast of Portrush. It is part of an overlying mass of basalt from 300 to 500 feet in thickness, which covers almost the whole county of Antrim, and the eastern part of Londonderry. It is exposed for 300 yards, and exhibits an unequal pavement, formed of the tops of 40,000 vertical closely fitting polygonal columns, which in shape are chiefly hexagonal. The diameter of the pillars varies from 15 to 20 inches. Each pillar is divided into joints of unequal length, the concave hollow at the end of one division fitting exactly into the convex projection of the other. The rock is compact and homogeneous, and is somewhat sonorous when struck with a hammer. The Giant's Causeway is itself formed of three causeways, the Little, Middle or Honeycomb, and the Grand Causeway. On the Little Causeway may be seen an octagon, pentagon, hexagon, and heptagon all together; on the Middle Causeway is the famous Wishing Chair, with two arms and a back, on a platform where the columns rise to a height of about 10 feet. On the Grand Causeway are pointed out the Lady's Fan, an exact arrangement of five perfect pentagons surrounding a heptagon; the Keystone of the Causeway — a sunk octagon; and the single triangle. At the starting point is the Giant's Loom, an imposing row of columns 30 feet high, each intersected by about 30 joints; to the left is the Giant's Well, to the right the Giant's Chair.

Gibara, gē-bä'rä, Cuba, a seaport on the northern coast of Santiago province. It has a fine harbor protected by a fort at the entrance. There is a military hospital here. Pop. 6,841.

Gibbes, Robert Wilson, American scientist and historian: b. Charleston, S. C., 8 July 1809; d. Columbia, S. C., 15 Oct. 1866. He was graduated from South Carolina College in 1827, from the Medical College of South Carolina in 1830. In 1827–35 was assistant professor of chemistry, geology, and mineralogy in the South Carolina College, and in the Civil War was surgeon-general of South Carolina. His contributions to science appeared in the 'Journal' of the Academy of Natural Science, and other learned publications. His paper on 'Typhoid Pneumonia' ('American Journal of Medical Sciences,' 1842) was the first to urge the substitution of stimulants for the knife in the treatment of that disease. He published: 'Documentary History of the American Revolution' (1853 et. seq.).

Gibbet, jĭb'ĕt, a gallows, formerly in use in Europe, on which the bodies of criminals who had been guilty of particularly atrocious crimes were suspended after execution, encased in an iron frame, near the spot where the crime was committed.

Gibbon Gĭ'bŏn, **Edward**, English historian: b. Putney, Surrey, 27 April (May 8) 1737; d. London 16 Jan. 1794. He was the eldest son of Edward Gibbon and Judith Porten. The family was originally Kentish and Gibbon gives some extended account of its origin in his justly celebrated 'Memoirs.' He there erred, however, as he suspected before the close of his life, in tracing the connection to Robert Gibbon of Rolvenden. He was really descended from Thomas Gibbon of West Cliffe, a younger branch of the family. It is significant that the arms of this younger branch, rather than that of the Rolvenden Gibbons, appears on the Gibbon bookplate, perhaps one that his father had used before him.

Gibbon's father was a care-free, pleasure-loving gentleman. He married against his father's wishes and lost thereby a large share of an ample fortune. He lost still more in the expensive pleasures of the mid-eighteenth century, in which he took a too active part. His public life was limited to sittings in two parliaments as a Tory, and to an aldermanship of the city of London for a few months. After some ten years of married life Gibbon's mother died and his father, deeply mourning his loss but also deeply in debt, retired to Buriton and the quiet life of a secluded country gentleman.

Gibbon's grandfather was a man of more force of character. The son of Matthew Gibbon, linen-draper of London, he, became an unusually successful business man. He contracted to clothe King William's troops in Flanders. He was made one of the commissioners of customs, and was commended by

Lord Bolingbroke for his exceptional knowledge of the trade of England. He became a director of the ill-starred South Sea Company, only to lose the labors of 30 years in the crash of 1720. Yet before his death, 16 years later, he amassed another fortune, almost, if not quite, as large as the first.

The future historian was a sickly child whose life was often despaired of. The famous practitioners of the time were frequently called to attend him. Fortunately, in addition to a mother's care, he had the loving devotion of her maiden sister Catherine, to whom he acknowledges that he owed his life. He was taught at home, partly by a domestic tutor, until almost nine, when he was sent to the school of Dr. Wooddeson at Kingston-upon-Thames. Here he remained some two years "reviled and buffeted" as a Tory, yet gaining an elementary knowledge of Latin "at the expense of many tears and some blood." But the precocious boy was gaining more from his "early and invincible love of reading," which was encouraged by his cultivated and judicious aunt. Of her he says, she was "the true mother of my mind as well as of my health." He thus read Pope's 'Homer,' the 'Arabian Nights,' Dryden's 'Virgil,' Ovid's 'Metamorphoses,' besides "many English pages of poetry and romance, of history and travels." Gibbon was next sent to Westminster School, which his father had attended before him. This was the easier because his aunt, who had been left dependent by the bankruptcy of her father, now took charge of one of the homes for the boys and could still care for him. Yet his bodily afflictions sadly interfered with his studies. He was finally transferred to Bath, and then to the house of a physician at Winchester. In his 15th year Gibbon's health wonderfully improved, and after a few ineffective weeks in the home of Rev. Philip Francis at Esher, Surrey, he was quickly transferred to Oxford, where he became a gentleman commoner of Magdalen College in April 1752.

Even before this time the genius of the future historian had asserted itself in the character of his reading. Some 20 volumes octavo of a 'Universal History' were devoured by the mere boy as they appeared. He then took up individual works on ancient or modern times, ranging through a vast number with great rapidity. It was Echard's 'Roman History' that first led him to the period he was later to make his own. From this he extended his reading to the mediæval age of Europe and, before he was 16, had exhausted all English sources in his favorite field. While he was yet to make himself the authoritative scholar, he already showed that marvelous ability in acquiring historical knowledge that marked his later manhood.

This remarkable self-education may be emphasized the more because Gibbon was soon to experience the inadequacy of university training in his time. He entered Oxford before he was 15 years old. Yet he soon found that regular tasks were not enforced, that absence from the university was not noticed, that folly and even vice were not restrained. Though unusually fond of reading, as we know, he fell into idleness and the mild, if expensive, pleasure of travel. Only in the long vacation did he again read assiduously, and begin his first independent work, an essay on the 'Age of Sesostris.' Under such circumstances it is not strange that Gibbon so severely arraigned the university in his 'Memoirs': "To the University of Oxford I acknowledge no obligation. . . . I spent 14 months at Magdalen College; they proved the 14 months the most idle and unprofitable of my whole life."

Yet Gibbon's mind was not wholly inactive at this time. The key of Magdalen library had been delivered to him and he was soon tempted by what he had heard of Middleton's 'Free Inquiry' (1749) as a dangerous book. Strangely enough he was repelled by the scepticism and led to consider seriously the claims of the Catholic Church. Falling in with a student who was already a Catholic, he was furnished with Catholic books and by boyish dependence on his own reason was led to embrace the faith. Not realizing the full consequences of his act he asked admission to the Catholic Church in June 1753. His father, to whom he wrote at once, unwisely disclosed the young man's conversion to the authorities at Oxford, and he was forever excluded from the university.

The course taken by Gibbon's father in these unusual circumstances was to have more than one important effect on the historian's life. He was sent to Lausanne, Switzerland, to the home of a Protestant pastor, who became his tutor and guardian. Here he remained almost five years, pursuing a regular and valuable course of instruction with pastor Pavilliard. Through the same instrumentality and his own reflections he again became a Protestant. He also learned French as a native, thus commanding another important literature. He acquired a thorough acquaintance with Latin and a beginning in Greek. He carried on with growing maturity his historical reading. His keenness for intellectual pursuits led him to correspondence with several European scholars, and he once visited and was received by Voltaire. So valuable were these years that Gibbon put the highest estimate upon them: "Such as I am, in genius or learning or manners, I owe my creation to Lausanne."

Nor must one other episode of those years be forgotten. At Lausanne the young Gibbon met and loved the brilliant and beautiful Susanne Curchod, daughter of a Swiss clergyman. The affection was sincere on both sides. But the engagement was conditioned on the approval of Gibbon's father, on whom he was dependent, and that approval was promptly refused on his return to England. Under these circumstances Gibbon did what many another young man of his country has since done. He "sighed as a lover," he "obeyed as a son." And if the failure of marriage was harder for the daughter of the poor Swiss clergyman, she was consoled not many years after with what proved a more remarkable match. She became the wife of Necker, afterwards French minister of finance, and the mother of Madame de Staël.

Before leaving Switzerland Gibbon had begun his first published work, his 'Essay on the Study of Literature.' It was written in his adopted language and was the result of his classical studies, with which it especially dealt. It was completed in the year of his return to England, though not published until 1761. Then it gained some recognition on the continent, where it was republished the following year. In England it was little noticed, though a translation was finally made.

Gibbon returned to England in 1758. As he had taken up no profession he was still dependent for the next 12 years upon his father's bounty. Two years and a half of this time (1760–62) he spent as captain in the South Hampshire militia, the result of a wave of military enthusiasm which had swept England on a threatened invasion by the French. This largely withdrew him from historical studies, but he acknowledges that these years again made him an Englishman and that the military experience had "not been useless to the historian of the Roman Empire." Every vacation, too, was spent with his beloved books, and he meditated for treatment several historical subjects, among them the life of Raleigh, the liberty of the Swiss, and a history of the republic of Florence.

As soon as he was freed from the militia, Gibbon hastened to the continent to complete his education by travel and study. In this he spent another two years and a half, at Paris, Lausanne, and in an extended Italian tour. Everywhere he was reading as well as seeing, so that it is not strange that on this tour he should finally have chosen the subject of his life work. The resolution was taken in Rome as he sat musing in the evening, while the Franciscan friars "were singing vespers in the temple of Jupiter on the ruins of the capitol." It was 15 Oct. 1764, and Gibbon had about half completed his 28th year.

Yet the great work could not be immediately begun. Gibbon was still dependent. At home he could not be master of his time. In London he could not use his books. Other plans also intervened in the five years following his second return to England (1765). His friend Deyverdum visited him and with his assistance Gibbon undertook the history of the Swiss, writing it also in French. But the historian was unacquainted with German and far from the Swiss archives, so that the first book of his projected work was finally committed to the flames. Then Gibbon assisted his friend in the 'Mémoires Littéraires de la Grand Bretagne,' which were published in 1767 and 1768. In 1770 he also printed anonymously his 'Critical Observations on the Sixth Book of the Æneid,' a brilliant and conclusive answer to a theory of Warburton in his 'Divine Legation of Moses.'

Meanwhile the historian had begun the more serious study of his Roman subject in 1768, after the failure of the Swiss project. Two years later he was left independent at his father's death, and establishing himself in London in 1772 he began the composition of his 'History of the Decline and Fall of the Roman Empire.' On the death of Goldsmith (1774) he was made professor of history at the Royal Academy. The same year he was elected to Parliament, "at the beginning of the memorable contest between Great Britain and America." Yet he was to attain fame not by tongue but by pen. Silent in the House of Commons he sprang at once into public esteem when the first volume of his 'History' issued from the press in 1776. The first impression was soon exhausted. A second edition was sold and a third printing within a year. "My book," he says, "was on every table, and almost on every toilette; the historian was crowned by the taste or fashion of the day, nor was the general voice disturbed by the barking of any profane critic." The lasting fame of the author was once for all established.

From the publication of the first volume of the 'Decline and Fall' to the issue of the last three (1788) is a period of 12 years, the whole period of collecting materials and composition covering two decades. Of these 12 years the first seven were the most active. After the first enthusiasm for his 'History' had subsided, a storm of clerical criticism burst upon his treatment of the growth of Christianity in the early centuries. This he did not at first answer, but when his good faith was attacked he at last replied in a 'Vindication' (1779). In the same year he prepared a state paper, the 'Mémoire Justicatif,' against the French course in relation to the American war. He was also made one of the Lords Commissioners of Trade. In 1781 he published the second and third volumes of the 'Decline and Fall.' The following year he lost his seat in Parliament and his place as Lord Commissioner, and though some offers were made of other public positions he never again took part in public life.

Gibbon now resolved on an unusual move for an Englishman. While by no means a poor man, he thought his income insufficient for English life. He therefore decided to remove to Lausanne and unite his establishment with that of his friend Deyverdun. To his friend and the place he was bound by ties of early affection. He could live well in Switzerland and yet save money. He could complete his 'History' and return to England at the age of 50 a comparatively rich man. So he explained his purposes, and he finally settled in his new home in 1783. Four years later he returned to England with the last three volumes of the 'Decline and Fall,' which were published on his birthday, 1788. After a year in England, however, he went back to Switzerland, fully satisfied with his foreign residence. Deyverdun died in 1789 but he still clung to his adopted country.

He was now to undertake the one other important literary work of his lifetime. In the year of the publication of his 'History' he began the celebrated 'Memoirs' which have delighted the world for more than a century. On these he was engaged at intervals for the next six years, and he left six different sketches covering more or less fully different portions of his life. The 'Memoirs' were finally printed in 1796 with the 'Miscellaneous Works' of the historian, edited by Lord Sheffield. The manuscripts remained in the possession of the Sheffield family for a century, when they were deposited in the British museum and the whole of the six partial sketches were published. Then it was seen that Lord Sheffield had taken unusual liberties with Gibbon's autobiography, though preserving much the larger part of the sketches not overlapping.

In 1793 Gibbon hastened to England on the death of the wife of Lord Sheffield, his intimate friend. During the year he was still full of plans. He had once hinted a supplement to his 'History.' He now meditated a series of biographies of eminent Englishmen. He even set his hand to a prospectus which should announce the editing of English historical writers by John Pinkerton. But all such plans were to be stayed. A disorder with which he had long been afflicted led to dropsy, for which he was treated at different times in the fall of 1793. At last he became rapidly worse at the beginning of the new year and died very suddenly.

Gibbon's fame rests upon his one great undertaking, the 'History of the Decline and Fall.' It was the most monumental work of its age, as he was the most erudite historical student of his time. In his 'Memoirs' Gibbon hesitates to class himself with Hume and Robertson, but he is the only one of the three to outlive a century of wonderful progress in historical research. It is true some defects have been found in his famous 'History,' and newer views of historical development find some omissions. But the century old work has been the basis for all later research, while it is still edited by learned historians instead of being replaced by labors of their own.

Bibliography.—For the 'Decline and Fall': Oxford ed., 8 vols., 1828; ed. by H. H. Milman, 12 vols., 1838–9; by W. Smith, 8 vols., 1854–5; latest and best by J. B. Bury, 7 vols., 1896–1900. French, German and Italian translations appeared in Gibbon's lifetime, Polish, Greek and Magyar since.

For 'Memoirs': 'Miscellaneous Works,' 2 vols., ed. by Lord Sheffield, 1796; sec. ed., enlarged to 5 vols., 1814; 'Memoirs,' ed. by Milman, 1739; 'Letters of Gibbon,' ed. by Prothero, 2 vols., 1896; 'Autobiographies,' ed. by Murray, 1897; 'Memoirs,' ed. by O. F. Emerson, 1898; by G. B. Hill, 1900. Notes on life in *Gentleman's Magazine*, lviii, lix, lxiv, lxvi; Egerton Brydges's 'Autobiography'; Boswell's 'Johnson'; Walpole's 'Letters'; Mme. de Deffand's 'Letters to Walpole'; D'Haussonville's 'Salon of Mme. Necker' (1882); 'Girlhood of Maria Josepha Holroyd,' ed. by J. H. Adeane (1896); 'Historic Studies in the Vaud, etc.', by Meredith Read (1897).

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Gibbon, John, American soldier: b. Holmesburg, Pa., 1827; d. 1896. He was graduated from the United States Military Academy in 1847, and after service in the Mexican War was assistant instructor in artillery in the Academy 1854–7 and quartermaster 1856–9. He served in the Civil War and became major-general of volunteers and brevet major-general United States army. In 1891 was retired from the service. He published 'The Artillerists' Manual' (1859).

Gibbon, a tailless anthropoid ape of the East Indies, the several species of which constitute the genus *Hylobates* of the family *Simiidæ*. They are nearly allied to the orangs and chimpanzees, but are smaller, of more slender form, and their arms are so long as almost to reach the ground when the animal assumes an erect posture; there are also naked callosities on the buttocks. In general the gibbons are the lowest among the anthropoid apes, and connect them with the Old World monkeys by way of the semnopithecine group. (See Langur.) The gibbons are inhabitants of forests, their long arms enabling them to swing themselves from bough to bough, which they do to wonderful distances and with extreme agility. They cannot, however, move with ease or rapidity on the ground. The conformation of the hinder extremities adds to their difficulty in this, while it increases their adaptation to a life among the branches of trees, the soles of the feet being much turned inward. None of the gibbons are of large size, averaging about three feet tall. Eight or ten species are named in the books, but probably increased knowledge will reduce this number. One, the siamang (*H. syndactylus*) has the second and third digits of the hind limb partly united, and the hair of the upper arm pointing downward, while that on the forearm grows upward. It is a native of Sumatra, and has been set apart as the type of a separate genus (*Siamanga*) by some naturalists. The other species have the digits mostly free; they are natives of Cambodia, the Malay Peninsula, Sumatra, and Java, and are known as lars, hoolocks, agile gibbons, white-handed gibbons, etc., but are much alike. One species is called "wow-wow" in imitation of the howling cry that is characteristic of all. Consult Cassell's and the Royal 'Natural Histories,' and Hartmann's 'Anthropoid Apes' (1886).

Gibbons, Abigail (Hopper), American philanthropist: b. Philadelphia 7 Dec. 1801; d. New York 10 Jan. 1893. She was daughter of Isaac T. Hopper (q.v.) and wife of James Sloan Gibbons (q.v.). She taught in Philadelphia and New York, in 1845 assisted in founding the Women's Prison Association, and was also a founder of the Isaac T. Hopper Home for discharged prisoners. In the Civil War she was active in Federal hospitals and camps. It was chiefly through her instrumentality that the New York State reformatory for women and girls was established by the legislature.

Gibbons, Grinling, English sculptor and wood-carver: b. Rotterdam 4 April 1648; d. London 3 Aug. 1721. In 1671 Evelyn found him at Deptford carving on wood Tintoretto's 'Crucifixion'; and on Evelyn's recommendation he was appointed by Charles II. to a place in the Board of Works, and employed in the ornamental carving of the choir of the chapel at Windsor. His works display great taste and delicacy of finish, and his flowers and foliage have almost the lightness of nature. For the choir of St. Paul's, London, he executed the foliage and festoons, and those in lime-tree which decorate the side aisles. At Chatsworth, at Burleigh, at Southwick, Hampshire, and other mansions of the English nobility, he executed an immense quantity of carved embellishment; the ceiling of a room at Petworth is regarded as his *chef d'œuvre*. He also produced several fine pieces in marble and bronze. Among these are the statue of James II., Whitehall; the base of the statue of Charles I., at Charing Cross; and that of Charles II., at the Royal Exchange.

Gibbons, James, American cardinal: b. Baltimore, Md., 23 July 1834. When very young he was taken by his father to Ireland to be educated. He returned to America in 1853 and resided in New Orleans until 1855, when he matriculated at St. Charles College, near Ellicott City, Md., where he was graduated with distinction in 1857. He then pursued his theological course at the Seminary of St. Sulpice and at St. Mary's University, Baltimore. On 30 June 1861 he was ordained a priest, his first mission being at St. Patrick's Church, Baltimore, where he was assistant. Transferred to St. Bridget's Church, Canton, he ministered to a small congregation till 1865, when Archbishop Spalding made him chancellor of the archdiocese and his private secretary. The second plenary council at Baltimore, 1866, made him its assistant chancellor, and in August 1868 he was consecrated titular bishop of Adramyttum *in partibus infidelium* and first vicar-apostolic of North Carolina, erected by bull of His Holiness, Pius IX., dated 3 March 1868. He found three churches, two priests, and about 1,000 Roman Catholics scattered over the entire State. He opened a school, which he personally conducted; built six churches; introduced into the vicariate the Benedictine order at Belmont, Gaston County, where Mary Help abbey was later erected; established the Sisters of Mercy and built for them a school for whites and one for negroes in Wilmington. He made the personal acquaintance of every adult Roman Catholic in the State, and met them at their homes, traveling from the seaside to the mountains, up and down the State, that none should be neglected. After four years he was translated to the see of Richmond in 1872. Here he erected five churches, St. Peter's Academy in charge of the Xaverian Brothers, and St. Sophia's home for old people in charge of the Little Sisters of the Poor, in Richmond, Va., and parochial schools in Petersburg and Portsmouth, Va.; and enlarged St. Joseph's female orphan asylum, Richmond, Va. In 1877 Archbishop Bayley asked to have Bishop Gibbons appointed his coadjutor, and on the death of Archbishop Bayley in October of that year Bishop Gibbons became archbishop of Baltimore, the highest ecclesiastical dignitary of the Roman Catholic Church in the United States. He headed the delegation of American prelates who visited Rome in 1883 to represent the affairs of the Church in the United States at the Vatican, and to outline the work of the third plenary council, to meet in 1884. Pope Leo XIII. appointed Archbishop Gibbons to preside over the council. In directing the proceedings of the council he co-operated in the enactment of many important new decrees, made necessary by the progress and development of Catholicism in America; and these acts and decrees were, after mature deliberation, approved by the ecclesiastical authorities. Leo XIII. expressed his approval of the action and course of Archbishop Gibbons and created him cardinal 7 June 1886, and on 30 June 1886 Archbishop Kenrick of St. Louis, representing the Pope, bestowed the insignia of his office upon the newly made cardinal. Cardinal Gibbons sailed for Europe the next year to receive the apostolic benediction and to be admitted to membership in the college of cardinals, the 25th in succession. While in Rome he interpreted to the Pope the democratic spirit of American Catholicism in respect to the labor organizations in the United States and the exact relation existing between the employers and the employed. He was installed as pastor of his titular church 25 March 1887, and was assigned to the Church of Santa Maria in Trastevere, a church of great antiquity, on the Tiber. He returned to America in November 1887; on 24 May 1888 laid the cornerstone of the Catholic University, Washington, D. C., and dedicated the divinity building 13 Nov. 1889. Cardinal Gibbons has been chancellor of the University since its foundation. In November 1888 he celebrated at Baltimore the centenary of the founding of the Catholic hierarchy in the United States, subsequently convening a congress of Catholic laymen, the first ever held in the United States. Cardinal Gibbons is president of the Bureau of Catholic Indian Missions, and is the first American cardinal to take part in the election of a pope. A model Churchman, he is also a typical American citizen, loyal, progressive, and public-spirited. He has published: 'The Faith of Our Fathers' (1876; 58th ed. 1903); 'Our Christian Heritage' (1889); 'The Ambassador of Christ' (1896); etc. The archdiocese of Baltimore now (1905) has a Catholic population of 250,000; 396 priests; 261 churches; 95 parochial schools; 3 universities; 2 diocesan seminaries; 6 hospitals, and other charitable and educational institutions.

Gibbons, James Sloane, American banker: b. Wilmington, Del., 1 July 1810; d. New York 17 Oct. 1892. He early became a strong abolitionist, and in 1863 his house in New York was sacked by a mob, during the draft riots, because he had illuminated it in honor of Abraham Lincoln. His fame rests chiefly on his patriotic song, which was very popular during the Civil War, 'We are Coming, Father Abraham, Three Hundred Thousand More.'

Gibbs, Alfred, American soldier: b. Sunswick, L. I., 22 April 1823; d. Fort Leavenworth, Kan., 26 Dec. 1868. He was graduated from the United States Military Academy in 1846, served in the mounted rifles during the Mexican War, was brevetted captain, and until 1861 was employed in frontier and recruiting service. He served in the Federal army during the Civil War and attained the rank of major-general of volunteers and brevet brigadier-general United States Army. He was mustered out of the volunteer service in 1866, became major of the Seventh cavalry in that year, and until his death was stationed at various Kansas forts.

Gibbs, George, American mineralogist: b. Newport, R. I., 8 Jan. 1782; d. Newtown, N. Y., 5 Aug 1833 Early becoming interested in the study of mineralogy, he collected during his travels in Europe, chiefly by purchase, a very extensive and valuable cabinet of minerals, the most extensive at the time that had been brought together in the United States. This collection he set up in the public rooms of Yale College, where it remained without charge from 1811–25, and in the latter year it was purchased for the college for $20,000.

Gibbs, James Edward Allen, American inventor: b. 1 Aug. 1829; d. Raphine, Rockbridge County, Va., 25 Nov. 1902. While a young man the subject of the sewing-machine was called to his attention, and presently he thought out the idea of the revolving hook which is the main feature of the Willcox & Gibbs machine. In all he took out 12 patents covering the sewing-

HIS EMINENCE JAMES, CARDINAL GIBBONS.

Archbishop of Baltimore

machine. The village in which he resided was named by him when he returned to it in middle life. The name is from the Greek word which means "to sew."

Gibbs, Josiah Willard, American philologist: b. Salem, Mass., 30 April 1790; d. New Haven, Conn., 25 March 1861. He was graduated at Yale College in 1809, and in 1824 was appointed professor of sacred literature in the theological department of Yale College, which he held till his death. He published a translation of Gesenius' 'Hebrew Lexicon of the Old Testament' (1824); 'Manual Hebrew and English Lexicon,' abridged from Gesenius (1828); 'Philological Studies' (1857); 'Latin Analyst' (1858), etc., and contributed to the periodical works of his time numerous important papers on topics of philology and criticism.

Gibbs, Josiah Willard, American mathematician: b. New Haven, Conn., 11 Feb. 1839; d. there 28 April 1903. He was a son of the preceding and was graduated from Yale in 1858. He was professor of mathematics at Yale in 1871 and held the position at the time of his death. Thermodynamics was the field in which he achieved his greatest renown. He was original in his manner of teaching and extremely successful in the class-room. The work that brought him first into prominent notice was his treatise on the 'Equilibrium of Heterogeneous Substances,' published in 1875 by the Connecticut Academy of Arts and Science. His last contribution on this subject was his book in the Bi-Centennial series at Yale, entitled 'An Elementary Treatise on Statistical Mechanics,' wherein he set forth what are likely to be the foundations of this branch of science in the future. In 1881 he began the development of the Vector analysis and applied it to problems in crystallography and to the computation of the orbits of the planets and comets and also to problems in the theory of light. His work gave strong support to the electro-magnetic theory and powerful influence in securing a general adoption of this theory by physicists.

Gibbsite, gĭb'zīt, a mineral usually occurring in mammillary or stalactitic masses or incrustations, or in monoclinic crystals (hydragillite). Its color is usually white, often tinted with green, yellow or red. Its hardness is 2.5 to 3.5 and its specific gravity about 2.4. It is an aluminum hydrate, $Al(OH)_3$, containing 28 per cent of aluminum. It occurs in the Urals, Norway, Brazil and at Richmond, Mass. It was named after George Gibbs (q.v.).

Gibeah, gĭb'ē-ā, the name of several towns in ancient Palestine, the birthplace of Saul, and the scene of Jonathan's romantic exploit against the Philistines.

Gib'el, or **Prussian Carp,** a European carp (*Cyprinus gibelio*) of small size, without barbels and with a forked tail. It occurs in England and is good food.

Gib'eon, one of the ancient cities of the Canaanites, in Palestine, a "great city" of the Hivites, who at an early stage of Joshua's conquests entered into a stratagem to get terms of peace for themselves. Taking old clothes on their persons, and dry and moldy bread in their bags, they professed to have come from a far country, and proposed an alliance with the Israelites, which was accepted by Joshua before the stratagem was discovered. When the discovery was made, the covenant was strictly observed, but the Gibeonites were condemned to be "hewers of wood and drawers of water unto all the congregation" (Jos. ix. 21). The town of Gibeon fell afterward to the lot of Benjamin. It was made a Levitical city, and the Tabernacle was transferred there from Nob after the slaughter of the priests. The engagement between the men of Abner and David took place here. Gibeon has been identified with the modern El-Jib. A large number of the Gibeonites, who had made a covenant with Joshua, were massacred by Saul, for which crime seven of Saul's sons were delivered up by David to the Gibeonites to be hanged (2 Sam. xxi. 1–9).

Gibraltar, jĭ-bràl'tar (Sp. hē-bräl-tär'), a town and strongly fortified rocky peninsula at the southern extremity of Spain, at the western entrance of the Mediterranean, belonging to Great Britain. This remarkable fortress, which lies opposite Ceuta in Africa (distance between Europa Point and Ceuta 14½ miles), and forms the key to the Mediterranean, is connected with the mainland of Spain by a low sandy isthmus, the peninsula having the Bay of Gibraltar on the west, and the open sea of the Mediterranean on the east. The British territory has a length of 2¾ miles and a greatest breadth of ¾ of a mile, the greater part of it consisting of "the rock," at the foot of which, on the north, is a race course, cemetery, etc. The highest point of the rock is about 1,400 feet above sea-level. Its north face is almost perpendicular, while its east side also presents tremendous precipices. On the south it is almost inaccessible, making approach from seaward impossible; the west side, again, although nearly as rugged and precipitous as the others, slopes toward the sea; and here the rock is secured by extensive and powerful batteries, and other works rendering it apparently impregnable. The body of the rock consists of a kind of dense limestone arranged in beds of 30, 40, and 50 feet in thickness. There are a number of remarkable caves in various parts of the rock, but all difficult of access.

Vast sums of money and an immense amount of labor have been spent in fortifying this celebrated stronghold. Numerous caverns and galleries, extending two to three miles in length, and of sufficient width for carriages, have been cut in the solid rock, forming safe and sheltered communications from one part of the garrison to another in cases of attack. Along these galleries are port-holes opening toward the bay or toward the Spanish territory (between which and the British territory there is a strip known as "the neutral ground"); while trees, shrubs, and flowers of various kinds have been planted at different points, both for ornament and utility. On the summit of the rock there are barracks, signal-stations, etc. Of late years the fortifications have been carefully strengthened at every vulnerable point, and guns of the newest construction have been mounted in them. Gibraltar has a naval dockyard, and is a victualing and coaling station of the British navy. Great harbor works have for some time been in course of construction (at a cost of some $20,000,000), including a large area of sea enclosed by massy walls, and graving-docks large enough to accommodate the largest battle-ships. The materials have been mostly brought from the east side of the rock by means of a tunnel specially constructed for this purpose.

The town of Gibraltar is situated on the west side of the peninsula, fronting the bay. It consists of two portions, the North Town and the South Town, the former being much the larger and separated from the South Town by the Alameda Gardens, parade ground, etc. The principal buildings are the governor's house, the naval hospital, the civil hospital, the garrison library (45,000 vols.), the court-house, revenue offices, remains of an old Moorish castle, and the barracks. The water for the supply of the town and garrison is collected in tanks during the rainy season. Splendid reservoirs for water have recently been constructed by the government. Gibraltar is a free port, and serves as a valuable entrepôt for the distribution of British manufactures to the neighboring countries. The administration is vested in the governor, who is also commander-in-chief of the troops; and the settlement is treated as a garrison town, the power of enacting laws being vested in the governor alone. All criminal cases are determined according to the laws of England. Newcomers to Gibraltar are stringently looked after. Foreigners are permitted to remain during specified periods only, and on giving the required security. The population in 1901 amounted to 27,460, including a garrison of 5,349 men. The permanent residents are of very various origin — Spanish, Portuguese, Maltese, etc.

The name is formed from the Arabic words *gebel al Tarik* (the height or rock of Tarik), since Tarik Ibn Zeiad, the general of the caliph Valid, at the time of the irruption of the Moors into Spain (711 A. D., and following years), landed at the foot of this rock (known as the *Calpe* of antiquity and one of the *Pillars of Hercules* — Abyla in Africa being the other), where he founded a strong fortress. About the beginning of the 14th century it was taken from the Moors by Ferdinand, king of Castile, but in 1333 it was recovered by them, and was not finally acquired by the Spaniards till 1462, when it was taken in the reign of Henry IV. The Duke of Medina-Sidonia, who had assisted in gaining it for the Christians, took forcible possession of it for himself, and it remained in the keeping of his family till 1501, when the Spanish sovereign got it into his own hands. The third duke unsuccessfully tried to recover it in 1506, by which time the fortress had undergone altogether some half score of sieges. The pirates of Algiers subsequently made an attack upon it, but were forced to retire. The German engineer, Speckel of Strasburg, in the reign of the Emperor Charles V., substituted for the old Moorish fortifications works in the European style. In the war of the Spanish Succession the Spaniards were obliged to surrender this fortress, 4 Aug. 1704, to the British admiral Rooke, assisted by a body of troops under Prince George of Darmstadt. From October 1704 to April 1705 it was besieged by the Spaniards. It was secured to Britain by the Peace of Utrecht in 1713. Since this time nothing has been omitted by Britain to render this fortress, which forms a bulwark of her Mediterranean trade, absolutely impregnable. As the increasing value of the place rendered the possession of Gibraltar more desirable to Spain, the siege of it was commenced 7 March 1727, but raised upon the approach of Admiral Wager, with 11 ships of the line. Spain then offered £2,000,000 sterling for the delivery of the place, but in vain; and by a compact at Seville in 1729 Spain agreed to renounce all its claims upon it. Still the Spaniards omitted nothing to prevent all entrance into the fortress, and to cut it off from the mainland, by constantly strengthening the lines of St. Roch and Algeciras. But it was easy to supply the inhabitants and garrison by sea. In the war which broke out between Britain and Spain in 1779 the last attempt was made for the recovery of Gibraltar. It now underwent the famous four years' siege from 1779 till 1783, but was ably and successfully defended by Gen. Elliot, afterward Lord Heathfield. It was secured to Britain by the Peace of 1783. Since that time, in the various British and Spanish, and also French wars, Gibraltar has only been blockaded on the land side.

Gibraltar of America, Quebec, Canada; so called on account of its commanding situation and its well-nigh impregnable defenses, both natural and artificial. It is the most securely fortified city in America.

Gibraltar of the East, a name given to Aden, a town and seaport of Arabia. Since 1839 it has belonged to the British, and its fortifications have been greatly strengthened and improved. The citadel is built on a rocky eminence, and is of great strategic importance, having a position between Asia and Africa like that of Gibraltar between Europe and Africa.

Gibraltar, Bay of, an inlet of the Atlantic formed by the headland of Cabrita and Europa Point, four miles distant from each other, and is spacious and well adapted for shipping, being protected from all the more dangerous winds; the extreme depth within the bay is 110 fathoms. To increase the security of the harbor, two moles have been constructed, which respectively extend 1,100 and 700 feet into the bay. The Spanish town and port of Algeciras lie on its western side.

Gibraltar, Straits of (anciently called PILLARS OF HERCULES); the straits connecting the Mediterranean Sea with the Atlantic Ocean, extending from Cape Spartel to Cape Ceuta on the northwest coast of Africa, and from Cape Trafalgar to Europa Point on the southwest seaboard of Spain. They narrow toward the east, their width between Europa Point and Cape Ceuta being only 15 miles, while at the west extremity it is 24 miles. Length, about 36 miles. Through these straits a constant current runs so strongly from the Atlantic that sailing vessels bound west can pass them only by the aid of a Levanter, or strong breeze from the east. It is believed that the waters of the Mediterranean find an outlet here by means of an undercurrent.

Gibraltar Ape or Monkey. See BARBARY APE.

Gibson, Charles Dana, American illustrator: b. Roxburg, Mass., 14 Sept. 1867. He studied at the Art Students' League (New York), became known as an illustrator for periodicals, particularly for the comic weekly, 'Life,' and through his satirical presentations of wealthy society attained a wide reputation. He has published various collections of his drawings.

Gibson, John, English sculptor: b. near Conway, Wales, 19 July 1790; d. Rome 26 Jan. 1866. He was the son of a landscape gardener, and was apprenticed to a wood-carver at Liverpool, where he attracted attention by a figure of 'Time,' modeled in wax, which he exhibited at the age of 18. The patronage of W. Roscoe (q.v.) assisted him to go to Rome, where he was cordially received by Canova. On the death of Canova in 1822 Gibson entered the studio of Thorwaldsen. In 1836 he was made a royal academician; but to the end of his life continued to make Rome his chief place of residence. Among his best works are: 'The Wounded Amazon'; 'The Hunter and His Dog'; 'Hylas and the Nymphs'; 'Helen'; 'Proserpine'; and 'Sappho.' The subjects of most of Gibson's works are taken from classical mythology, but he was no servile imitator of the antique; on the contrary, he exhibited thorough originality in his treatment, and gave marked individuality and expression to the goddesses, nymphs, and heroines of antiquity that proceeded from his studio. He was the author of one remarkable innovation, at least in modern sculpture, that of coloring his figures, and though he believed to the last that the experiments of this nature which he made were successful, he never succeeded in securing the approbation of other artists for the practice.

Gibson, Randall Lee, American politician: b. Spring Hill, Woodford County, Ky., 10 Sept. 1832; d. Hot Springs, Ark., 15 Dec. 1892. He was graduated from Yale in 1853, studied law in Tulane (then the University of Louisiana) and Berlin, was a sugar planter in Louisiana until the Civil War, entered the Confederate army in the ranks, and finally attained the rank of major-general. Subsequent to the War he practised law, and having entered public life was elected to Congress as a Democrat in 1872, though not seated, was in the House from 1874–82, and in the Senate from 1882 until his death.

Gibson, Robert Atkinson, Protestant Episcopal bishop: b. Petersburg, Va., 9 July 1846. He entered the ministry in 1870, was rector of Moore Memorial Chapel, Richmond, Va., 1872–8; of Trinity Church, Parkersburg, W. Va., 1878–87; and Christ Church, Cincinnati, 1887–97. In November of the year last named he was consecrated coadjutor-bishop of Virginia, succeeding to the bishopric on the death of Bishop Whittle in 1902.

Gibson, Robert Williams, American architect: b. Essex, England, 17 Nov. 1854. He studied at the Royal Academy of Arts, came to the United States in 1881 and has since practised his profession in New York. He has designed many important American buildings, among which are the Episcopal Cathedral at Albany, N. Y., and many churches, the Botanical Museum, New York, and banks at Buffalo, Albany, Utica, and elsewhere.

Gibson, William Hamilton, American artist and author: b. Sandy Hook, Conn., 5 Oct. 1850; d. Washington, Conn., 16 July 1896. Many of his illustrations appeared in the 'Art Journal' and in 'Picturesque America'; and his illustrations of books were numerous and popular. He published: 'Camp Life in the Woods' (1876); 'Pastoral Days' (1881); 'Highways and Byways' (1883); 'Strolls by Starlight and Sunshine' (1891); 'Sharp Eyes' (1896).

Gid, gĭd, **or Staggers,** a disease of sheep caused by a larval tape-worm (*Coenurus*) in the brain. See SHEEP, DISEASES OF.

Giddings, Franklin Henry, American sociologist: b. Sherman, Conn., 23 March 1855. He was graduated from Union College in 1877, and engaged in journalism until 1888, when he became lecturer in political science at Bryn Mawr. In 1894 he became professor of sociology at Columbia University. He has written: 'The Principles of Sociology'; 'The Theory of Socialization'; 'The Elements of Sociology'; 'Democracy and Empire'; and 'Introduction to Sociology.' He has greatly aided in systematizing the facts and theories of his department, and is distinguished from other modern sociologists by the emphasis he lays on the "consciousness of kind" as the distinguishing motive of the social individual, and one of the chief factors in the organization of society.

Giddings, Joshua Reed, American statesman: b. Athens, Pa., 6 Oct. 1795; d. Montreal, P. Q., 27 May 1864. He was admitted to the Ohio bar in 1820; elected a member of its legislature in 1826, and of Congress in 1838, where he was prominent as an opponent of slavery. Not only did he predict the tightening of the slavery chain about the neck of the two parties, but he foresaw the armed struggle. On different occasions in different speeches, he prophesied the Civil War and as a political abolitionist sought to hasten it by using the power of political organization. In 1861 he was appointed consul-general to British North America. Among his works are: 'The Exiles of Florida' (1858); 'The Rebellion: Its Authors and Causes' (1864).

Gid'eon (Heb. Feller, Hewer), deliverer of Israel from the Midianites. These nomad Arabs of the Syrian and Arabian deserts had invaded the central district of Palestine. In one of their expeditions they had murdered Gideon's brothers at Tabor. He is called by an angel of the Lord to save Israel. He is also bidden to destroy the altar of Baal, and to erect a sacrificial altar to Jehovah in its place. He gains from the performance of this command the name of Jerubbaal. Collecting the men of his clan Abieger he surprises the Midianites under cover of night, drives them toward the Jordan and captures and slays the two princes Oreb and Zeb. Continuing his pursuit to the Jordan he overtakes and kills the kings Zeba and Salmunna. The Israelites wished to make Gideon king as a reward for his valor, but he asks merely for the golden earrings taken in the spoil, out of which he makes and sets up an ephod to Jehovah. The victory of Gideon is one of the remarkable events in Jewish history. "The day of Midian" is spoken of in the prophets, and allusions are found to it also in the Psalms, and even in the Book of Revelations.

Giessbach (gēs'bäh) **Falls,** Switzerland, a cataract of the Giessbach, falling into Lake Brienz; consisting of 7 cascades, the largest of which has a fall of 190 feet.

Giffen, SIR **Robert,** English economist: b. Strathaven, Scotland, 22 July 1837. He went to London in 1862, where he was acting editor of the ‘Economist’ under Walter Bagehot 1868–76; then founded the ‘Statist’ and became chief of the Statistical Department in the board of trade and assistant secretary in 1882. He was John Morley's assistant on the ‘Fortnightly Review’ in 1873–6; and is the author of reports, papers, and essays which have given him a high rank. His works include: ‘American Railways as Investments’ (1873); ‘Stock Exchange Securities’ (1877); ‘Essays in Finance’ (1879); ‘The Progress of the Working Classes in the Last Half Century’ (1884); ‘The Growth of Capital’ (1890); ‘The Case Against Bimetallism’ (1892).

Gifford, Robert Swain, American artist: b. Naushon Island, Mass., 23 Dec. 1840; d. New York 15 Jan. 1905. He studied with Albert Van Beest in Rotterdam, Holland; traveled through California and Oregon in 1869, and in Europe and North America 1870–1. He was best known as a painter of landscapes and seashore scenes, and among noted paintings by him were: ‘The Rock of Gibraltar’; ‘A Lazy Day in Egypt.’

Gifford, Sandford Robinson, American artist: b. Greenfield, N. Y., 10 July 1823; d. New York 29 Aug. 1880. He was educated at Brown University; studied painting in Europe 1855–7. His works include: ‘A Lake Scene on the Catskills’; ‘Ruins of the Parthenon’; ‘Sunrise on the Matterhorn’; ‘Home in the Wilderness’; ‘Lake Geneva’; ‘Fishing-Boats in the Adriatic’; ‘San Giorgio, Venice’; etc.

Gifford, William, English critic: b. Ashburton, Devonshire, April 1757; d. London 31 Dec. 1826. He studied at Oxford, afterward traveled on the continent with Lord Belgrave for some years, and on his return to England devoted his time to literary pursuits. In 1794 he published ‘The Baviad,’ a poetical satire, in which the poetasters of the Della Crusca school are the chief objects of his ridicule; and in 1795 appeared ‘The Mæviad,’ a severe animadversion on the degraded state of the drama. These works, though virulent and coarse, display much critical ability. In 1797 he became editor of the Anti-Jacobin newspaper — an office which involved him in a quarrel with Dr. Wolcot, against whom he published a pamphlet in verse, entitled ‘An Epistle to Peter Pindar.’ His translation of the ‘Satires of Juvenal’ was published in 1802, and is executed in a manner highly creditable to his abilities. He edited the plays of Massinger, with notes, and a life of that dramatist (1805); and afterward in a similar manner the works of Ben Jonson, Ford, and Shirley. He also translated the ‘Satires of Persius.’ In 1809 he entered on the editorship of the ‘Quarterly Review,’ of which he continued to be conductor till 1824, when he resigned. He was interred in Westminster Abbey.

Gift, Theo. See Boulger, Dorothy Henrietta.

Gigan'tism, a rare form of disease supposed to be associated with changes in the pituitary body; characterized by abnormal processes of growth, chiefly in the bones of the face and extremities. Most giants, as seen in circuses, etc., have this disease or develop it in time. Technically the disease is known as acromegaly (q.v.).

Gigantostraca, jī-găn-tŏs'tra̤-ka̤. See Eurypterus.

Gignoux, François Regis, frāṅ-swā rā-zhē zhēn-yoo, French painter: b. Lyons 1816; d. Paris 6 Aug. 1882. He studied at the Beaux-Arts and with Delaroche, and in 1840–70 was in the United States, where he became a national academician. Many of his works are in the possession of private collectors of New York. He painted chiefly studies of natural scenery, such as ‘The Indian Summer’; ‘Niagara by Moonlight’; ‘The Bernese Alps at Sunrise.’

Gigoux, Jean, zhŏṅ zhē-goo, French painter: b. Besançon 8 Jan. 1809; d. 10 Dec. 1894. He studied at the Beaux-Arts, and as a pupil of Géricault and Sigalon, and achieved a high reputation by his historical works, religious and secular, in which he displayed forceful coloring and a faithful attention to detail. By his drawings on the stone, he did much to further the development of lithography. He executed 600 illustrations for an edition of ‘Gil Blas.’ Among the best of his paintings are: ‘The Eve of Austerlitz’; ‘The Good Samaritan,’ and ‘The Death of Leonardo da Vinci,’ his chief work now hung in the Besançon Museum. He published: ‘Causeries sur les artistes de mon temps’ (1885).

Gihon, gī'hŏn, **Albert Leary,** American sanitarian: b. Philadelphia, Pa., 28 Sept. 1833; d. New York 17 Nov. 1901. He was appointed assistant surgeon in the United States navy in 1855; took part in the attack and capture of the barrier forts, near Canton, China, in 1856; and served throughout the Civil War. He was promoted medical director in 1895, and was retired with the rank of commodore the same year. He published: ‘Practical Suggestions in Naval Hygiene’; ‘Need of Sanitary Reform in Ship Life’; ‘Sanitary Commonplaces Applied to the Navy’; ‘Prevention of Venereal Diseases by Legislation’; and was editor of ‘Annual of the Medical Sciences’ for six years.

Gil Blas (zhēl blās) **of Santillane,** sāṅ-tīl-āṅ, **The Adventures of,** a famous romance by Alain René Le Sage. It is a series of pictures of life among all classes and conditions of people in Spain two centuries ago. The narrative runs on, with excursions and interpolated histories, and the thread of the story is as inconsequential as that of a tale of the ‘Arabian Nights.’ The charm of the work is its absolute truth to human nature, and its boundless humor and satire. These qualities have made it a classic. Le Sage was a Frenchman, who never saw Spain; but through his familiarity with its literature he produced a work so essentially Spanish in its tone and spirit as to provoke long controversy as to its originality. Its writing occupied 20 years; the first two volumes appearing in 1715, and the last in 1735. It has been translated into many languages, the earliest in English; the one which has remained the standard being by Tobias Smollett.

Gila, hē'lā, a river of the United States, an affluent of the Colorado, origin in New Mexico; length 450 miles. Its upper course is through mountains, with many deep and precipitous cañons; farther south it flows through an open and comparatively level country, the valley being productive when irrigated. About 200 miles from the Colorado is the reservation of the Maricopa and Pima Indians. Ancient ruins are numerous on the banks of the Gila.

Gila Monster, the poisonous lizard (*Heloderma suspectum*) of the sandy deserts of the southwestern United States, so called because first brought to notice in the valley of the Gila River, Arizona, and on account of the great size (two feet in length) which it sometimes attains. Another "species" (probably a variety — *H. horridum*) exists in the arid parts of Mexico, where it is called "caltotepon" or crust-lizard. These constitute a family *Helodermatidæ,* characterized by the presence of pleurodont, fang-like teeth, each with a groove on its front and rear surface, and each having near its base a labial gland which secretes venom of the same nature as that of serpents. The food of these lizards consists of worms, centipedes, the eggs of birds and lizards, frogs and other small animals which its bite paralyzes or kills. It is slow to anger, but instances are on record of its biting men, producing illness and in some cases death.

Gilbert, Anne Hartley, American actress: b. Rochdale, England, 21 Oct. 1821; d. Chicago, Ill., 2 Dec. 1904. She was a graceful dancer in early life, and later became very successful in high comedy. She was married to George Henry Gilbert, a dancer, in 1846. She visited the United States in 1846, and in 1849 made her home here. For many years before her retirement she was a member of the Daly Company, her especial roles being those of old women, in which she achieved very marked success. On 21 Oct. 1899, her birthday was observed by her admirers by a special performance, a reception, and the presentation of a silver service at the Lyceum Theatre, New York. Her 'Stage Reminiscences' was published in 1901.

Gilbert, Charles Henry, American educator: b. Rockford, Ill., 5 Dec. 1859. He was graduated at Butler University, Ind., in 1879, and became professor of zoology in the Leland Stanford University in 1891. He is the author of 'Synopsis of the Fishes of North America,' with D. S. Jordan (q.v.).

Gilbert, Grove Karl, American geologist: b. Rochester, N. Y., 6 May 1843. He was graduated from the University of Rochester in 1862 and has been geologist of the United States Geological Survey from 1879. He has published: 'Geology of the Henry Mountains' (1879–82); 'Lake Bonneville' (1890); and numerous reports issued under the direction of the United States government.

Gilbert, Sir **Humphrey,** English navigator: b. Devonshire 1539; d. September 1583. He studied at Eton and Oxford, and adopting the military profession, he served with reputation in France and Ireland. He was knighted in 1570, and sat in the House of Commons as member for Plymouth in the following year. Possessing a strong propensity for speculation and enterprise, he turned his attention to maritime exploration, and published 'A Discourse of a Discovery for a New Passage to Cataia' (1576; reprinted in Hakluyt's collection of voyages, Vol. III.). In 1578 Sir Humphrey Gilbert obtained from the Queen a patent empowering him to discover and colonize in North America any land then unsettled. His first voyage ended in failure, but in 1583 he sailed again with a small fleet, and, having landed on Newfoundland, he took possession of the harbor of St. John's. On his return voyage to England in a small sloop he was lost in a storm. See 'Lives by Tytlor (1833); St. John (1868); Edwards (1868); Payne, 'Voyages of the Elizabethan Seamen' (1880).

Gilbert, Sir **John,** English painter: b. Blackheath, near London, 21 July 1817; d. Villers-sur-Mer, France, 5 Oct. 1897. In 1836 he began to exhibit both in oil and water colors; and in 1852 he was elected an associate, in 1853 a member, in 1871 the president of the Society of Painters in Water Colors, receiving soon after the honor of knighthood. He also became an A.R.A. in 1872, an R.A. in 1876, and a chevalier of the Legion of Honor. His oil paintings include: 'Don Quixote and Sancho Panza'; 'Education of Gil Blas'; 'Murder of Becket'; 'Joan of Arc Entering Orleans'; 'Crusaders'; 'Wolsey at Leicester,' and 'Morning of Agincourt.' He was a well-known and popular illustrator of books.

Gilbert, Linda, American philanthropist: b. Rochester, N. Y., 1847; d. 1895. She became known for her work in the interest of prison reform, and by her success in placing libraries in prisons. She was also foremost in obtaining the incorporation under the laws of New York of the Gilbert Library and Prisoners' Aid Society.

Gilbert, Rufus Henry, American inventor: b. Guilford, N. Y., 26 Jan. 1832; d. New York 10 July 1885. He was graduated at the New York College of Physicians and Surgeons: served as surgeon in the Union army in the Civil War; and was appointed superintendent and medical director of the United States army hospitals. Owing to the failure of his health after the war he abandoned his profession and engaged in the railroad business, making a special study of the needs of rapid transit in New York. The result was the erection of the first elevated railroad in that city.

Gilbert, William, English physician and physicist: b. in 1540 at Colchester, a town in Essex 50 miles from London; d. in 1603, and was buried in Trinity church, Colchester. At the age of 18 he entered Saint John's College, Cambridge, from which he graduated in 1560. In 1564, after taking his M.A. degree, he was appointed mathematical examiner of his college. Later, he devoted himself to the study of medicine, obtaining the Doctorate in 1569 and at the same time a senior fellowship in the University. Leaving Cambridge the same year, he went abroad for four years. In 1601, he was elected President of the Royal College of Physicians, an honor which was followed by his appointment as chief physician to Queen Elizabeth.

Gilbert's fame rests on the discoveries which he made in electricity and magnetism and which he tersely recorded in his work on the magnet, 'De Magnete magneticisque Corporibus,' published in London in 1600. He devoted all the time he could spare from his professional duties during a period of 18 years to the researches described in this remarkable treatise, which researches he informs the "candid reader" cost him over £5,000. By way of distinction, he marks his discoveries with marginal asterisks, large ones denoting important discoveries and small ones, those of minor note. Of the former, there are 21; of the latter 178. Besides a remarkable title-page, the work contains 84 illustrations.

In magnetism, Gilbert recognizes the magnetic field, the effects of heat, magnetic induction and magnetic screening; but his cardinal discovery is that the earth itself is a great magnet with its magnetic poles, equator and axis. He was led to this generalization by prolonged experiments with globular magnets, or terrellas, on which he poised small magnetic needles, finding that, however placed, they always pointed to the poles. He confirmed his theory by reference to the prevalence of magnetic materials in the crust of the earth, the behavior of the compass-needle and the dip circle, and also by the magnetic condition of vertical masses of iron such as the crosses of church-steeples.

Gilbert was an ardent advocate of the Copernican theory and there is reason to believe that his magnetic work was undertaken in its defence, convinced as he was that the revolution of the earth round the sun and its suspension in space would follow at once from the magnetic attraction of the other planets provided the earth itself could be proved to be a colossal magnet. Gilbert was belittled in *De Augmentis Scientiarum* by Chancellor Bacon, who was a staunch anti-Copernican, but was praised and admired by Galileo and Kepler. Two translations of 'De Magnete' have been made, the first by P. Fleury Mottelay of New York (1893), and the second by the Gilbert Society of London (1900). Gilbert's work stands out as the second landmark on magnetic philosophy, the first being a treatise on the lodestone by Peregrinus (q.v.) A.D. 1269.

Brother Potamian,
Professor of Physics in Manhattan College.

Gilbert, William Schwenck, English dramatist: b. London 18 Nov. 1836. He was the son of William Gilbert (1804–89), who published 30 novels, tales, etc. He was a clerk in the Privy Council Office 1857–62, and in 1864 was called to the bar. He contributed to the magazines, and was on the staff of 'Fun,' in whose columns his 'Bab Ballads' first appeared. His burlesque 'Dulcamara' (1866) was followed by other burlesques, dramas, comedies, fairy comedies and operas, chief of which was the celebrated series of Savoy operas written in collaboration with Sir Arthur Sullivan (q.v.) as composer. In nearly all his better-known works Gilbert displays fantastic humor that is often subtle, nearly always healthy in tone, and none the worse for a slight flavor of cynicism. His operas and 'The Bab Ballads' have been exceedingly popular in America. See P. Fitzgerald, 'The Savoy Opera and the Savoyards' (1894).

Gilbert Islands, or Kingsmill Group, a group of 15 islands in the South Pacific Ocean, between lat. 1° 0′ S. and 2° 30′ N.; and lon. 172° 0′ and 174° 30′ E. They are the most easterly of the groups collectively constituting Micronesia and are of coral formation, all low, the highest land in the group not exceeding 20 feet. The natives resemble the Malays. The whole group is under the protection of Great Britain, but the islands are self-governed, a sort of republicanism prevailing. Pop. (est.) 40,000.

Gil'bertines, The, a religious order founded about 1141 by Saint Gilbert (1083–1189), a parish priest of Sempringham, Lincolnshire, England. It was the only purely English order ever established prior to the Reformation. At the dissolution of the order, in the reign of Henry VIII., it numbered 22 convents. See Graham, 'Saint Gilbert of Sempringham and the Gilbertines' (1901).

Gilboa, gil-bō'a, a chain of hills in Palestine, between 500 and 600 feet high, overhanging the site of the ancient city of Jezreel, and rising between the fertile plain of Esdraelon and the valley of the Jordan. It is memorable as the scene of the defeat and death of King Saul and his three sons at the hands of the Philistines.

Gilchrist, gĭl'krĭst, **William Wallace,** American musician: b. Jersey City, N. J., 1846. He was a pupil of Clarke at the University of Pennsylvania, was an organist in Cincinnati 1872–83, and from that time was in Philadelphia, where he became a member of the faculty of the Musical Academy and a leader of choral societies in eastern States. His setting of Psalm XLVI. for solo voices, chorus, organ, and orchestra obtained the prize for composition at the Cincinnati festival of 1882, and his choral works are well known.

Gilder, gĭl'dėr, **Jeannette Leonard,** American editor: b. Flushing, N. Y., 3 Oct. 1849. Having entered journalism in 1869, she became editorially connected with 'Scribner's Monthly' (the present 'Century Magazine'), was a member of the New York *Herald* staff as literary editor and later musical and dramatic editor (1875–80), and in 1881 with her brother, J. B. Gilder (q.v.), founded and became editor of the 'Critic,' a monthly review of literature, drama, and art. Her publications are: 'Taken by Siege' (1886–96): and 'The Autobiography of a Tomboy' (1900). She also dramatized Sienkiewicz's 'Quo Vadis.'

Gilder, Joseph B., American journalist: b. Flushing, N. Y., 29 June 1858. After varied experience in journalism he, with his sister, J. L. Gilder (q.v.), established the 'Critic,' of which he became an editor. In 1895 he was appointed literary adviser to the Century Company and subsequently London representative of Dodd, Mead & Company. He edited 'Orations and After-Dinner Speeches of C. M. Depew' (1890), and other publications.

Gilder, Richard Watson, American editor and poet: b. Bordentown, N. J., 8 Feb. 1844. After secondary schooling he was a private of artillery during the emergency campaign in Pennsylvania (1863), and later managing editor of the Newark (N. J.) *Advertiser.* He subsequently established, with Newton Crane, the Newark *Register,* was editor of 'Hours at Home,' a monthly of New York, and when this was merged in 'Scribner's Monthly' became managing editor of the latter (1870). In 1881 he succeeded J. G. Holland (q.v.) as editor-in-chief of the 'Monthly,' in which capacity he remained after it became the present 'Century Magazine.' He was prominently identified with public affairs as chairman of the New York Tenement-house Commission (1894), member of the council of the National Civil Service Reform League, and other posts, and was a founder of the Authors' Club, the International Copyright League, and the Society of American Artists. The best of his verse, most of which originally appeared in magazines, was collected in 'Five Books of Song' (1894). Later volumes are: ‘In Palestine, and Other Poems’ (1898), and ‘Poems and Inscriptions’ (1901).

Gilder, William Henry, American journalist and arctic explorer: b. Philadelphia 16 Aug. 1838; d. 1900. He served in the Civil War, and was brevetted a major at its close. He accompanied Lieut. Schwatka in 1878 on a polar expedition, and in 1881 was a member of the Rodgers expedition as a correspondent of the New York *Herald*. His chief works are: ‘Schwatka's Search’ (1881); ‘Ice Pack and Tundra’ (1883). He was a brother of R. W. Gilder (q.v.).

Gil'dersleeve, Basil Lanneau, American classical scholar: b. Charleston, S. C., 23 Oct. 1831. He was graduated at Princeton in 1849, and studied in Germany for several years. He was professor of Greek and Latin at the University of Virginia from 1856 to 1876, when he was appointed professor of Greek at Johns Hopkins University. He is the founder and editor of the ‘American Journal of Philology.’ Among his works are: ‘Satires of Persius Flaccus’ (1875); ‘Justin Martyr’ (1875); ‘Odes of Pindar’; ‘Latin Grammar’ (1867); ‘Essays and Studies’ (1890); ‘Greek Syntax’ (1900).

Gilding, the art of applying and permanently attaching gold leaf or gold dust to surfaces of wood, stone, metals, etc. The Egyptian monuments present numerous traces of the existence of the art in ancient Egypt. The process seems to have been the same with that now used. The Persians also were acquainted with this art, as appears from the ruins of Persepolis. The Greeks and Romans employed gilding for many purposes. The Greeks used to gild the hoofs and horns of victims. The practice of gilding statues prevailed in the infancy of the art of sculpture, and was never entirely dropped by the ancients. The Romans used to gild sweetmeats; and many articles of furniture and utensils which have come down to us are gilt. There are also specimens of gilt glass and metals. The gilding which still remains on some ancient bronze monuments is remarkable for its brilliancy. The ancients carried the practice of gilding to a greater extent than the moderns: they gilded almost all their statues of bronze, wood, or plaster, and frequently those of marble, the ceilings of rooms, and even marble columns. The most remarkable examples of gilding employed with taste and effect in architecture, are the ceiling of St. Peter's, and that of Santa Maria Maggiore.

The art of gilding at the present day is performed on metals, or on wood, plaster, leather, parchment, paper, glass, etc. Chemical processes are those which are usually employed for metals. Gilding on copper is performed by the process called wash or water gilding, with an amalgam of gold and mercury. The surface of the copper, being freed from oxide, is covered with the amalgam, and afterward exposed to heat till the mercury is driven off, leaving a thin coat of gold. Copper, however, is rather too soft and dark-colored a metal to be treated in this way with advantage. Brass is a very suitable metal for this mode of gilding, but the best of all is a mixture of copper with one seventh of brass. The following method of gilding articles of copper, brass, etc., was patented by Elkington in 1836: Five ounces troy of fine gold are dissolved by heat in a mixture of 21 ounces of pure nitric acid of specific gravity 1.45, 17 ounces of pure hydrochloric acid of specific gravity 1.15, and 14 ounces of distilled water. The liquid is then poured off into a stone vessel, the sediment being left at the bottom of the vessel in which it was first contained. Four gallons of distilled water and 20 pounds of the best bicarbonate of potash are now added and the whole is boiled moderately for two hours. At the end of this time the mixture is ready for use. The articles are gilded by being attached to wires and plunged into the mixture, where they are allowed to remain as long as the workman thinks necessary, from a few seconds to a minute, when the mixture is newly prepared, but longer if it has been used for some time. Gilding is also performed by dipping a linen rag in a saturated solution of gold, and burning it to tinder. The black powder thus obtained is rubbed on the metal to be gilded with a cork dipped in salt water till the gilding appears. Iron or steel is gilded by applying gold leaf to the metal, after the surface has been well cleaned and heated till it has acquired the blue color, which at a certain temperature it assumes. Several leaves of gold are thus applied in succession, and the last is burnished down cold. The same process may be applied to copper. The operation of gilding may also be performed on iron and steel by diluting the solution of gold in nitro-hydrochloric acid with alcohol and applying it to the clean surface. A saturated solution of gold in nitro-hydrochloric acid, being mixed with three times its weight of sulphuric ether, dissolves the chloride of gold and the solution is separated from the acid beneath. To gild the steel it is merely necessary to dip it, the surface being previously well polished and cleaned, in the ethereal solution for an instant, and on withdrawing it to wash it instantly by agitation in water.

Gilding on wood, plaster, leather, parchment, or paper, is performed by different processes of mechanical gilding. The first of these is oil gilding, in which gold leaf is cemented to the work by means of oil size. In the case of paper or vellum the parts to be gilded receive a coat of gum water or fine size, and the gold leaf is applied before the parts are dry. They are afterward burnished with agate. Lettering and other gilding on bound books are applied without size. The gold leaf is laid on the leather and imprinted with hot brass types. Brass rollers with thin edges are employed in the same way for lines, and similar tools for other ornaments. When the edges of the leaves of books are to be gilded they are first cut smooth in the press, after which a solution of isinglass in spirits is laid on, and the gold leaf is applied when the edges are in a proper state of dryness. Japanner's gilding is another kind of mechanical gilding which is performed in the same way as oil gilding, except that instead of gold leaf a gold dust or powder is employed.

Porcelain and other kinds of earthen-ware as well as glass may be gilded by fixing a layer of gold in a powdered state by the action of fire. The gold dust or powder required in this operation may be obtained by precipitating it from a solution in aqua regia, either by means of sulphate of iron or protonitrate of mercury. In order that the gold powder may be applied to the surface of the article to be gilded it must be well mixed with some viscous vehicle such as spirits of turpentine mixed with some fatty matter, or strongly gummed water. It is then laid on with a fine camel's hair brush. When the article to be gilded is made of soft porcelain, delft-ware, or any kind of earthen-ware with a plumbiferous glazing, nothing else is required than to apply the gold in this manner, and then subject the piece of earthen-ware to a heat sufficient to soften the glazing, and thus fix the gilding. But in the case of hard porcelain, some kinds of stoneware and other varieties of pottery, in which the glazing does not soften at a suitable temperature, the gold powder, before being mixed with the viscous vehicle by which it is applied, must have a flux added to it, which serves as a means of attachment between the metal and the earthen-ware. The best flux is oxide of bismuth precipitated by water from a solution of nitric acid, with the addition of one twelfth part of melted borax. One tenth or one fifteenth part of this flux is added for every part of gold contained in the mixture, which is applied to the surface of the earthen-ware. Heat is applied in the same way as in the previous case to melt the flux, and thus fix the layer of gold to the article. The gilding must finally be burnished in order to bring up the gold color. Another method of gilding these substances is to mix neutral chloride of platinum with rectified spirits of turpentine in such a manner that the chloride is held in suspension in a finely divided state in the turpentine, to apply this liquid to the article to be gilded by means of a brush, and then to subject the article to heat so as to volatilize the spirits of turpentine and leave a uniform layer of platinum affixed to the glass or earthen-ware. The article, after being cooled, cleaned with aqua fortis, and washed with water, is next dipped in a gilding liquid prepared like that already described as patented by Elkington. The gilding is completed by rubbing the gilt parts with chamois leather. This method of gilding has the advantage of enabling the gilder to dispense with the burnishing, which is a very hazardous operation for fragile articles, and in the case of those which are of a very intricate form or very deeply cut out often impracticable. See Metallurgy.

Gilead, gĭl'e-ad (rough, rugged, hard), a country on the east side of the Jordan, at one time a portion of the kingdom of Israel. Its exact area is doubtful; but the southern boundary, the River Arnon, and the western boundary, the Jordan River, are well defined. The Yarmuk is given by some as a northern boundary; and some historians mention the country of Gilead as extending to the shores of the Sea of Galilee and the Plains of Bashan. The eastern boundary was "the desert." It is a mountainous country traversed by many small streams which flow into the Jordan. All the mountains are mentioned frequently as "mountains of Gilead," and one peak is called in ancient history, "Mount of Gilead." This peak is thought to be the one now known as Jebel or Djabal (mount) Osha. The soil is fertile and the vegetation generally luxuriant. The low round mountains or hills are no hindrance to cultivation as practised by the native inhabitants. A considerable portion is devoted to pasturage and large herds of cattle and flocks of sheep graze on the hillsides and table-lands as in the times mentioned in the Old Testament. The balm of Gilead, a small evergreen tree of the *Terebinthine* family, has long been noted because of the efficacy of its balm (balm of Mecca) in healing wounds. The terebinth tree and the oak still flourish in Gilead, especially in the valley of the Jabbok. Gilead is mentioned frequently in the Bible. Much of its history before the birth of Christ is given in the Old Testament. In Deuteronomy and Numbers may be found an account of the conquest of the country and the transfer of a part to Reuben and Gad. In Judges and Kings is a record of the wars waged upon Gilead by the Syrians, the Midianites, and the Ammonites, and finally the victory of the Assyrians. The flight of Absalom is given in 2 Sam. xiii. In 1 Sam. xxi. is an account of the battle in which the sons of Saul were slain, and of Saul's own death. It is there told that "the valiant men of Jabesh-Gilead arose and went all night, and took the body of Saul and the bodies of his sons from the wall of Beth-Shan," and burned them according to the custom of the times. And afterward these "valiant men" fasted several days. The chief cities of Gilead were Jazer, Mizpeh, Mahanaim, Penuel, and Succoth.

Giles, jīlz, **Saint (Saint Aegidius)**, a native of Greece, who, according to legend, lived in the 7th century. He gave all his property to the poor, and went to France, where he lived in solitude for many years. Finally he permitted companions in his retreat, and founded a house of the Benedictine order. A town grew up around it, and was called Saint Giles. The saint is the patron of many churches in France, Germany, Scotland, and Poland.

Giles, Saint (Saint Giles in the Fields), a parish in London, a mile to the northwest of St. Paul's. The church is in classical style, and contains the remains of Chapman, Shirley, Marvell, Lord Herbert of Cherbury, and Sir Roger L'Estrange. One district of it, by its poverty and wretchedness, long formed a very striking contrast to the west end of the metropolis, so that Saint Giles and Saint James were spoken of as typical of wretchedness and luxury respectively. There is another London church of Saint Giles, called Saint Giles Cripplegate, which contains the tomb of Milton.

Giles, William Branch, American politician: b. Amelia County, Va., 12 Aug. 1762; d. Albemarle County, Va., 4 Dec. 1830. He was educated at Hampden-Sidney College and at Princeton, studied law and practised at Petersburg, was a member of the Federal House of Representatives in 1790–8 and 1801–2, and of the Senate in 1804–15. In 1827–30 he was governor of Virginia. Originally a Federalist, he later became a Republican, and was the leader of his party in the Senate 1804–11. He took a prominent part in the Virginia Constitutional convention of 1829–30. He was an effective speaker, assertive in methods and frequently broke with his party, in which he finally lost influence. His 'Political Letters to the People of Virginia' appeared in 1813.

Gilgal, gĭl'găl, the name of several ancient towns near the Jordan, where the Israelites passed the river into Caanan, where they were circumcised and held the first Passover after leaving the desert (Joshua iv. 19). Here rested the tabernacle, till removed to Shiloh; here

Samuel held court as judge of Israel, and here Saul was crowned. It is frequently mentioned in the Bible; a school of the prophets was established here (2 Kings iv. 38), yet it afterward became a seat of heathen worship (Amos iv. 4). Josephus places one of the towns within two miles of Jericho, but no traces of it are at this day extant.

Gill, gĭl, Sir **David**, Scottish astronomer: b. Aberdeen 12 June 1843. He was chief of staff of Lord Lindsay's observatory, founded in 1870; in charge of Lindsay's expedition to Mauritius in 1874 to observe the transit of Venus and the opposition of Juno, by means of the heliometer, for the determination of the solar parallax. He determined the longitudes of Malta, Alexandria, Suez, Aden, Bombay, Seychelles, Reunion, Mauritius, and Rodriguez by cable and chronometers, and measured the first base-line for the Egyptian triangulation at the request of the khedive. In 1877 he was in charge of the expedition to Ascension to observe the opposition of Mars for parallax; and in 1879 appointed director of the Cape Observatory. He has published many valuable professional papers and reports.

Gill, Henry Z., American physician: b. Richboro, Pa., 6 Oct. 1831. He was a surgeon in the Union army during the Civil War; and was professor of chemical and operative surgery in Wooster University 1883–6; removing to Kansas in the year last named. His publications include: ‹Report on the Prisons of the United States›; ‹Gill's Sanné on Diphtheria, Croup, and Tracheotomy›; etc.

Gill, Theodore Nicholas, American educator: b. New York 21 March 1837. He became professor of zoology in Columbian University in 1884. His publications include: ‹Arrangement of the Families of Mollusks›; ‹Arrangement of the Families of Mammals›; ‹Catalogue of the Fishes of the East Coast of North America›; and ‹Scientific and Popular Views of Nature Contrasted› (1882); ‹Principles of Geography› (1884); etc.

Gill Net, a net suspended vertically, by means of floats, and leaden weights, in standing or running water, fresh or salt. It has meshes which allow the head of the fish to pass, but are too small for the body beyond the gills to get through, and when the captive tries to draw back, catch in the gills, from which no effort can disentangle them.

Gil'lem, Alvan Cullem, American soldier: b. Jackson County, Tenn., 1830; d. near Nashville, Tenn., 2 Dec. 1875. He was graduated from the United States Military Academy in 1851, served in the Seminole war (1851–2), in the Civil War became brevet colonel, United States Army, and brigadier-general of volunteers, and upon the reorganization of the State government of Tennessee was vice-president of the convention for revision of the Constitution and a member of the first legislature of the new régime. In 1867–8 he commanded the district of Mississippi. He attained the rank of colonel and brevet major-general in the regular service.

Gillenia, jĭ-lē'nĭ-a̤, or **Proteranthus**, a North American perennial genus of *Rosaceæ*, closely allied to *Spiræa*, embracing only two known species; also called Indian physic, bowman's root, and American ipecac. See Bowman's Root.

Gillespie, gĭ-lĕs'pĭ, **Eliza Maria**, American philanthropist: b. near West Brownsville, Washington County, Pa., 21 Feb. 1824; d. Notre Dame, Ind., 4 March 1887. In 1853 she became a member of the congregation of the Holy Cross, and after a novitiate in France was appointed in 1855 superior of the St. Mary's Academy, Bertrand, Mich. She later transferred the academy to its present location, St. Mary's, Ind., and established nearly 30 similar institutions in the United States. During the Civil War she directed from Cairo, Ill., an important hospital work for Federal soldiers. Upon the separation of the congregation of the Holy Cross in the United States from the order in Europe she was for two terms superior.

Gillespie, George de Normandie, American Protestant Episcopal bishop: b. Goshen, N. Y., 15 June 1819. He was graduated from the General Theological Seminary in New York in 1840, entered the ministry and held rectorates at Leroy, N. Y.; Cincinnati, Ohio; Palmyra, N. Y., and Ann Arbor, Mich. In 1875 he was consecrated bishop of Western Michigan. He published ‹The Communion of Saints› and other religious works.

Gillette, William, American actor and playwright: b. Hartford, Conn., 24 July 1853. He studied at the University of Boston, and at New York University; and in 1877 commenced his work on the stage, playing with different stock companies in New Orleans, Boston, New York, and other cities. He has since then acted important parts in many of his own plays. Among his best-known productions are: ‹The Professor› (1881); ‹Esmeralda› (1881), with Mrs. F. H. Burnett; ‹The Private Secretary›; ‹Held by the Enemy› (1886); ‹A Legal Wreck› (1888); ‹Too Much Johnson› (1895); Secret Service› (1896); and ‹Sherlock Holmes.›

Gillis, gĭl'ĭs, **James Melvin**, American astronomer: b. Georgetown, D. C., 6 Sept. 1811; d. Washington, D. C., 9 Feb. 1865. He entered the navy in 1827, soon obtained leave of absence and was graduated at the University of Virginia, and then spent six months in study in Paris. He was in charge of the observation of occultations and transit observations made in connection with the Wilkes exploring expedition, Gillis making the observations at the Washington end at a little observatory on Capitol Hill. He had charge of the United States astronomical expedition to the southern hemisphere, and in 1861 was appointed superintendent of the national observatory at Washington, D. C. He published: ‹Astronomical Observations› (1846); ‹Report of the United States Astronomical Expedition of 1849–52› (1855).

Gillis Land, an arctic region north of Spitzbergen, first sighted in 1707 by Gillis, a Dutchman, in lat. 81° 30′ N. and lon. 36° E., but not visited by him. Some geographers identify it with King Charles or Wiche Land, one of the Spitzbergen group.

Gill'man, gĭl'man, **Henry**, American botanist: b. Kinsale, Ireland, 16 Nov. 1833. He settled in Detroit, Mich., in 1850; and was United States consul at Jerusalem in 1886–91. During his consulate he so strongly opposed the Turkish government in its expulsion of Jews from Palestine that several European countries supported him, and the exclusion laws were modified. He is the author of 'The Wild Flowers and Gardens of Jerusalem and Palestine' (1894); 'Hassan' (1896); etc.

Gillmore, gĭl'môr, **Quincy Adams,** American military officer: b. Black River, Lorain County, Ohio, 28 Feb. 1825; d. Brooklyn, N. Y., 7 April 1888. He was graduated at West Point in 1849; promoted captain in 1861, and brigadier-general of volunteers in 1862. He displayed skill as an engineer by the capture of Fort Pulaski in April 1862, and was appointed commander of the Department of the South in June 1863. He made a successful attack on Morris Island in July 1863, began to bombard Fort Sumter and Charleston in August, and took Fort Wagner in September; Fort Sumter was reduced to a ruinous condition, but its garrison continued to hold it till 17 Feb. 1865. Gen. Gillmore commanded the Tenth corps near Richmond in 1864, and was brevetted major-general, United States Army, in 1865.

Gillott, jĭl'ŏt, **Joseph,** English manufacturer: b. Sheffield 11 Oct. 1799; d. Birmingham 6 Jan. 1872. He shares with Sir Josiah Mason the credit of having brought the manufacture of steel pens to its present state of high perfection.

Gills, gĭlz, the breathing organs of fishes, larval amphibians, crustaceans, and certain other aquatic animals. See *Respiratory System*, in article ANATOMY; also FISH.

Gillyflower, jĭl'ĭ-flow-ėr, a popular English name for some of the cruciferous plants most prized for the beauty and fragrance of their flowers, as the wallflowers and stocks; also for *Hesperis matronalis,* dame's rocket or dame's violet (q.v.). The name gillyflower has been regarded as a corruption of July-flower; but in Chaucer it appears in the form *gilofre;* and the French *giroflée* indicates the true derivation from *girofle*, a clove, the smell of the clove-gillyflower, or clove-pink, having suggested the name of that flower.

Gilman, gĭl'man, **Arthur,** American educator and author: b. Alton, Ill., 22 June 1837. He was engaged in banking in New York 1857–62, when he removed to Lenox, Mass., and devoted himself to literary and educational work until he went to Cambridge in 1870. He was the originator (1876) of the Harvard Annex, of which he became executive officer, and, upon its organization as Radcliffe College, regent. In 1886 he founded and became director of the Cambridge school for girls, known as the Gilman School. He edited Chaucer's works (1879) and other collections, collaborated in several volumes of the 'Stories of the Nations' series, and wrote a number of educational works, chiefly historical in character, such as 'The Story of Rome' (1886); 'The Colonization of America' (1887).

Gilman, Caroline Howard, American author: b. Boston 8 Oct. 1794; d. Washington, D. C., 15 Sept. 1888. In 1819 she was married to the Rev. Samuel Gilman (q.v.) and removed with him to Charleston, S. C., where she began to edit in 1832 the 'Rosebud,' a juvenile weekly newspaper, which subsequently took the name of the 'Southern Rose,' and contained articles of much literary merit. From this periodical she reprinted at different times the 'Recollections of a New England Housekeeper' (1835); 'Recollections of a Southern Matron' (1836); 'Ruth Raymond, or Love's Progress'; 'Poetry of Traveling in the United States'; 'Verses of a Lifetime'; 'Mrs. Gilman's Gift Book'; and other volumes. The first two of these works attracted particular attention by their practical lessons as well as their genial simplicity and humor, and passed through many editions. She was especially successful, also, in her books for children.

Gilman, Charlotte Perkins Stetson, American writer: b. Hartford, Conn., 1860. She is a daughter of Frederic Beecher (q.v.) and was married to G. H. Gilman in 1900. She is a prominent advocate of equality for women and has published 'Woman and Economics' (1898); 'In This Our World,' a book of verse (1898); 'The Yellow Wall Paper' (1899); 'Concerning Children' (1900).

Gilman, Daniel Coit, American educator: b. Norwich, Conn., 6 July 1831. He was graduated at Yale College in 1852; was professor of physical and political geography in Yale in 1856-72; and president of the University of California 1872–5. When Johns Hopkins University was founded in Baltimore, Md., in 1875, he was elected its first president and served in that capacity till 1901, when he resigned. In 1896–7 he was a member of the commission to settle the boundary line between Venezuela and British Guiana, and in the latter year also served on the commission to draft a new charter for Baltimore. He was president of the American Oriental Society 1893–1901, and has been vice-president of the Archæological Institute of America, executive officer of the Maryland Geological Survey, and president of the National Civil Service Reform League in 1901. His publications include: 'Life of James Monroe' (1883); 'University Problems' (1898); Introduction to DeTocqueville's 'Democracy in America'; 'Life of James D. Dana'; etc. On the organization of Carnegie Institution, Washington, D. C., 29 Jan. 1902, he was elected president, and in 1893 president of the American Bible Society.

Gilman, John Taylor, American statesman: b. Exeter, N. H., 19 Dec. 1759; d. there 31 Aug. 1828. In 1775, on the morning after the news of the battle at Lexington and Concord reached Exeter, he marched with 100 other volunteers to Cambridge, Mass., where he served in the provincial army. In 1782 and 1783 he was a member of the Continental Congress, and in 1797 he was chosen governor of New Hampshire, and was annually re-elected for 10 successive years. In 1813–14–15 he was again elected governor, after which he declined to be a candidate. He was a zealous Federalist, and his popularity in New Hampshire was so great that he was frequently chosen governor when his party was in the minority.

Gilman, Nicholas, American statesman: b. Exeter, N. H., 3 Aug. 1755; d. Philadelphia 2 May 1814. He was a brother of J. T. Gilman (q.v.) and like him served in the Continental army during the War of the Revolution. He represented New Hampshire in Congress in 1786, and again 1789–97, and was a United States Senator 1805–14. He was one of the

DANIEL COIT GILMAN,

LATE PRESIDENT CARNEGIE INSTITUTE.

framers of the Constitution of the United States.

Gilmer, Jeremy Francis, American soldier: b. Guilford County, N. C., 23 Feb. 1818; d. 1 Dec. 1883. He was graduated at West Point and entered the engineer corps of the United States in 1839. At the opening of the Civil War he resigned his captain's commission and entered the Confederate service, becoming major-general in 1863.

Gilmor, gĭl'môr, **Harry,** American soldier: b. Baltimore County, Md., 24 Jan. 1838; d. Baltimore 4 March 1883. He entered the Confederate army at the beginning of the Civil War, became known for his exploits as scout, in 1863 raised a battalion of horse of which he was made major, and later in that year, in command of the 1st Maryland Confederate regiment, captured Frederick, Md., and Chambersburg, Carlisle, and Gettysburg, Pa. In 1864 he led Early's advance into Maryland. He was elected Baltimore's police commissioner in 1874, and wrote 'Four Years in the Saddle' (1866).

Gilmore, gĭl'mōr, **James Roberts** («Edmund Kirke»), American miscellaneous prose writer: b. Boston, Mass., 10 Sept. 1823. He was at first in mercantile life, subsequently entering journalism and literature, and his earlier works were written under the pseudonym, «Edmund Kirke.» He wrote: 'Among the Pines' (1862); 'My Southern Friends' (1862); 'Down in Tennessee' (1863); 'Life of Garfield'; 'Among the Guerrillas'; 'Adrift in Dixie' (1863); 'On the Border'; 'Patriot Boys'; 'The Rear-Guard of the Revolution'; 'John Sevier as a Commonwealth Builder'; 'The Advance-Guard of Western Civilization' (1888); etc.

Gilmore, Joseph Albree, American politician: b. Weston, Vt., 10 June 1811; d. Concord, N. H., 17 April 1867. He became superintendent of various New Hampshire railway lines, was elected to the State Senate in 1858, and re-elected in 1859. In 1863 he was elected governor by the legislature, and in 1864 re-elected by popular vote. His energy increased the troops furnished by New Hampshire to the Federal armies from 15,500 to 33,258.

Gilmore, Patrick Sarsfield, American musical conductor: b. near Dublin, Ireland, 25 Dec. 1829; d. St. Louis, Mo., 24 Sept. 1892. He went to Boston at 18 and the next year organized Gilmore's band. In 1869 he arranged the Peace Jubilee in Boston, and in 1872 the World's Jubilee, in Boston also. Later he formed the noted 22d Regiment band in New York, which gave concerts in the United States and made a European concert tour in 1882. He composed but little; an anthem entitled 'Columbia,' intended to serve as the country's national hymn, was his only work of note.

Gilmour, gĭl'moor, **Richard,** American Roman Catholic prelate: b. Glasgow, Scotland, 28 Sept. 1824; d. St. Augustine, Fla., 13 April 1891. He was ordained priest in 1852, and after various pastorates, including those at Portsmouth, Ironton, Cincinnati, and Dayton, was consecrated bishop of Cleveland in 1872. His administration of the diocese was markedly efficient, and particularly so along the lines of Roman Catholic education. He published a Bible history, a series of 'Catholic National Readers,' and other books, and in 1874 founded the 'Catholic Universe,' an influential journal.

Gilolo, jē-lō'lō, **Jilolo,** or **Halmahera,** an island of the Molucca group in the Indian Archipelago, belonging to the Netherlands; area 6,500 square miles; length 225 miles. It is of singular form, consisting of four peninsulas, radiating from a common centre, and having large bays between. It is rugged and mountainous, the mountains being volcanic. The original inhabitants have been gradually pressed into the interior by the Malays. Pop. 120,000.

Gilpin, gĭl'pĭn, **Henry Dilwood,** American lawyer: b. Lancaster, England, 14 April 1801; d. Philadelphia 29 Jan. 1860. He was graduated from the University of Pennsylvania, studied law and became State attorney in 1822. He was United States attorney for Pennsylvania in 1832, and attorney-general of the United States 1840–1. Besides 'Reports of Cases' he published 'Opinions of the Attorney-Generals of the United States from the Beginning of the Government to 1841' (1841) and edited 'The Papers of James Madison' (1846).

Gilpin, John, the hero of a well known ballad by William Cowper, entitled 'The Diverting History of John Gilpin, Showing how he Went Further than he Intended and Came Safe Home Again.' It was first printed anonymously in 1782, and published with the author's name in 1785.

Gilsonite, gil'sŏn-īt, also called **Uintahite,** a natural hydrocarbon compound; a pure hard variety of asphaltum. It is very brittle, a lustrous black in color and fuses. It is used for a great variety of purposes in the arts, for instance in the manufacture of varnishes. Mixed with heavy California maltha or with petroleum residuum it has been used as a paving cement. The principal deposits in the United States are near Soldiers' Summit in Uintah County, Utah. The total output in 1902 was 4,052 short tons, valued at $61,182.

Gilthead, or **Gilteye,** English names for a small and beautiful sea-bream (*Chrysophrys aurata*), with conspicuous gold-colored spots over the eyes. It abounds in the Mediterranean, and ranges northward to England and southward to the Cape of Good Hope. This was one of the fishes kept and fattened by the Romans in their vivaria. Several other species are known in the Far East, one species (*C. berda*), being one of the favorite fishes of Madras under the name of black rock-cod.

Gin (more properly Geneva, from Fr. *genièvre*, «juniper»), a compounded spirit, prepared by redistilling plain spirit with juniper berries, coriander seeds, angelica root, etc., or by adding various essential oils to rectified spirit. The gin produced by distilling possesses a much more delicate flavor than that produced by mixing or compounding. The strength of gin varies from proof to 50 under proof. It was first made in Holland, notably at Schiedam.

As used in machinery the word gin is an abbreviation of engine and is used of Whitney's device for separating cotton-seed from the fibre and more generally of a portable hoisting machine whose frame is a tripod, one leg being movable so as to vary its angle of elevation, and thus determine the height of the apex. The other two legs preserve their relative distance.

and form standards for the drum, round which the rope is wound by power applied to the handspikes. For heavy weights a fall and tackle is used; and for hoisting a bucket from a well or mine, simply a couple of pulleys to change the direction of motion of the rope. One pulley is suspended from the apex, and the other attached between the two permanent legs, so as to change the rope to a horizontal position, for the attachment of a draught horse.

Gin, Cotton. See COTTON; COTTON GIN.

Ginatilan, hē-nä-tē'län, Philippines, a town on the western coast of Cebu, at the mouth of the Rio Ginatilan. There is valuable timber in the vicinity. Pop. (1900) 12,144.

Ginevra, gĭ-nev'ra, or jē-nĕv'ra, the title of a noted narrative poem by Samuel Rogers. It is named for its heroine whose affecting story is also recounted in 'The Mistletoe Bough,' a ballad by Thomas Haynes Bayly.

Gingal. See JINGAL.

Ginger, in botany, *Zingiber officinale*, common or narrow-leaved ginger, and in ordinary language the rhizomes of the same plant, which has subsessile linear lanceolate smooth leaves, oblong spikes, acute bracts, and a three-lobed lip. It is a native of India, but is cultivated in most tropical countries. A broad-leaved ginger, *Z. zerumbet*, also a native of India, is used externally for cataplasms and fomentations, but is not eaten. The pieces or races of the rootstocks are usually from 2 to 4 inches long, branched, flat, and of a pale buff color. Ginger is known in commerce under two forms, coated and uncoated or scraped; the latter is deprived of its epidermis when in the green state, and sold as white ginger. The chief varieties imported into the United States are Jamaica, Cochin, Bengal, Japan, and African. The first three are scraped gingers, and of these Jamaica is the most esteemed owing to its color and flavor. Ginger is an agreeable aromatic, and a valuable stomachic; but is more largely used as a condiment than as a medicine. Preserved ginger, imported from China in jars, consists of the young rhizomes boiled in syrup. Ground ginger is frequently adulterated with sago flour, wheat flour, ground rice, and arrowroot.

Ginger Ale or **Beer**, an effervescent drink, made of ginger, water, sugar, cream of tartar (or lemon juice), etc. A well-known method is by pouring a gallon of boiling water over ¾ pound of loaf-sugar, 1¼ ounces of sliced ginger, and the peel of one lemon, and after allowing the mixture to cool till it is milk-warm adding the juice of a lemon and a spoonful of yeast.

Gingerbread Tree. See DOOM PALM.

Ging'ham (*ali, gingamo*, from Guingamp, a town in Brittany, where the fabric was woven), a kind of cotton, the manufacture of which was introduced into Great Britain through France from India. It is distinguished from calico by having the colors woven in with the fabric, not printed on it. The patterns are various; sometimes fancy designs, sometimes checkered, and sometimes striped.

Gingili (jĭn'jĭ-lĭ) **Oil**, a name often given to the bland fixed oil obtained by expression from the seeds of *Sesamum Indicum*. It is used medicinally as laxative or mild purgative. See SESAME.

Ging'ko, the Japanese name of a genus of trees (*Salisburia*), of the yew group of conifers. The *S. adiantifolia* (*Gingko biloba* of Linnæus), the only species, is a tree which sometimes attains a height of nearly 100 feet. Its head is conical, and the branches are usually horizontal. The leaves are compound, with from two to four thick coriaceous leaflets marked with small longitudinal nervures, their resemblance to the maidenhair fern giving it its English name of maidenhair tree. It is a native of China and Japan, and was first introduced into Europe in 1754. Its fruit, which is of the size of a small plum, has a pulp with a disagreeable odor of butyric acid and enclosing a kernel which, when roasted, may be used as food, having a taste like that of maize. It is largely eaten throughout China and Japan. The Japanese consider the tree sacred and plant it near their temples. The gingko is considerably used as an ornamental tree in England and in the United States. It flourishes best in the shade, in a deep and somewhat moist soil.

Ginigaran, hē-nē-gä'rän, Philippines, a pueblo of the province of Negros Occidental, at the mouth of the Ginigaran River on the east shore of Guimarás Strait, 29 miles south of Bacólod; it is also on the West Coast road. Pop. 13,620.

Ginseng, jĭn'sĕng, several species of herbs of the genus *Panax*, natural order *Araliaceæ*. The most noted species are *Panax ginseng*, a native of China, and *P. quinquefolium*, of America. These two species so closely resemble each other that the discovery of the latter near Montreal, Quebec, in 1716, was based upon a description of the former. The plants grow about 18 inches tall, bear five long-petioled nearly smooth leaves arising from one point, whence also arises the flower-stem bearing an umbel of small flowers from which develop conspicuous scarlet, generally two-seeded berries. The light yellow root, especially of the former species, is used by the Chinese for every conceivable domestic and medicinal use and specimens resembling the human body often command their weight in gold because of supposed occult virtues. Neither species, however, is considered by American or British physicians to have any pronounced medical qualities. The Asiatic species has long been cultivated in China and Korea.

Shortly after the discovery of the American species a shipment of the wild root was made to China and soon a trade was established. Since the plant has a natural range from the valley of the St. Lawrence to the mountains of Georgia and westward to the eastern bank of the Mississippi, the wild supply of roots long met the demand. In 1858 the price was 52 cents a pound; in 1902, $5.55, the advance being largely due to the decrease of the native supply. In the latter year many lots of northern root (considered always better than southern) sold for $8.00 or even more. The advancing price led to many attempts to cultivate the plant, but until about 1885 none were reported successful. Then George Stanton, of Apulia, N. Y., succeeded by growing the plant in beds prepared in the forest and later under lath sheds. These methods have led to the establishment of American ginseng growing. Cultivated ginseng has commanded about 20 per cent more than wild root from the same locality.

The plants thrive best in a well-drained, rather loose soil, well supplied with humus, potash and phosphoric acid, but not with nitrogenous material. Little has been done to improve the plant, but the time required to mature a crop of roots can probably be shortened considerably and the size of the root increased. In 1902 most growers calculated upon five years as necessary to mature a crop, but at the price of $2.50 a pound they figured upon making a profit under reasonably favorable conditions. The atrocious prices paid for plants and seed during 1898–1903 were largely due to speculation, an exaggerated estimate of the demand in China, which is almost the sole market, and to the novelty of the industry, and hence the scarcity of plants and seed. Consult: Revised edition of Bulletin No. 16, Division of Botany, United States Department of Agriculture (Washington, D. C.); Kains, 'Ginseng' (New York 1902).

Ginx's (gĭnks'ĕz) **Baby,** the title of a famous book by John Edward Jenkins. It is a satire on the English poor-laws and the administration of sectarian charitable associations, and was published anonymously in London in 1871. It speedily ran through many editions, was republished in the United States, and excited warm controversy in the press and even in parliament. It was followed by satires on other phases of social economy, but none of the other works of this author attained such a vogue or exerted such an undoubted influence upon the direction of social reforms.

Giobertine (jō-bĕrt'ĭn) **Tincture,** a preparation for restoring writings which have become illegible through age, or faded pictures. The inventor of it was Giovanni Antonio Gioberti, a native of Piedmont (1761–1834). This invention has been invaluable in restoring the original writing of palimpsests. See PALIMPSEST.

Gioja, jō'yä, **Flavio,** Italian mariner: b. Pasitano, near Amalfi, in the latter part of the 13th century. He is said to be the inventor of the mariner's compass, of which he made use in 1302–3. The tendency of the loadstone to turn toward the north was known before his day, but the compass then in use consisted only of a magnetized reed floating upon cork in a vessel of water. Gioja invented the plan of suspending it on a pivot, thus leaving it free to move in any direction, whereby observations were rendered both easier and more exact.

Giorgione, jŏr-jō'nĕ (easel name of GIORGIO BARBARELLI or BARBARELLA), Italian painter: b. Castelfranco 1477; d. Venice 1511. He was a pupil of Giovanni Bellino, and painted history and portraits. He was one of the most celebrated of the Venetian school, was a fellow student of Titian, whom he might have rivaled, had he not died of the plague in early life, while Titian lived for nearly a century. To him Venetian painting owes much of its marvelous technique, and by his example in the use of pigments and glazings he set an example many followed; he has had more pictures by other hands attributed to him (nearly a hundred) than any other Italian master. Even connoisseurs have been deceived by the depth and richness of coloring, the luminosity of aërial perspective, which his imitators had learned from him too well. Yet there are not more than 12 authentic pictures by Giorgione, and these are dispersed among the public galleries of Florence, London, Madrid, Dresden and Vienna.

Giotto, jŏt'tō (called GIOTTO DI BONDONE), Italian painter and architect: b. Vespignano, near Florence, about 1266; d. Florence 8 Jan. 1337. He was the son of a peasant, and was employed, it is said, in tending cattle. But having been once seen by Cimabue, as he was drawing figures of his sheep upon a piece of slate with a stone, that artist obtained leave from his father to take him with him, carried him to Florence, and taught him painting. This may be a mere story, but at any rate his first teacher was Cimabue. His natural talent, and especially the gracefulness so peculiar to him, developed so rapidly that he soon surpassed all contemporary artists. He represented the human figure in his pieces with truth and nature, and excelled in the dignity of his figures, a pleasing arrangement of them, and a regard to correct proportions and natural disposition of the drapery. His earliest extant works are mural paintings in the Church of St. Francis at Assisi, executed before the end of the 13th century. He was now called to Rome, and after painting various works there he went to Padua, in 1303, and adorned the chapel of the Annunciata dell' Arena with a series of famous frescoes, including 38 subjects, disposed in three rows, on the sides of the chapel and the front of the chancel wall, with a vast representation of the 'Last Judgment' filling the west end. Dante was his guest at Padua in 1306, and he is celebrated in the great poet's 'Divina Commedia.' He was also a friend of Petrarch. He worked also at Milan, Verona, Ravenna, Rimini, and Arezzo. In 1330–33 he was at Naples, and in 1334 was appointed master of the cathedral works and other undertakings at Florence, where he designed the celebrated Campanile, a structure finished by his scholar and godson, Taddeo Gaddi. Besides the frescoes at Assisi and Padua, comparatively few works of Giotto are extant. Among his most celebrated pieces is the 'Navicella' (ship) at Rome (a picture of 'Peter Walking upon the Waves,' in mosaic). The National Gallery possesses a 'Coronation of the Virgin' painted in tempera, on wood. "The influence of Giotto was profoundly felt over the greater part of Italy. His example caused a revolution in art, the effects of which are traceable into the 15th century." Many anecdotes of more or less authenticity are told regarding this painter. On one occasion, when asked for a sample of his art to show the Pope, Giotto is said to have drawn a perfect circle with a single stroke; whence "round as the O of Giotto" became proverbial. See Crowe and Cavalcaselle, 'History of Painting in Italy' (1864–6); Janitscheck, 'Die Kunstlehre Dantes und Giottos Kunst' (1892); Ruskin, 'Giotto, and his Works in Padua' (1854–60); Zimmermann, 'Giotto' (1899); Thiorle, 'Giotto' (1902).

Gippsland, gĭps'lănd, Australia, one of the four important districts into which Victoria is divided, so named after an early governor. It forms the southeast portion of Victoria, and has an area of 13,898 square miles. Its length from west to east is 250 miles, and mean breadth about 80. It was originally called Caledonia Australis by Macmillan, its first explorer (1839).

Gipsies, jĭp'sĭz (from Egyptians, the name by which they were called in the English statutes), a wandering nation. They are called by the French Bohémiens, from the belief that they were Hussites driven from their country; in Switzerland, the Netherlands, and the Black Forest they go under the names of Heiden (Pagans); in North Germany, Denmark, and Sweden they are called Tater (Tartars). The name they most frequently pass under in Germany is Zigeuner, which is not unlike the Italian Zingaro or Zingano, the Spanish Zingaro or Gitano, the Hungarian Cigany, the Turkish Tschinganeh. They call themselves Rom, whence Romani, or Romany, the name of their language. The number of gipsies in Europe is roughly set at perhaps 750,000. Of this number about 200,000 are in Rumania; 95,000 in Austria-Hungary; 120,000 in European Turkey; 40,000 in Spain; 40,000 spread over Germany, France, and Italy; 18,000 in Great Britain; and the remainder scattered over other countries. The main body of their language is the same throughout Europe, and even now has a close affinity with the dialects of Hindustan, though it is mixed with a great number of words and expressions borrowed from the races among whom they have sojourned. The gipsies are distinct from the people among whom they dwell, especially in their bodily appearance as a race and in their language. They are slight and agile in frame, though sometimes tall of stature. Their skin is tawny, or olive-colored, their eyes large, dark and brilliant. They have long hair, raven-black, and sometimes ringletted. The mouth of the gipsy is small and finely shaped, and the teeth of pearly whiteness. Scientific men have come to the conclusion that these wanderers are neither of European nor of African origin, but are a remnant of some obscure Indian tribe. This ethnological conclusion is borne out by the fact that their language is undoubtedly derived from the Sanskrit, although intermingled with Oriental terms and inflections appear words of Greek, Slavic, Rumanian, Magyar, German, French, and English origin.

Their history is curious and interesting. Organized gipsy bands first appeared in Europe at the beginning of the 15th century, and in Italy their number in 1422 was computed at 14,000. Five years later they made their first appearance in Paris, saying that they were Christians of Lower Egypt, driven to take refuge in Europe from the Saracens, and had recently left Bohemia. They professed to be performing a penance imposed upon them by Pope Martin V., who, after hearing their confessions of sins committed during their travels, had ordered them to wander over the earth for seven years without taking rest on beds. They were permitted to settle outside the city of Paris, but when they began to practise palmistry and fortune-telling the archbishop had them driven away, and excommunicated the vast number of citizens who had consulted them. Other bands succeeded the 120 gipsies who first made their appearance in Paris: these latter had crossed the channel for England. They were great thieves and in every European country they visited were regarded with disfavor. In vain laws were passed against them. Francis I. of France ordered them to leave the country on pain of being sent to the galleys without trial. The States-General of Orleans condemned them to perpetual banishment. In the middle of the 15th century Pope Pius II. cites them as thieves from the Caucasus. In 1492 Spain exiled them and renewed the decree 100 years later. Elizabeth of England followed Henry VIII. in uttering a proclamation against them. In Scotland they were sheltered and protected, and John Faw, Lord and Earl of Little Egypt, was empowered by royal writ to exercise authority over his gipsy subjects. Germany tried to eliminate them, and Maria Theresa in 1768 undertook to settle them as peasants on the land. This attempt was not successful, but Joseph II., by severe measures induced many of them to settle, practise trades, and have their children educated. Though their number in Europe must be estimated at three quarters of a million they are less a vagrant class than formerly, a fact which is due largely to the stricter policing of the rural districts, and the increase of intelligence among the peasantry, and among the gipsies themselves. Gipsies have never settled in the United States as vagrant communities.

Gipsy-moth, a large moth (*Porthetria*, or *Ocneria*, *dispar*), of the family *Liparidæ*, imported into Massachusetts, in 1868, where it soon became a pest by defoliating shade-trees: and up to 1900 it had cost the commonwealth $1,550,000. The sexes of the moth differ greatly, the male expanding only about one and a half to two inches, while the female measures across its expanded wings two and a half inches; the female is spotted brownish, and the male is white, marked with black lines. The former lays her eggs in masses to the number of 500 wherever convenient, covering them with hairs and scales from her own body. The females have such heavy abdomens that the wings are inadequate for flight, hence the insect, owing to the measures which have been employed to prevent its artificial carriage has not spread far beyond the place where originally introduced, near Malden. The caterpillar measures when mature about 1.5 inches, is white, with black markings, and furnished with long hairs. It is arboreal and capable of being most troublesome on shade, forest, and fruit-trees, but when abundant it feeds and develops on any form of vegetation. A single generation is produced annually. The best means of combating it are spraying with arsenical mixtures, the collection of the cocoons and egg-masses and destroying them; the scraping of loose bark from trees, thus destroying the young and depriving them of hiding places; also the destruction of the eggs by means of oily substances, and the trapping of the larvæ with strips of burlap placed about the infested trees. Consult: 'The Gipsy Moth,' by Forbush & Fernald (Boston 1896); Howard, 'The Gipsy Moth in America,' Department of Agriculture, (Washington, 1897).

Giraffe, jĭ-răf', or **Camelopard**, the tallest of mammals (*Giraffa camelopardalis*), the type of a family of ruminants (*Giraffidæ*), intermediate between deer and antelopes, and also containing the okapi (q.v.). It is a native of Africa south of the Sahara, but is now to be found only in the interior, remote from civilization and where there are brushy plains or open forest, and is fast decreasing. It occurs generally in small herds of from 5 to 40. It feeds on the leaves and small branches of trees, especially mimosas, which, in districts where the animals abound are kept cropped to a convenient height for browsing. Its general aspect is remarkable from the height of the foreparts and great elongation of the neck, the head being sometimes 18 feet from the ground. The number of vertebræ in the neck, however (seven), is not greater than in other quadrupeds, and it has no extraordinary flexibility, although its form and movements are very graceful. The length, therefore, is due to the elongation of each cervical vertebra. The body is short, and the back slopes from the shoulder to the tail; yet the greater height of the foreparts is not entirely owing to the greater length of the fore-legs, but to the neural processes of the vertebræ, which form a basis for the support of the neck and head. The head is long, capable of a wide range of movements, and the upper lip is projecting and somewhat prehensile, while the tongue is remarkably capable of elongation, and can be thrust far out of the mouth, and employed to grasp and take up even very small objects; it is said that its tip can be so tapered as to enter the ring of a very small key. The usefulness of such an organ for drawing in leaves and branchlets to the mouth is obvious. The giraffe adroitly picks off the leaves of acacias and other thorny plants, without taking the thorns into its mouth. The dentition of the giraffe agrees with that of antelopes, sheep, and oxen; the upper jaw of the male is destitute of the canine teeth which are present in the male of many deer.

Anatomically the most remarkable feature of the giraffe is the presence in both sexes of two protuberances between the ears, generally described as horns, but very different from the horns of other animals, and each consisting of a permanent bone united to the skull by an obvious suture, covered with skin and hair, and terminated by long hard bristles. These long outgrowths correspond to the bony core of the antelope's horn or to the pedicel of the antler in the deer. There is also a projection on the forehead, which, in the giraffes of South Africa, is so elongated as to indicate a separate species (*G. australis*) in the opinion of recent naturalists. If this view be accepted then the name *camelopardalis* applies properly only to the giraffes now to be found only in Somaliland. Moreover, Sir H. Johnston has reported that there exists in Uganda a very brilliantly colored form which has five horny protuberances, instead of three, upon the head; and when better known may prove to be in a new genus as well as of a novel species. The hair of the giraffe is short and smooth, with a short mane on the neck, and a tuft on the end of the tail. The color is reddish-brown in irregular areas sharply marked off by white borders, like the mortar between brick-work; but there is much variation in tint as well as pattern. A few extinct forms are found fossil in the Pliocene beds of China, India, and Greece, of which *Samotherium* and *Hallidotherium* are prominent examples; they had a shorter neck and legs and more bovine appearance than their successors, and the males alone have horns.

The giraffe is an inoffensive animal, and generally seeks safety, if possible, in flight, although it is capable of making a stout resistance, and is said to beat off the lion by kicking with its hind-legs, discharging a storm of kicks with extraordinary rapidity. It is not easily overtaken even by a fleet horse, and has greatly the advantage of a horse on uneven and broken ground. Its pace is described as an amble, the legs of the same side moving at the same time. The giraffe was known to the ancients, and was exhibited in Roman spectacles. Representations of it appear among Egyptian antiquities. It has been supposed to be the zemer of the Jews, translated chamois in the English Bible (Deut. xiv. 5).

It is one of the costliest and most uncommon animals in menageries, although in former years they were kept and bred in Europe. The flesh is excellent meat, and the hide is thick and makes good leather. Consult: Beddard, 'Mammalia' (1902), and the writings of naturalists and sportsmen in Africa, especially Johnston, Baker, Bryden, Holub, and Selous.

Giralda, hē-räl'dä (Spanish *girar*, "to turn round"), a weathercock in the form of a figure or statue. It is pre-eminently applied to the weathercock, and from that to the Moorish tower or minaret (part of the cathedral) which it surmounts at Seville, Spain. The figure in this weathercock is that of Faith, which turns round to face every wind and storm. In the copy of the tower of Seville cathedral which appears in Madison Square Garden, N. Y., the figure of Faith is replaced by that of Diana.

Girard, jĭ-rärd', **Charles**, American naturalist: b. Mülhausen, France, 1822. In 1839 he was a pupil of Agassiz, at Neufchâtel, Switzerland, and soon became one of his assistants, accompanying him to America, and remaining his assistant until 1850. He was attached to the Smithsonian Institution 1850–9, and has published: 'Herpetology of the United States Exploring Expedition under Capt. Wilkes' (1858); and many professional articles and monographs.

Girard, zhē-rär, **Marc Amable**, Canadian politician: b. Varennes, P. Q., 25 April 1822; d. Winnipeg 10 Sept. 1892. In 1871 he was admitted to the bar of Manitoba, in whose politics he was long active as treasurer (1870–2), premier (1874), and later secretary, minister of agriculture, and president of the council. In 1871 he became a senator of the Dominion of Canada and in 1872 a member of the executive council for the Northwest Territories.

Girard, Philippe Henri de, fē-lēp ŏṅ-rē dĕ, French inventor: b. Lourmarin, France, 1 Feb. 1775; d. Paris 26 Aug. 1845. He was a man of versatile, scientific tastes, but concentrated his powers on mechanics. When Napoleon offered 1,000,000 francs as a prize for a machine that would spin flax, Girard invented the machine, but the fall of Napoleon deprived him of the reward. In 1815 he settled in Austria, built a flax-mill at Hirtenberg, and inaugurated steamboat service on the Danube. At the invitation of the Russian czar he went to Poland in 1825 and established a flax-mill which became the centre of the village of Girardou.

Girard, jĭ-rärd', **Stephen**, American philanthropist: b. Bordeaux, France, 24 May 1750; d. Philadelphia 26 Dec. 1831. In 1769 he settled in Philadelphia and engaged in various trades. Later, in 1780–90, he formed a partnership with his brother John and for some years continued a most successful West Indian and coastwise trade. He became interested in the first United States Bank in Philadelphia, and in 1812 had purchased the controlling interest and building. The bank continued to do business under the name of the Girard Bank, and soon became one of the foremost financial institutions of the country. He was a man of peculiar habits, ill-tempered and repellent in manner, but with all, a man uncommonly generous in his charities, chief among which was the $5,000,000 left for the erection and maintenance of a college for male white orphans. During the rage of yellow fever in Philadelphia he was ever present in relieving the afflicted, both by his free giving and by his personal care.

Girard, Kan., a city and county-seat of Crawford County, on the Atchison, T. & S. F., and St. Louis & S. F. R.R.'s. Its situation is well adapted to agricultural pursuits. It has 6 churches, 2 banks, and 3 public schools. The industries include zinc smelting, stove manufacturing, and flour-mills. The city owns its own water-works. Pop. (1900) 2,473.

Girard College, Philadelphia, Pa., an institution for the education of poor white orphan boys; founded under the will of Stephen Girard, and opened 1 Jan. 1848. By a provision in the will no ecclesiastic, missionary, or minister of any sect whatever is to have any connection with the college. At the close of the school year 1900 it reported: Professors and instructors, 67; students, 1,731; volumes in the library, 16,800; productive funds, $15,938,293; income, $1,000,000; number of graduates, 4,754; president, A. H. Fetterolf, Ph.D., LL.D. The total value of the college property exceeds $16,000,000.

Girardin, MADAME **Delphine Gayde**, dĕl-fēn gādė zhē-rär-dăn, French poet and novelist: b. Aix-la-Chapelle, Rhine Province, Prussia, 26 Jan. 1804; d. Paris 29 June 1855. Carefully educated by her mother, Sophie Gay (q.v.), she won fame with her poetry at the age of 15, an academic prize at 18, and a royal pension at 20. In 1831 she married the eminent journalist M. Emile de Girardin, and began now to turn her attention to prose fiction, producing successively: 'Le Lorgnon'; 'Le Marquis de Pontanges'; 'La Canne de M. de Balzac'; 'Il ne faut pas jouer avec Douleur'; and 'Marguerite.' She also contributed to the 'Presse,' conducted by her husband, her 'Lettres parisiennes,' which, under the pseudonym of the "VICOMTE DE LAUNAY," attracted great and deserved admiration by their wit and liveliness. As a writer for the stage Madame de Girardin obtained some distinction, two of her most successful pieces being: 'Lady Tartuffe' and 'La joie fait peur.' She also composed two tragedies, 'Judith' and 'Cleopatra,' for the celebrated Rachel; and a little piece by her, 'Le Chapeau de l'Horloger,' became a popular farce in England under its English title of 'The Clockmaker's Hat.'

Girardin, Emile de, ā mēl dė, French journalist and politician: b. Paris 22 June 1806; d. there 27 April 1881. He bore the name of Delamothe till 1827, when he assumed that of his father, who acknowledged him in 1847; and his first attempt in literature was a novel, 'Emile,' in which he pleaded the cause of adulterine children. After the July revolution of 1830 he established the 'Journal des Connaissances Utiles,' and in 1836 founded the 'Presse,' an Orleanist journal with Conservative leanings. Its rivals accused it of being subsidized by the government, and one of the unfortunate results of the quarrels thus fastened on Girardin was his duel with Armand Carrel, editor of the 'National,' in which the latter fell. He promoted Louis Napoleon's election to the presidency, and afterward became a Socialist. In 1856 he sold his share of the 'Presse,' but became its editor again in 1862, eventually abandoning it for the direction of the 'Liberté,' which he maintained till 1870. During the Commune he proposed a scheme for splitting up the republic into 15 federal states. In 1874, however, he founded the 'France,' and both in its pages and in the 'Petit Journal' supported the republic. He wrote a few pieces for the stage; his political ideas he gave to the world in a host of brochures.

Girder, a beam, of wood or metal, spanning the distance from wall to wall or pier to pier, and used to support a superstructure or superincumbent weight, as a floor, the pathway of a bridge, etc. Girders are often compound, the timbers being scarfed together and stayed by truss-work, or fished at the joint. The ends of the girder rest on the wall or pier to an extent varying according to the span; thus for a girder of 10 foot span, the bearing at each end should be 7 inches; for a 20-foot span, 14 inches. The ends rest on templates. Girders are of various sorts, according to the purpose for which they are required. A sandwich girder is one which is composed of two wooden beams with an iron flitch plate between, all bolted together. See BRIDGE BUILDING; BUILDING.

Gir'dler, a small American longicorn beetle (*Oncideres cingulatus*), which in August lays an egg in a hole bored into a twig of a hickory, pear, or other tree, and then gnaws a deep groove below the egg, thus girdling the twig. This kills the extremity and provides a supply of dead wood as food for the grub which is soon hatched. The grub eats all the woody tissue, and within the concealing shell of bark remaining, pupates and passes the winter, becoming a full beetle and emerging the following spring. When this insect is numerous it may do serious damage to forests and orchards.

Girls' Clubs, societies with a membership of girls banded together for recreation, study, mutual helpfulness, etc. Among girls there is apparently less spontaneity than among boys in regard to the formation of clubs, but large numbers of girls are found in clubs organized and to a greater or less degree supervised by older persons. In women's clubs so called, large numbers of girls are found either as regular members or in a junior branch or department. Some large societies, such as the Young Women's Christian Association, do not apply the name club to any of their branches, and could not accurately do so, and yet the opportunities they afford to girls, for entertainment, self-improvement and social intercourse, and the use of rooms for gatherings, reading, and writing, etc., afford to members what is largely equivalent to club membership, a fact appreciated by the girls themselves, who sometimes give as a reason for joining such societies, the wish to be connected with "a club." Many girls are found in the large organization known as King's Daughters and Sons, especially in the junior circles. In such bands, religious or benevolent features predominate, but the social element is cultivated in a greater or less degree. The Girls' Friendly Society is also largely of a religious nature, but in addition to church and missionary work, it provides opportunities for recreation and for the mental and industrial training of its members. Instruction in hygiene is an important feature, and music receives much attention. The aim of the society is to encourage purity of life, dutifulness to parents, faithfulness to employers, and thrift; and to cultivate a spirit of fellowship and kindliness. It ensures the privileges of the society to its members wherever they may be, by giving them an introduction from one branch to another. The parent society was started in England in 1875 (at a time when much interest was shown in "rescue work") with the central idea of helping young women along preventive rather than reformatory lines. The form of organization follows as far as possible that of the Church of England, being diocesan and parochial. Any girl of good character, 12 years of age or over may become a member, and younger girls may become probationers or candidates. Associate members must be communicants. This society now extends wherever the English language is spoken and is the largest society of girls and women in existence, numbering about 300. The Girls' Friendly Society in America is under the auspices of the Protestant Episcopal Church. Branches were started in Lowell, Mass., and in Baltimore, Md., soon after the organization of the English society, and a central council was formed in 1886. On 1 Oct. 1902 the society reported 435 branches, in 54 dioceses; and a total membership (including associates, probationers, candidates, etc.) of 25,399. There are six holiday houses, belonging respectively to the diocesan branches of Massachusetts, New York, Pennsylvania, Rhode Island, and New Jersey. The organs of the society are two monthly periodicals, 'The Girls' Friendly Magazine,' and 'The Associates' Record.' The central office is in the Church Missions House, New York. Some individual churches maintain girls' clubs as a part of their parish work. The club connected with St. Bartholomew's Church, New York, has a club-room, baths, classes of various kinds, and a mutual benefit fund. In the social, university, and college settlements in large cities throughout the United States, clubs for girls generally constitute an important feature of the work.

The use of the word "girl" in connection with working-girls' clubs is somewhat vague, as the term is very elastic in its application. In most working-women's clubs girls are admitted who have passed the age of 14, but in some cases there are also junior clubs for the younger girls. These "sub-clubs" are to some extent under the supervision of the older members, but usually have their own officers and constitution. The State and city associations of working-girls' clubs secure for the individual clubs belonging to them enlarged advantages and more effective working. The results of united effort are illustrated by the success of the movement for the early closing of stores in Boston in 1896–7, a step due in great part to clubs having a membership largely drawn from girls in stores and factories. One of the objects of the Massachusetts association is to assist clubs in obtaining the services of good teachers, physicians, and lecturers. Among the subjects very frequently taught in the classes connected with working-girls' clubs are plain sewing and embroidery, millinery, cooking, gymnastics, and singing. Lessons in English literature, elocution, French, German, stenography, drawing, modeling, and painting are also offered to many club members. In some of the clubs the teachers are paid, and in others they contribute their services. Besides the more formal lessons, talks are often given to club girls on hygiene, nursing, morals, manners, etc.; and concerts, lectures, and readings, with "evenings of travel" fill many of the evenings devoted to entertainment. Outings of various kinds form a summer feature in many clubs, and vacations are often made possible at cheaper rates than could otherwise be obtained by the members. Large clubs or associations conduct vacation houses at the seashore or in the country. The pleasures and privileges connected with club life form the brightest and most hopeful element in the life of many a self-supporting girl. See BOYS' CLUBS; CLUBS; KING'S DAUGHTERS AND SONS, INTERNATIONAL ORDER OF; LEND A HAND CLUBS; WOMEN'S CLUBS; WORKING WOMEN'S CLUBS.

Girls' Friendly Society. See GIRLS' CLUBS.

Gironde, zhē-rônd, France, a department, bounded north by the estuary which gives it its name, and the department of the Charente; east by Dordogne and Lotet-Garonne; south by Landes; and west by the Bay of Biscay; area, 4,140 square miles. The whole department, with exception of the west, which sends its waters either directly to the coast or the long series of lagoons by which it is lined, belongs to the basin of the Gironde, which is formed in its interior by the junction of the Dordogne and Garonne. The only other streams deserving of notice are the Leyre, which discharges itself into the most southern lagoon; the Ciron, a left affluent of the Dordogne; and the Isle, with its tributary Dronne. The quantity of waste land is very great, amounting to more than one third; while the arable land is rather less than one fourth of the whole surface. Of the remainder about one seventh is occupied by vineyards, and one ninth under wood. The great staple of production is wine. The most celebrated wines are Médoc, Graves, Côtes, Palus, and Entre-deux-Mers. (See WINES.) The trade, which has its centre at Bordeaux, is very important. The principal exports are wine, brandy, corn, flour, fruit, rosin, liqueurs, etc. For administrative purposes Gironde is divided into six arrondissements — Bordeaux, Bazas, Blaye, Lesparre, Libourne, and La Réole. The capital is Bordeaux (q.v.). Pop. (1901) 821,131.

Girondist, jĭ-rŏn'dĭst, or **Girondin,** the name of a great political party in France; one of the most powerful factors in the earlier part of the first French Revolution. When the Legislative Assembly met in 1791, it contained representatives of the upper, the middle, and the lower classes. The Girondists were the party of the middle classes, and were republican in sentiment, but suffered from the lack of a definite policy. They obtained their designation from the fact that their most celebrated leaders, Vergniaud, Guadet, and Gensonné, were members for the department of the Gironde, originally lawyers in the law court of Bordeaux. Sometimes they were called Brissotins from Brissot, their most eloquent leader. They were the most powerful party in the Assembly, and for a time shaped the policy of their country. When conservative Europe threatened France with invasion, the Girondists in April 1792, declared war, the Jacobins deprecating hostilities, as fearing the result. To overcome their monarchic rivals, the Girondists coquetted with the last-named party, and found that they had gained, not a servant, but a cruel and exacting master. The quarrel between the two arose after the massacres perpetrated in August and September 1792, and the extreme revolutionists ultimately prevailing, an armed mob on 31 May 1793 assailed the Convention, and demanded the imprisonment of 29 Girondist deputies. These were arrested on 2 June, and 21 of them were guillotined on 31 October. Others were subsequently put to death; a few escaping, reappeared in the Convention after the fall of Robespierre.

Girouard, Désiré, dā-zē-rā zhē-roo-är, Canadian jurist: b. Saint Timothée, P. Q., 7 July 1836. He practised his profession as a member of the Montreal bar 1860–95, and was a member of the Dominion Parliament for Jacques Cartier 1878–95. He carried the Deceased Wife's Sister Bill in 1882 and since 1895 has been a justice of the supreme court of Canada. He has published: 'Essai sur Lettres de Change' (1860); 'The Bill of Exchange Act' (1890); 'Lake St. Louis, Old and New and La Salle' (1893).

Girton (gėr'tŏn) **College,** England, a noted college for women, instituted at Hitchin in 1869, but removed to Girton, near Cambridge, in 1873. The students, 110 in number, are admitted after an entrance examination; the ordinary course extends over three years, half of each year being spent in college. Degree certificates are granted for the B.A. of Cambridge University.

Girty, gėr'tĭ, **Simon,** American frontiersman and leader of the Indians: b. present Dauphin County, Pa., 1741; d. Canada 1818. He became a second lieutenant of Virginia militia, later an Indian interpreter, deserted to the English in 1776, was appointed an interpreter to the English Indian department, and was declared a traitor by the Pennsylvania legislature. His name was popularly associated with many Indian atrocities on the frontier, although it is likely that he was not at any time commander of a large force and that his prestige among the savages was much less than was supposed. He did, however, lead the Indians who attacked Dunlap's Station (1791) and Fort Jefferson (1791).

Gisborne, gĭz'bôrn, **Frederick Newton,** Canadian telegrapher: b. Broughton, Lancashire, England, 8 March 1824; d. 29 Aug. 1892. He went to Canada in 1845 and soon after engaged in telegraph work. He laid before the Nova Scotia authorities in 1850 a plan for telegraphic communication between Newfoundland and Ireland, and the first cable in America was laid by him in 1852, connecting Prince Edward Island and New Brunswick. In 1879 he was appointed superintendent of the Dominion Telegraph Signal Service.

Gismondite, jĭs'mŏn-dīt, or **Gismondine** (named after C. G. Gismondi, an Italian mineralogist), a monoclinic transparent or translucent mineral of vitreous lustre, its hardness 4.5; specific gravity 2.27; sometimes colorless, sometimes white, bluish-white, grayish, or reddish. It is optically biaxial. Composition: Silica, 35.88; alumina, 27.23; lime, 13.12; potassa, 2.85, and water, 21.10. Occurs in leucitic lava near Rome and in Sicily.

Gissing, gĭs'sĭng, **George,** English novelist: b. Wakefield 22 Nov. 1857; d. Saint Jean de Luz, France, 28 Dec. 1903. In his stories he has made a remarkable study of the London masses, from the ranks of skilled labor to the most noisome human refuse of the slums, the result being half repulsive and wholly powerful. He has published: 'The Unclassed' (1884); 'Demos' (1886); 'Isabel Clarendon' (1886); 'Thyrza' (1887); 'A Life's Morning' (1888); 'The Nether World' (1889); 'The Emancipated' (1890); 'New Grub Street' (1891); 'Born in Exile' (1892); 'Denzil Quarrier' (1892); 'The Odd Women' (1893); 'In the Year of Jubilee' (1894); 'Eve's Ransom' (1895); 'The Whirlpool' (1897); 'Human Odds and Ends' (1897); 'The Town Traveler' (1898); 'Charles Dickens, a Critical Essay' (1898); 'The Crown of Life' (1899); 'Our Friend the Charlatan'; 'By the Ionian Sea' (1901).

Giulio Romano, joo'lē-ō rō-mä'nō, properly Giulio Pippi de Giannuzzi, Italian artist: b. Rome about 1492; d. Mantua 1 Nov. 1546. He assisted Raphael in several of the latter's works, including the 'Benefactors of the Church' in the Incendio del Borgo, and at Raphael's death completed the 'Battle of Constantine' and the 'Apparition of the Cross' in the Hall of Constantine in the Vatican. He built the Villa Madama, for which he painted a fresco of Polyphemus. In 1524 he accepted the invitation of the Duke of Mantua to undertake for him a series of architectural and pictorial works, and restored the Palazzo del Te, the cathedral, the streets, and a ducal palace at Marmirolo, near Mantua. Among other Mantuan works of his are the 'History of Troy,' in the castle, and 'Psyche,' 'Icarus,' and the 'Titans,' in the Te palace. In Bologna he designed the façade of the church of St. Petronio. Other works are the 'Martyrdom of Saint Stephen,' at Genoa; 'A Holy Family,' at Dresden; 'Mary and Jesus,' and the 'Madonna della Gatta.'

Gizeh, gē'zē, **Ghizeh,** or **Geezeh,** Egypt, a town on the left bank of the Nile, almost directly opposite Cairo. It was formerly an important place, beautified by palaces, but now forms a scene of ruins, amidst which the town is built. Five miles to the west are the great pyramids which have been named from this town, and here also is the famous Sphinx. Pop. about 11,500.

Gizzard, a stomach or a part of it or of the alimentary canal where it is unusually muscular and tough, so that it is able to crush or grind solid food. It is not possessed by animals whose food is soft or else is chewed before swallowing; and is best developed among seed-eating birds, which frequently swallow pebbles to assist the gizzard in its grinding work. Birds not accustomed to hard food, if compelled and able to adopt such a diet, will develop a serviceable gizzard. Various fishes, reptiles, crustaceans, insects, worms, and other invertebrates have gizzards. See *Digestive System* under Anatomy; Stomach.

Glace Bay, Canada, town of Cape Breton Island and County, Province of Nova Scotia, on the extreme eastern seacoast and on the Sydney & Louisburg R.R., 14 miles east of Sydney.

Industries.— The town and the surrounding district are underlaid with vast deposits of coal and almost the entire population is dependent upon the coal mines, five of which are within the town limits and three others closely adjoining. The Dominion Coal Company employs about 5,000 persons and has a yearly output from their mines of over 4,000,000 tons.

Banks and Churches.— There are three banks, branches of those located in other cities. Nearly half the population is Roman Catholic, while the Presbyterians have great predominance over the Evangelical bodies.

Public and Educational Institutions.— Saint Joseph's Hospital is the second largest in America and one of the finest in the province. On Table Head, a bleak promontory one mile east of the town, Marconi completed in December 1902 his first transatlantic wireless telegraph and sent his first wireless messages across the Atlantic. The educational system consists of common and convent schools.

Government and Population.— The town was incorporated in 1901, its affairs being administered by a mayor, elected yearly, and a council of six members, elected for two years. The majority of the population are of Highland Scotch descent. Pop. Glacé Bay and surrounding collieries (1901) 6,945; (1905) 16,000.

Glacial Acetic Acid. See Acetic Acid.

Glacial Drift. See Drift.

Glacial Period, or Ice Age. Over nearly all of the North American continent north of the 40th parallel and over a vast tract of the work of moving ice sheets or glaciers, rock surfaces have been ground and polished, great boulders have been carried long distances from the ledges whence they came, and the topography has characteristically rounded outlines. Since the marks of the ice chisel are plainly visible on hard rocks, and even on easily weathered rocks that have been protected by a thin layer of soil, it is evident that the ice finished its work recently.

Effects of Glaciation.— At the opening of the Glacial Period most of the land surface over which the ice advanced was covered by a deep soil grading through partly decayed rock into solid rock. Undoubtedly the ice did not level off the general surface of the country as much as has been supposed, but it wiped off the soil and partly decayed rock, rounded the outlines of hills, broadened north and south valleys and pushed before it or carried along a mass of detritus which formed whenever the ice stopped its advance, a terminal moraine. It is possible that clay and boulder were laid down in a thin sheet under the ice in places at least, forming what is known as boulder clay or till, near where was the southern edge of the ice, oval hills of clay and boulders known as drumlins. Other deposits were formed along the edge of the ice, from material worked over by water and known as stratified drift. These deposits include irregular hills of sand, gravel, and boulders, called kames, and long winding ridges of the same material called eskers. These latter are supposed to represent the filled channels of subglacial rivers. The irregular depressions known as pot holes, in a glaciated region, may sometimes represent where were isolated masses of ice when glacial detritus was deposited all around as the ice sheet retreated. It is in fact in the retreat of the ice front that topography was most modified, the terminal moraines, at each pause in the retreat, dammed river valleys, while the valleys were filled sometimes to a depth of hundreds of feet with detritus. Between the morainic dams in front and the ice in the rear, great lakes were formed, one of these, Lake Agassiz in Minnesota, the Dakotas, and Manitoba being 700 miles long from north to south. As the glacial retreat was recent, streams have not had time to cut down valleys and so a glaciated region is a region of lakes.

Cause and Duration of the Glacial Period.— Though several theories of the cause of the Glacial Period have been proposed, no one has received general acceptance, and the existence of Glacial periods in past geologic ages is still disputed. Probably there were Glacial periods before the Pleistocene. As to the Pleistocene, there is good evidence for believing that northern North America and probably Scandinavia were much elevated at the close of Tertiary time. This elevation of the land caused so heavy a snowfall that snow lay on the ground all the year round, and glaciers started. Another hypothesis, that of Croll, is that owing to variations in the eccentricity of the earth's orbit around the sun the hemisphere having winter when the earth was farthest from the sun, would for a period have protracted winters, and during this period great masses of ice might accumulate. Whatever the cause, the ice sheets formed and advanced. In North America three centres of glaciation are generally recognized, the Cordilleran, along the Rocky Mountains in British Columbia, whence the ice flowed eastward possibly 1,000 miles or more; the Keewatin, near Hudson Bay, whence the ice advanced southwest, south and southeast, reaching as far south as Iowa; and the Laurentide, north of the St. Lawrence River and in Labrador, whence the ice advanced over eastern Canada, New England, and the Central States as far west as the Mississippi River. These ice sheets did not advance simultaneously, but probably in the order named. Their retreat was accompanied or preceded by changes of level, until at the close of the Ice Age, during the so-called Champlain stage, or its equivalent, the Columbian, the ocean covered what is now dry land, and the climate was milder than now. The ice did not advance nor retreat steadily. Some geologists recognize in the Mississippi valley four or five advances and corresponding retreats, and speak of these as epochs or stages. The time since the close of the Ice Age has been variously estimated; average estimates being around 20,000 years. There is good evidence for believing that as much time elapsed between some of the advances of the ice. Hence it is sometimes said that we may be living to-day in an Inter-glacial Period. It is certain that man was in Europe in what is known as the Chellean Epoch, or early Pleistocene. He may have been in America at the same time, but no certain evidence of his presence has been found.

Bibliography.— Agassiz, 'Système Glaciale' (1847); Croll, 'Climate and Time' (1885);

Dawson, 'Canadian Ice Age' (1894); Bonney, 'Ice Work, Past and Present' (1896); Geikie, 'Great Ice Age' (1895); Heim and Penck, 'On the Ancient Glaciers of the Isar and Liuth' (1886); Wright, 'Ice Age in North America' (1890); Upham, 'Glacial Lake Agassiz' United States Geological Survey, Monograph XXV. See BOULDER CLAY; COLUMBIAN FORMATION; DILUVIUM, CHAMPLAIN STAGE; DRIFT; DRUMLIN; TILL.

SAMUEL SANFORD,
Engineering and Mining Journal.

Glacier Bear, a small gray or "blue" bear (*Ursus emmonsi*) of the St. Elias Alps, Alaska. See BEARS.

Glacier, a current of ice derived from snow. Water, changed into vapor by sun-heat and carried by the winds over frosty highlands, is crystallized into snow. Glaciers take their rise in regions which lie above the snow-line. Upon these regions, from their geographical position and elevation, the quantity of snow that falls exceeds the quantity melted and evaporated. The surplus, instead of accumulating indefinitely, is changed by the pressure of its weight into ice, which, though hard and apparently as brittle and inflexible as glass, flows down toward the sea in beautiful swaying undulating lines, as if soft like honey or tar. Thus the overburdened regions above the snow-line are relieved and a continuous circulation is maintained,— ocean water flying away through the air in the form of vapor, but in returning creeping along the ground in the form of ice, grinding and crushing the rocks that lie in its way, and leaving a heavier track than anything else that moves on the face of the earth.

In general a glacier flows like a river, and drains off snow as a river drains off rain. At different places it moves at different rates, not only along its cross-sections, but along its length and from surface to bottom, as friction and the declivity of its bed varies. The velocity of the swiftest parts of the largest glaciers of the Alps is about from one foot to three feet per day; of the smallest, about as many inches. The lower central part of the Muir Glacier of Alaska flows about 10 feet a day. Some of the Greenland glaciers are said to flow much faster. Glacier motion, however slow, is continuous. It is less in winter than in summer, and slightly less in frosty nights than in warm and rainy days.

Crevasses.— Though obedient to the laws of liquid motion in general, a glacier refuses to stretch, as is shown by its breaking sharply asunder at right angles to tension strains, thus forming the so-called transversal, longitudinal, marginal, and *bergschrund* crevasses. The first two are caused by unevenness of the channel, the marginal by differential motion, the *bergschrund* by the glacier flowing away from the motionless snow attached to the head of its basin. The last is of course a feature of all glaciers; so are the marginal crevasses, since the middle of all glaciers flows faster than the sides; but large central areas, where the bed is regular in slope or slightly concave, are free from crevasses. The largest crevasses are several miles long, 1,000 feet deep or more, and 30 or 40 feet wide, though at first they are usually too narrow to admit a knife-blade. In some places all sorts of crevasses are interlaced, forming labyrinths of yawning gulfs defying the skill and will of the bravest mountaineer who tries to hew a way through them.

Regelation.— The brittleness of ice, with its flowing motion, is partly explained by regelation. In 1850 Faraday discovered that when two pieces of thawing ice are placed together they freeze at the points of contact. Snow at a temperature of 32° F., stuffed into a mold and squeezed, becomes transparent ice. So also fragments of ice pressed in a mold break, are crushed, and recongealed into a solid mass of the form of the mold, illustrating the breaking of glaciers and their regelation when from change of position the sides of the chasms, great or small, are pressed together.

Moraines.— The life of a glacier is one eternal grind. Its draining streams are always milky with rock mud rubbed off its bed, and separated from the large detached masses by the waters. Moraines, lateral, medial, and terminal, are the general detritus of a glacier and the weathered heights about it, drawn out and arranged by the ice currents, and located as their names indicate. The medial moraines, of which each glacier has one fewer than the number of its tributary glaciers, are formed by the union of two laterals at the confluence of the tributaries, and extend down the trunk in beautiful order. The terminal moraine is made up of parts of all the others. The moraine material, clay, sand, and boulders, of the great continental glaciers of the Ice Age, is often called drift. The detached rock masses, borne along by the ice currents and left in the terminal moraines, or if the glacier reaches the sea, dropped perhaps hundreds of miles away by icebergs, are called erratics.

The most striking features of large glaciers are the medial moraines, the lakes and streams on its surface, the wild ice cataracts corresponding to the cascades and rapids of rivers, and the discharging frontal wall, with its icebergs upheaving, sinking, and roaring amid eternal thunder. Glaciers vary widely in size and form; they may be classified as follows:

(*a*) Continental glaciers, of which only two now exist, the Greenland and South Polar ice caps.

(*b*) Glaciers of the first order, which are more or less river-like, flow into the sea, and terminate in berg-discharging ice cliffs.

(*c*) Glaciers of the second order, which approach the sea, but do not enter it, and of course do not discharge icebergs, waste from melting and evaporation equaling the snow supply.

(*d*) Glaciers of the third order, residual branches of those of the second, separated and made independent by the melting away of the trunks to which they belonged. Nearly all the glaciers of the world are now of this order.

Distribution of Glaciers.— Most of the glaciers of North America are distributed along the mountain ranges of the Pacific coast between lat. 36° 30′ and 36°. About 65 small residual glaciers a mile or less long still linger on the Sierra Nevada of California between lat. 36° 30′ and 38°, at an elevation of 11,000 to 12,000 feet above sea-level. Groups of larger glaciers drain the snow-fields of Mount Shasta and the high volcanic mountains of the Cascade Range in Oregon and Washington. From ice-crowned Mount Rainier, 14,600 feet high, eight glaciers, 5 to 10 miles long, descend into the forests to within 3,000 and 4,000 feet of sea-level. The

GLACIERS.

1. Small Residual Glacier. 2. Front of Columbia Glacier.

broad, lofty mountain chain extending along the coasts of British Columbia and southeastern Alaska is generally ice-laden; the upper branches of the main cañons are occupied by glaciers, which gradually increase in size and descend lower, up to the highest and snowiest region of Alaska between lat. 56° and 61°, where a considerable number flow into arms of the sea. This is the region of greatest glacial abundance on the continent. To the north of lat. 61° the glaciers gradually diminish in size to about lat. 62° 30′ or 63°. Beyond this, to the north end of the continent, few if any glaciers now exist, the ground being comparatively low and the snowfall light.

Glaciers of the third order, a mile or two to 15 or 20 miles long, fill the uppen cañons and hollows of the highest region in countless thousands.

The large glaciers of the second order number about 100. They are distributed along the coast from the mouth of the Stickeen River to Cook Inlet and the Alaska Peninsula, pouring their majestic floods from far-reaching fountains in the white recesses of the peaks. The expanded fan-shaped ends of many of this order are from two to four or five miles wide. The largest among these are the Malaspina Glacier, the Miles, Yakutat, Grand Plateau, Crillion, and La Pérouse, fronting the sea along the St. Elias and Fairweather mountains. The Malaspina is the largest of them all, being about 20 miles long and 65 or 70 miles wide,— a grand undulating ice prairie sloping gently from the base of the St. Elias Mountains, and separated from the sea by a girdle of forested moraines five or six miles wide, except at Icy Cape, where it presents bluffs of pure ice that are being undermined by the waves. The La Pérouse also presents ice bluffs to the open ocean, which at high tide are wave-washed, and small bergs are occasionally detached; but far the greater number terminate a mile or two from the tide line, back of moraines in rather low-spreading crevasse-gashed brows, over which one may easily climb.

The great glaciers of the first order flowing out into deep ocean water and discharging fleets of icebergs number about 31. One, the southmost, flows into the Le Conte Fiord in lat. 56° 50′. 4 into branches of Holkam Bay, 1 into Taku Fiord, 9 into the Glacier Bay fiords, 2 into Lituya Bay at the base of Mount Fairweather, 3 into Disenchantment Bay, and 11 into the wild fiords of Prince William Sound the northmost being a little above the 61st parallel.

The scenery of these fiords is of the grandest description. From wall to wall they are encumbered, often jambed with icebergs, which by the most active glaciers are discharged at intervals of a few minutes with thundering roaring that may be heard 5 or 10 miles away, proclaiming the restless work and power of these mighty crystal rivers, in striking contrast with the dead silence of those of the second order, though they also, except at their decaying ends, are ceaselessly flowing and grinding.

Glacier Bay is the iciest of the inlets which fringe the coast. Both to the north and south of it the glaciers are generally less lavishly snow-fed, and of course give birth to fewer icebergs. Of its nine glaciers of the first order, the Muir is the largest. It is about 50 miles long, the main trunk below the confluence of the principal tributaries is about 25 miles wide and probably about 1,500 feet deep. The berg-discharging part of the sea-wall is less than two miles wide, rises above the water to a height of 250 to 300 feet, and sinks to a depth of about 700 feet.

The grandest of the Prince William Sound glaciers are the Columbia, Barry, Harvard, Yale, and Harriman. Some of the smallest of the noble company descend flowery mountain-sides in the wildest and most imposing ice-cataracts.

Residual glaciers from a mile to 10 or 12 miles long, including neve, are distributed throughout the Rocky Mountain ranges from lat. 43° to 53°. The greater number lie between 50° and 52° 30′ at the heads of the Saskatchewan, Athabasca, and Columbia rivers. The largest groups are magnificent rags and patches of an ancient ice-sheet, some of them covering an area of 40 to nearly 100 square miles, and sending down river-like glaciers six to eight miles long.

Glaciers of the third order abound on the Alps, the Pyrenees, the Caucasus, the Scandinavian Peninsula, the Andes, the lofty snowy ranges of Asia, and on the mountains of New Zealand.

More than 1,000 with an area of about 1,200 square miles, have been surveyed and named in the Alps. The largest are river-like, 10 to 15 miles long, descend into the forests, and terminate at an elevation of 4,000 to 6,000 feet. Most of the smaller ones are like masses of pure snow, and terminate about 2,000 feet higher.

The Caucasus is perhaps about as heavily ice-laden as the Alps. Few of its glaciers are known to descend much lower than 6,000 and 7,000 feet. Those of the Pyrenees are comparatively small.

Many of the glaciers of Norway pour grandly down from extensive neve fields to within 1,000 feet of the sea-level. A few approach the shore and may rank as glaciers of the second order, while one, the only one in Europe of the first order, discharges into Jokul Fiord, near the 70th parallel. Between the larger glaciers flowing toward the heads of the fiords there are many hanging and cascading glaciers, ranged along the brows of plateaus, some of which pour over precipices in separate bergs with loud roaring like that of glaciers discharging into the sea. At the foot of the cliffs the battered fragments are welded, and thus these wild ice-streams, after their plunge through the air, are made whole again, and flow quietly on their way as "regenerated glaciers," the space between their upper and lower parts being only a wider kind of crevasse.

The low-descending New Zealand glaciers almost rival those of the Alps in size, while their beauty is greatly enhanced by the rich vegetation through which they flow.

The glaciers of South America are distributed along almost the whole extent of the Andes. According to Whymper those under the equator attain their greatest size on the snow-laden, storm-beaten summits of Antisana, Cayambe, and Chimborazo. On Cayambe, 12 glaciers of considerable size were counted, flowing from the central neve reservoir, descending to about 15,000 feet above sea-level. To the south of lat. 46° many approach the sea.

On the lofty mountain chains of Asia, especially the snowy Himalaya, Karakoram, Hindu-

Kush, Kuen-Lun, and Thian-Shan, thousands of little known residual glaciers still exist. The largest which have been explored are the magnificent Biafo and Baltoro Karakoram glaciers, 30 and 35 miles long, descending to about 11,500 and 12,000 feet.

Excepting Australia, which seems to have lost all its glaciers, Africa is glacially the poorest of the continents. Its only known glaciers are those of the two great snowy mountains, Kenia and Killimanjara, near the equator.

The Arctic islands — Jan Mayen, Nova Zembla, Spitzbergen, Franz-Joseph Land, and many others — are heavily ice-laden. Their largest glaciers are broad sheets discharging magnificent bergs into the frozen sea.

But it is on Greenland and the South Polar lands that glacier ice reaches its grandest development. Excepting a narrow interrupted strip around its shores, Greenland lies buried beneath a continuous mantle of ice thousands of feet in thickness, through which only the tops of its highest peaks, called «nunataks,» protrude. From this ice-cap huge glaciers pour into the sea, discharging icebergs of enormous dimensions, some of which sail into the Atlantic thousands of miles from home.

Still greater is the South Polar ice-cap, probably over two miles in thickness. The sea front of some of the glacier currents it pours forth are from 100 to over 400 miles wide, from which flat-topped island-like icebergs 5 to 10 miles long are discharged. Here the great cosmical winter of the Glacial Period still exists in severe, serene grandeur.

Greater Extension of Glaciers.— That a great part of the earth in both the northern and southern hemispheres, now warm and fruitful, was recently covered by flowing, grinding ice, is well known. Over the eastern half of North America from the Arctic regions to lat. 40° or lower, moraines and beds of moraine material variously modified, grooved, scored, and polished surfaces, with other characteristic traces of glacial action, are displayed in wonderful abundance and uniformity.

Along the mountain ranges of the west side of the continent they extend still farther south. The broad Rocky Mountain chain and the plains along its flanks abound in glacial traces on a grand scale. On the Sierra Nevada polished and striated rock surfaces the most evanescent of glacier inscriptions may still be found as far south as lat. 36°; while a degree or two farther north, at an elevation of 7,000 to 8,000 feet above the sea, there are broad glacier pavements in so perfect a state of preservation that they reflect the sunbeams like glass and attract the attention of every observer.

Over the greater part of Oregon, Washington, British Columbia, and the Arctic and sub-Arctic regions about Bering Sea and northwestern Alaska, the rocks in general are less resisting, and the weathering they have been subjected to is more destructive. Therefore the superficial records of glaciation are less clear in these northern regions than in California.

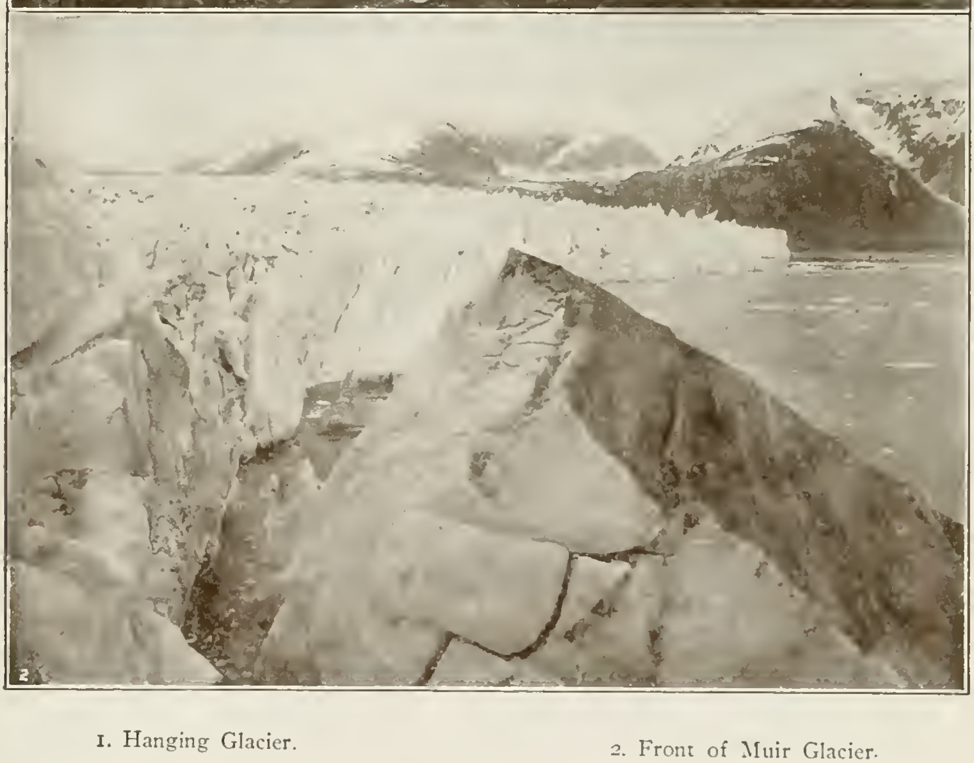
But in all glaciated regions there are other monuments of ice action which endure for tens of thousands of years after the simpler traces we have been considering have vanished. These are the sculpture and configuration of the landscape in general,— the cañons, valleys, fiords, mountains, ridges, and *roches moutonnées*, the forms, trends, and correlations of which are specifically glacial and almost imperishable. These also, it is true, suffer incessant waste, being constantly written upon by other agents. But because they are so colossal in size and peculiar in form and arrangement they continue to stand out clear and telling through every after-inscription, showing how great the ancient glaciers must have been, and how great are the geographical and topographical changes they have produced. On the Atlantic coast, where man is busiest, even in the parks and gardens of New York, glaciated rocks shine and call attention to the story of the Ice Period; and in orchards growing on moraine soil around the town of Victoria on the west side of the continent, fruitful boughs drop apples and peaches on the edges of glacier pavements, while the harbor rocks are still bright notwithstanding the centuries of wave-action they have been subject to. Thus strikingly are the works of ice displayed beside the works of man; yesterday in nature's chronology our continent now so fertile was a dreary wilderness of ice. No tale of fairyland is so exciting to the imagination as the story of the works and ways of snow-crystals banded together as glaciers and marching forth from their white tents on the highlands to develop earth's beauty, make beds of fertile food-soil, basins for lakes, valleys for rivers; to separate continents and sculpture their shores into countless islands, bays, sounds, and fringing fiords, then vanishing like clouds.

This change from icy darkness and death to life and light was slow as we count time, and is still going on wherever glaciers exist. The great winter of the Glacial Period is giving place to a great summer before which all the glaciers of the world are wasting away,— the Polar ice-caps, as well as the small shrinking remnants. All are shorter, narrower, shallower than they once were. The world is growing warmer, the snow-supply diminishing. But in trying to account for these changes we must bear in mind that the same sunshine that wastes glaciers nourishes them. In the formation of glaciers an enormous amount of sun heat is required to produce the vapor for the snow of which they are made. For the structure and physics of glaciers, see Agassiz, 'Système Glaciale'; J. D. Forbes, 'Travels in the Alps'; and 'Norway and Its Glaciers'; Tyndall, 'Glaciers of the Alps.'

John Muir,
Geologist, Explorer, and Naturalist.

Glad'den, Washington, American Congregational clergyman: b. Pottsgrove, Pa., 11 Feb. 1836. He was graduated at Williams College in 1859; ordained in the Congregational Church, and after several other pastorates became pastor of the First Congregational Church in Columbus, Ohio, in 1882. He is widely known as a writer on social reforms. His publications include: 'Plain Thoughts on the Art of Living' (1868); 'Workingmen and Their Employers' (1876); 'The Christian League of Connecticut' (1883); 'Things New and Old' (1884); 'The Young Men and the Churches' (1885); 'Applied Christianity' (1887); 'Parish Problems' (1888); 'Burning Questions' (1889); 'Who Wrote the Bible' (1891); 'Tools and the Man' (1893); 'Social Facts and Forces' (1897); 'Art and Morality'

GLACIERS.



1. Hanging Glacier.

2. Front of Muir Glacier.

(1897); 'The Christian Pastor' (1898); 'How Much is Left of the Old Doctrine' (1899); etc.

Gladiators (Lat. «swordsmen»), combatants who fought at public games in Rome for the entertainment of the spectators. Gladiators were first exhibited at Rome in 264 B.C., by Marcus and Decimus Brutus at the funeral of their father; and the custom probably originated in Etruria, where a slave was killed at his master's pyre. Gladiators also fought at public festivals and other entertainments. They were at first prisoners, slaves, or condemned criminals; but afterward freemen fought in the arena, either for hire or from choice. Under the empire persons of senatorial rank, and even women, fought in the arena. The regular gladiators were instructed in schools («ludi») established for this purpose. The overseer of the school («lanista») purchased the gladiators, trained them and rented them to those who gave games to the people. Men of position, especially such as aimed at popularity, sometimes kept gladiatorial schools of their own, and hired lanistæ to instruct them. The gladiators fought in the schools with wooden swords. The games were commenced by a «prælusio,» in which the combatants fought with their weapons o wood till, upon a signal, they assumed their arms, and began in earnest to fight in pairs. In case the vanquished was not killed in the combat, his fate was decided by the people. If they decreed his death, the thumb was held up in the air; the waving of handkerchiefs was the signal to save him. In general they suffered death with wonderful firmness, and the vanquished often exposed himself to the death-blow. If he wished to appeal to the people he raised his hand. When a gladiator was killed attendants dragged his body away with iron hooks. The gladiators were often released from further service, and presented with wooden swords, as badges of freedom, from which they were called «rudiarii.» The gladiators were divided into classes, according to their mode of fighting: the «andabatæ» fought blindfold; the «catervarii» fought in troops; the «essedarii» fought in chariots, like the Gauls and Britons. Other classes were the «retiarii,» armed with net and trident but unprotected by any armor, their usual opponents being armed as Gauls, and styled «mirmillones.»

The most celebrated gladiatorial statues are: (1) The Gladiator Borghese, a combatant with extended arm in the act of warding off a blow. It is a statue of the first rank, made of fine grained marble, and is now in the capitol, to which it was restored from Paris 1815. (2) The Dying Gladiator, purchased from the Ludovisian collection for the Museum Capitolinum. It is a dying warrior, and not a gladiator, probably, to judge by his «torques» or twisted necklace, a Gaul, who is wounded and is trying to rise.

Gladiolus, glā-dī'ō-lŭs (Lat. «a small sword»), a genus of plants of the order *Iridaceæ;* sword-lily. It received its name from the shape of its leaves. It has bulbous rhizomes, and the stems are leafy and bear beautiful flowers which, in garden culture, open in midsummer. There are nearly 100 species, some of them natives of southern Europe, the greater number being found in South Africa. Gladiolus is largely cultivated in the United States, and Long Island, N. Y., has important fields of it.

Glad'stone, Herbert John, English politician: b. London 7 Jan. 1854. He was educated at Eton and Oxford. He was private secretary to his father 1880–1; under-secretary home office 1892–4; first commissioner of works 1894–5; and Secretary of State for Home Affairs 1905. He sat in Parliament for Leeds 1880–5, and for Leeds West from 1885.

Gladstone, John Hall, English scientist: b. London 1827; d. 6 Oct. 1902. He was Fullerian professor of chemistry at the Royal Institution 1874–7, and a member of the London School Board 1873–94. He published: 'Life of Michael Faraday' (1872); 'Spelling Reform from an Educational Point of View' (1878); 'Chemistry of Secondary Batteries' (1883).

Gladstone, William Ewart, English statesman, orator, and author: b. Liverpool 29 Dec. 1809; d. Hawarden, England, 19 May 1898. He was educated at Eton and at Christ Church, Oxford. He had distinguished himself greatly as a speaker in the Oxford Debating Society and soon became known as a young man of promise, who would be able to render good service to the Conservative party. He was invited to contest the Scottish burgh of Newark and was elected. He delivered his maiden speech and made a decided impression on the House of Commons. In December 1834 Sir Robert Peel appointed him to the office of a junior lord of the treasury. The great struggle on the question of the repeal of the Corn Laws was now going on. It is a somewhat curious fact that he was not in the House of Commons during the eventful session when the great battle of free trade was fought and won.

Up to the time of the abolition of the Corn Laws, or at least of the movement which led to their abolition, he had been a Tory of a rather old-fashioned school and in 1847 represented Oxford in Parliament. He startled Europe and indeed the whole civilized world in 1851, by the terrible and only too truthful description which he gave in 1851 of the condition of the prisons of Naples, under the king who was known by the nickname «Bomba,» and the cruelties which were inflicted on political prisoners in particular.

By the death of Sir Robert Peel in 1850 he had lost a trusted leader and a true friend. But it was not until after Peel's death that he compelled the House of Commons and the country to recognize in him a supreme master of parliamentary debate. The first really great speech made by him in Parliament was made in the debate on Mr. Disraeli's budget in the winter of 1852, the first session of the new Parliament.

On the fall of the short-lived Tory administration Lord Aberdeen came into office and formed the famous coalition ministry. Lord Palmerston took what most people would have thought the uncongenial office of home secretary; Lord John Russell became secretary of foreign affairs. Gladstone was chancellor of the exchequer. His speech on the introduction of his first budget was waited for with great expectation; but it distanced all expectation. A budget speech from Gladstone thereafter came to be expected with the same kind of keen artistic longing as waits the first performance of a new opera by some great composer.

The Crimean war broke up the coalition ministry. A motion by Roebuck for inquiry into the condition of the army before Sebastopol was carried by a large majority against the government. Lord Aberdeen at once resigned. Lord Palmerston was the one indispensable man, and he became prime minister. Gladstone gave the government of Lord Palmerston a general support, until, after the attempt of Orsini on the life of the Emperor Napoleon III. in 1858; Palmerston introduced his ill-fated Conspiracy to Murder Bill. The government was defeated, Lord Palmerston resigned, and Lord Derby was called on to form a new ministry.

The year 1859 saw Lord Palmerston back again in office and Gladstone as chancellor of the exchequer. The budget of 1860 was remarkable. Gladstone introduced a provision for the abolition of the duty on paper — a duty which was simply a tax on reading, a tax upon popular education and the next session the Lords passed measure for the repeal of the duty. The death of Lord Palmerston in 1865 called Lord Russell to the position of prime minister. Gladstone's mind had long been turning in the direction of an extension or rather expansion of the suffrage. The bill he proposed was defeated (1866), but when Disraeli came into office he introduced a reform bill of his own, which was practically a measure of household suffrage for cities and boroughs.

About this time the attention of Gladstone began to be attracted to Ireland. He made short work with the Irish State Church. He defeated the government on a series of resolutions foreshowing his policy; the government appealed to the country; the Liberals returned to power, and Gladstone became prime minister (1868). In his first session of government he disestablished and disendowed the state Church in Ireland. In the next session he passed a measure which recognized the right of the Irish tenant to the value of the improvements he had himself made. For the first time in English history a system of national education was established. The Ballot Act was passed for the protection of voters. The system of purchase in the army was abolished — by something, it must be owned, a little in the nature of a *coup d'état*. Then he introduced a measure to improve the condition of university education in Ireland. The bill was thrown out and he tendered his resignation of office. Disraeli came back to power, and Gladstone retired from the leadership of the House of Commons (1874).

For a while he occupied himself in literary and historical studies, and he published essays and pamphlets. But even in his literary studies he would appear to have always kept glancing at the House of Commons. The Parliament which had gone from the spring of 1874 was dissolved in the spring of 1880, and Gladstone, after the famous Midlothian campaign had become prime minister once more.

It was an unpropitious hour at which to return to office. There were troubles in Egypt; there was impending war in the Sudan, and in South Africa. There was something very like an agrarian revolution going on in Ireland; and the Home Rule party in the House of Commons was under new, resolute, and uncompromising leadership. It is to the credit of the Conservative party that after a while they co-operated cordially with Gladstone in his reforming of 1885.

The use he made of office and power astonished his enemies, and startled and shocked not a few of his friends. His government had had in the years between 1881 and 1884 to fight a fierce battle against the policy of obstruction organized by Parnell, the leader of the Home Rule party. But when the elections under the new and extended Reform Bill were held, and the Irish Nationalist party came back 87 members out of the whole Irish representation of 103, in March 1886 he brought in a measure to give a statutory parliament to Ireland. In 1893 his Home Rule Bill was carried in the House of Commons, but was thrown out in the House of Lords. Owing to the increasing infirmities of age, especially impaired eyesight, the veteran statesman resigned 3 March 1894, and was succeeded by Lord Rosebery. He still took an interest in public affairs and busied himself with literary work. In January 1898 he published his reminiscences of Arthur Hallam; but falling seriously ill, after some months of suffering borne with noble fortitude, he died at Hawarden. He was buried in Westminster Abbey. Among Mr. Gladstone's works are: 'The State in its Relations with the Church' (1838); 'A Manual of Prayers from the Liturgy' (1845); 'Two Letters on the State Persecutions of the Neapolitan Government' (1851); 'Studies on Homer and the Homeric Age' (3 vols. 1858); 'A Chapter of Autobiography' (1868); 'Juventus Mundi' (1869); 'The Vatican Decrees, bearing on Civil Allegiance' (1874); 'Vaticanism' (1875); 'Homeric Synchronism Gleanings of Past Years' (7 vols. 1879); 'The Irish Question' (1886); 'A Translation of Horace' (1894); and 'The Psalter with a Concordance.'

Glagolitic (glag-ō-lĭt'ĭk) **Alphabet**, a Slavvonic alphabet classed as ancient Bulgarian. There is a MS. of the 11th century written in this alphabet in the Vatican, containing extracts of the Gospels for each day in the year; there are extant also three other MSS. written in the same letters.

The origin of this alphabet is undiscoverable. It is older than the Cyrillac; it may be a modification of Greek cursive writing; perhaps it is connected with Armenian and Albanian alphabets. Its use is confined to the liturgical books of Dalmatian Slavs. Cyril, a monk of Constantinople invented the Cyrillac alphabet, of which this has sometimes been considered a variant. Both of these differ from the current Russian alphabet.

Glagolitsa. See Glagolitic Alphabet.

Glair (Lat. *clarus*, clear, Fr. *clair*), the white of eggs prepared and used as a varnish for preserving paintings. For this purpose it is beaten to an even consistence, and commonly mixed with alcohol to make it work more freely, and with a little fine sugar to give it body and prevent it cracking, and then spread over the picture with a soft brush. Bookbinders also use it for finishing the leathern backs of books.

Glaisher, glā'shėr, **James Whitbread**, English meteorologist: b. Lewisham, Kent, 7 April 1809; d. Croydon, Surrey, 7 Feb. 1903. In 1840 he became superintendent of the magnetical and meteorological department of the Royal Ob-

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servatory, a post which he held for 34 years. Between 1862 and 1866 he made 28 balloon ascents for the purpose of studying the higher strata of the atmosphere, on one occasion reaching a height of over seven miles. He was the founder of the Royal Meteorological Society, became a Fellow of the Royal Society in 1849, and wrote numerous papers on subjects relating to astronomy and meteorology.

Glance, English equivalent of the German *glanz*, a term applied to opaque minerals of which the high lustre and color indicate their metalliferous character. The following are some of them: *Antimonial copper-glance*, or wölchite, sulphide or antimony, copper, and lead, with a little iron; *antimony-glance*, or stibnite, sulphide of antimony; *bismuth-glance*, or bismuthinite, sulphide of bismuth; *cobalt-glance*, or cobaltite, sulph-arsenide of cobalt sometimes with a little iron, also nickel and antimony; *copper-glance*, sulphide of copper; *glance-blende*, or manganese blende, sulphide of manganese; *glance-coal*, anthracite; *iron-glance*, or specular iron, oxide of iron; *lead-glance*, sulphide of lead or galena; *nickel-glance*, amoibite or gersdorffite, arsenide and sulphide of nickel, with cobalt, iron, etc.; *silver-glance*, sulphide of silver; *yellow-gold-glance*, or sylvanite, telluride of gold and silver; *zinc-glance*, silicate of zinc. German miners use almost indifferently the term *glanz* and *kies*, the latter signifying pyrites, as iron pyrites, copper pyrites; but glance is not so frequently used among American and English miners, though copper-glance, antimony-glance, are sometimes employed by scientific men as well as in the mines.

Glan'ders, the most dangerous form of equinia, and one of the most formidable diseases to which horses are subject. It is diagnosed by a discharge from one or both nostrils, with a hard enlargement of the submaxillary glands. It is distinguished into acute and chronic. In acute glanders the discharge from both nostrils is so great as ultimately to impede respiration and produce death from suffocation. Chronic glanders may run on for years before it terminates in the acute form of the disease. The discharge is usually confined to one nostril, is only occasional and sometimes trivial, with a moderate swelling of the gland on the affected side. The only other symptom of disease is a harshness of the coat. In the latter stages the discharge becomes offensive. The disease is highly infectious, and acute glanders may be communicated to healthy horses and asses, while the animal first affected is still able to feed and work apparently as well as ever. It may even be communicated to man by the pustular matter coming in contact with any part where the skin is broken; and not a few deaths have happened through this cause. The disease is often difficult to determine, as the discharge is only offensive in the latter stages. The symptoms may be mitigated by tonics and other treatment, but it is rarely if ever cured. The disease is now known to be produced by a species of bacillus about the size of the tubercle-bacillus. See FARCY.

Glandina, glăn-dī'na, a genus of large spirally elongated snails (q.v.), which attain their maximum development in the southern United States and in Mexico. They include many species, all graceful in outline and beautifully colored. A rosy species (*Glandina truncata*) is common along the coast of Florida and westward, which varies greatly in size according to its circumstances, in favorable localities reaching a length of four inches. These mollusks are most commonly found among the marsh-grasses, where they hunt for and devour other snails by filing through their shells and rasping away the flesh by means of their lingual ribbons. Marine mollusks and other animals are also attacked.

Glasgow, the chief commercial and manufacturing city in Scotland, and as regards population the second in the British Isles, is situated on both banks of the Clyde, about 14 miles from Dumbarton where the river broadens into a Firth; latitude 35° 51′ 32″ N.; longitude 4° 17′ 54″ W. Distance northwest by north of London 348 miles, as the crow flies, and by the various railway routes from 400 to 450 miles; west by south of Edinburgh, by road and rail, from about 42 to 50 miles; south of Inverness 206 miles by rail. The original city was wholly in Lanarkshire but was extended into Renfrewshire. By statute the whole municipal area (12,796 acres) is now in Lanarkshire, and for certain administrative purposes that area forms by itself the County of the City of Glasgow.

Topography.— In prehistoric times, though subsequent to the appearance of man in the district, the lower part of the Clyde valley, including a large portion of the site occupied by the modern city, formed the bottom of an estuary, as is evidenced by the discovery of canoes as well as marine shells and other organisms in localities at a considerably higher level than the existing water-way. A very different condition of things existed when, in the 16th and 17th centuries, documentary evidence is procurable. Owing to shoals, produced by rock and other obstructions, no vessels other than small boats could then come within 12 miles of Glasgow. Deepening of the channel was commenced in the middle of the 18th century, and this and other improvements for facilitating navigation have since been prosecuted with such success that for a long time the largest trading vessels have had free access to the harbor at Broomielaw.

Glasgow streets are in general wide and straight. This is now the case even in the older portions of the city, the operations of the Improvements Trustees, under their act of 1866, having removed most of the buildings bordering on narrow thoroughfares and substituted spacious streets for the former overcrowded lanes. At first the citizens got building material, consisting of a light-colored freestone, within their own lands, and similar supplies were subsequently procured from quarries in the neighborhood; but a red sandstone brought from a distance is now being freely employed. Brick is seldom used in street frontage. Substantial masonry, combined with architectural beauty and amenity, generally prevails throughout the city.

Bridges.— The north and south sides of the river Clyde are connected by bridges and ferries at convenient intervals, and there is likewise a tunnel under the river Clyde for the accommodation both of pedestrians and vehicular traffic. The bridges are (1) the Caledonian Railway bridge, giving access to the Central Station; (2) Glasgow or Broomielaw bridge, 80 feet broad, in line with Jamaica street, rebuilt in 1899, the features and materials of Telford's earlier bridge of 1833-6 being retained; cost $500,000; (3) Portland Street suspension bridge; (4) Victoria bridge, erected in 1851 to replace the old Glasgow bridge, supposed to date from the 14th century; (5) the Glasgow and South-Western Railway bridge leading into Saint Enoch's Station; (6) the Albert bridge built in 1871 of stone and iron, in line with Saltmarket and Crown Street; cost $280,000; (7) Saint Andrew's suspension bridge and (8) Polmadie bridge, both communicating with Glasgow Green; (9) Rutherglen bridge, 60 feet wide, three granite arches, opened in 1896; cost about $367,500; and (10) Dalmarnock bridge. There are also several bridges over the river Kelvin and other streams within the city.

Parks.—Glasgow Green, superseding a smaller space known as the Old Green, though incorporating a portion of ancient burgh territory, was mainly formed on lands acquired in 1662 and subsequent years, but was not specially laid out as a public resort till the beginning of the 19th century. Since that time it has been chiefly used as a public park. Area 136 acres. One of the attractions is the People's Palace and Winter Garden, opened in 1898. The following are the other city parks, with the dates of acquisition and areas:—Kelvingrove Park, intersected by the river Kelvin (1857-97) 85 acres; Queen's Park, embracing an old British camp and part of the site of the battle of Langside (1857-94) 148 acres; Alexandra Park (1871-91) 104 acres; Cathkin Park, gifted by James Dick (1886) 49 acres; Ruchill Park (1892) 53 acres; Bellahouston Park (1895-1903) 185 acres; Tollcross Park (1897-1900) 83 acres; Richmond Park (1898) 44 acres; Springburn Park (1892-1900) 76 acres; Maxwell Park, gifted by Sir John Maxwell (1890) 21 acres; Rouken Glen Park, gifted by Mr. A. Cameron Corbett, M. P., (1905) 136 acres; Botanic Gardens, with extensive ranges of hot-houses and green-houses (1891-1901) 50 acres. Mr. Cameron Corbett has also gifted to the citizens the mountainous estate of Ardkinglas in Argyllshire, containing upwards of 14,000 acres.

Monuments, etc.—In George Square are statues of Queen Victoria, Prince Albert, James Watt, Lord Clyde, Robert Burns, Dr. Livingstone, Sir John Moore, Mr. Gladstone, and others, and in the centre a tall fluted Doric column surmounted by a statue of Sir Walter Scott. An equestrian statue of King William III. stands near Glasgow Cross, a similar statue of the Duke of Wellington is placed in front of the Royal Exchange in Queen Street, an obelisk to Nelson and the highly ornamental Doulton fountain are conspicuous in Glasgow Green, John Knox has a tall monument in the Necropolis, and a memorial pillar is erected on the site of the battle of Langside, where Queen Mary's chance of regaining the crown was finally lost.

Buildings.—The oldest as well as the most interesting and picturesque building is the Cathedral, erected piecemeal in and between the 12th and 16th centuries, mainly in the early English style but marked by individuality. It contains nave, aisles, transepts, choir, and crypt or lower church with chapter-house and Lady-chapel. Length of building 319 feet; breadth 63 feet; height of nave 90 feet and of choir 85 feet; height of central spire from floor of nave 217 feet. Two western towers were, under what is now regarded as a grievous error of judgment, removed in 1846 and 1848, respectively. In the vicinity of the Cathedral were the residences or manses of the 32 canons, all of which buildings have now disappeared with the exception of the manse which was occupied by the prebendary of Provan. This pre-Reformation dwelling, the oldest in Glasgow, is still occupied. The Cathedral belongs to and is maintained by the Crown, but the choir is used as one of the 10 city churches belonging to the municipal corporation, and the latter keep up the fittings connected with the religious services. Several of the other churches, belonging to different denominations, are of high architectural merit. Among other conspicuous buildings are those of the University, occupying about four acres of elevated ground, overlooking Kelvingrove Park. Consisting of an oblong rectangular pile, in the Collegiate Gothic style of the 14th century, and having a tower and open-work spire about 300 feet high, the new premises were opened in 1870, replacing the old college which stood in High Street on a site obtained shortly after the foundation of the original "Pedagogy" in 1451. At a short distance, on the opposite side of the River Kelvin, is the United Free Church College, built in the Italian style, with a high tower; and still nearer to the college, within the bounds of the Park, the new Art Galleries have been erected. Saint Andrew's Halls, for concerts and other public gatherings, were erected by private enterprise but were acquired in 1890 by the corporation who are at present using the adjoining ground for the erection of a fine building for their Mitchell Library. Besides the older City Hall in Candleriggs Street, the corporation possess other halls throughout the city for the accommodation of the respective districts. The City Chambers, in the Italian Renaissance style of architecture, and occupying the whole of the east side of George Square, with a central tower 216 feet high, were erected under the authority of an act of Parliament obtained in 1878 and were formally opened by Queen Victoria in 1888 though not occupied till the following year. Cost of site, buildings, and furnishings about $2,756,000. Also abutting on George Square are the General Post-Office, the Bank of Scotland, and the Merchants' House; and a few paces off, in George Street, is the partially erected Glasgow and West of Scotland Technical College, the foundation stone of which was laid by the King in 1903. Of other buildings throughout the city may be noted the Royal Exchange, in the Corinthian style, surrounded by a circular clock tower; the Stock Exchange, in the Byzantine style, the Athenæum buildings, the Deaf and Dumb Institution, the Christian Institute, the Royal Infirmary (the reconstruction of which is proceeding), and the Western and Victoria Infirmaries, the Hotels connected with Saint Enoch's Station and Central Station, and the Hall belonging to the Faculty of Procurators.

Libraries.—The principal libraries are (1) the University Library (founded in the 15th century) 220,000 volumes; (2) public libraries administered by the corporation, comprising the Mitchell Library (largest public reference library in Scotland) 175,000 volumes, with 16 district libraries (for defraying cost of which Mr. Andrew Carnegie gifted $500,000) each 8,000 to 12,000 volumes; (3) Stirling's Library (established 1792) 25,000 volumes; (4) Baillie's Institution Library, 22,000 volumes; (5) United Free Church College Library, 25,000 volumes; (6) Libraries of Faculty of Physicians and Surgeons, Faculty of Procurators, Glasgow Athenæum, and Royal Philosophical Society. There are also numerous libraries in connection with scientific and other societies, churches, etc.

Art Galleries.—The corporation may be said to have begun its collection of works of art in 1670 when portraits of Kings Charles I. and II. were ordered from London. Portraits of other sovereigns were subsequently procured and were hung in the Council Hall; but it was not till about the year 1856, when the town council acquired the exhibition galleries and pictures which had belonged to Baillie Archibald M'Lellan, that the gallery and museum enterprise in Glasgow took definite shape. In consequence of many munificent donations and of judicious purchases, the collection became more and more valuable and rapidly increased, necessitating the finding of additional accommodation. This object was attained when the new Art Galleries in Kelvingrove Park were occupied in 1902. Cost of construction $1,279,700. Branch art galleries have also been opened at the People's Palace on Glasgow Green (cost of construction, including Winter Garden, $83,375), and at Camphill in the Queen's Park.

Churches.—Churches of the various denominations are well represented, those of the Presbyterian order preponderating, but there are numerous places of worship belonging to the Episcopal Church of Scotland and the Roman Catholics, and the following are also represented:—Episcopal Church of England, Christadelphian, Congregational Union, Baptist, Wesleyan, Children of Zion, Old Scots Independent, Primitive Methodist, Catholic Apostolic, New Jerusalem, United Original Secession, Unitarian, Church of Christ, Friends' Meeting House, German Protestant, German Evangel, etc.

Educational Institutions.—The principal educational institutions are the University already referred to, Saint Mungo's College, the Glasgow and West of Scotland Technical College (including Anderson's College Medical School and Allan Glen's School); the United Free College (for Divinity students); Queen Margaret's College for women, connected with the University; the Glasgow Athenæum, the Glasgow School of Art, the Veterinary College, the West of Scotland Agricultural College, the Training Colleges for Teachers in connection with the Church of Scotland and the United Free Church, the Glasgow Academy, and the Kelvinside Academy, the High School, and others under the School Board, wth several educational establishments conducted by private enterprise.

Charitable Institutions.—Besides the three infirmaries already mentioned, Glasgow has an Eye Infirmary, the Royal Hospital for Sick Children, the Glasgow Samaritan Hospital for Women, the Glasgow Maternity Hospital, the Royal Asylum for the Blind, the Glasgow Institution for the Deaf and Dumb, the Glasgow Royal Asylum at Gartnavel, several minor hospitals and dispensaries, nursing institutions and convalescent homes.

Public Works.—The water supply of Glasgow was originally derived from the nearest streams and wells, and when these sources became insufficient water companies were formed for bringing in supplies by gravitation works and pipes. In 1855 the corporation acquired the works of these companies, at the same time obtaining statutory authority to bring water from Loch Katrine, 34½ miles north of Glasgow. Amount of capital expenditure on water supply to 31 May 1905, $20,199,925. Consumption per head (population of supply area 1,075,000) per day, 34 gallons for domestic purposes and 22½ gallons for trade and public purposes. The gas supply, formerly in the hands of private companies, was taken over by the corporation in 1869. Capital expenditure to 31 May 1905, $18,821,705. Street lighting and the lighting of common stairs, together with street cleansing, the fire brigade, and all matters relating to public health, including the management of fever hospitals, are under the charge of the Police department. In 1890 the corporation obtained statutory authority to supply electricity, and the necessary works having been put in operation, several of the streets are now lighted by that means, and the demand by the public both for lighting supply and motive power has been large and always on the increase. The total cost of the electricity works up to 31 May 1905, was about $6,220,810; there were 11,643 private consumers and 825 public lamps. In 1900 the corporation obtained from the Postmaster-General license to construct and work a telephone exchange over the Glasgow Telephone area, covering about 1 2-3 square miles. A telephone department was forthwith organized, and the work of construction proceeded with. The operating service began in 1901 and has gradually developed, but the National Telephone Company, which was first in the field, has been a powerful competitor for public patronage. Capital expenditure to 31 May 1905, $2,010,925. The undertaking was transferred to the Postmaster-General in 1906. Markets, slaughter-houses, and foreign animals' wharves are managed by the corporation, under a series of acts of parliament, the earliest of which was passed in 1845. The corporation likewise administer the Weights and Measures Acts, and manage several model lodging-houses, baths, and wash-houses, an Inebriates' Reformatory (situated in Ayrshire) and a labor bureau. The navigation of the river Clyde was in the hands of the corporation, exclusively, till 1825, when it was vested in a body of trustees under a constitution which has since been altered from time to time. Substantial changes were made in 1905. An extensive main drainage scheme for the collection and treatment of the sewage of Glasgow and adjacent districts (drainage area about 30 square miles) has been in progress for about 15 years and is expected to be completed within the next two or three years. Estimated cost about $10,000,000.

Railways.—The principal railway systems are the Caledonian, North British, and Glasgow and South Western, all of which have large modern termini in the heart of the city. There are underground railways, a cable subway, with a circular course passing twice under the river Clyde, and having convenient stations for various parts of the city. In 1894 street tramways, formerly worked by a company, were converted by the corporation into a municipal enterprise. In 1901 the whole system was changed from horse to overhead electric traction; existing length 160 miles of single track, and extensions proceeding; total capital expenditure to May 1906, $13,816,905; revenue to 31 May 1905, $3,839,520; net profit, $591,490; passengers for a year, 195,767,519, at fares of a cent and upwards.

Industry and Commerce.—Glasgow is one of the greatest industrial centres of the kingdom, and among its older industries are those connected with cotton, linen, and wool, including spinning and weaving, bleaching, calico printing, lace making, and Turkey-red dyeing. But of late years the progress of textile manufactures has been slow compared with the rapid development of the iron and steel industries. Mechanical engineering, marine engineering, and ship-building, with their connected trades, are in extensive operation while chemical industries, the manufacture of glass and pottery and brickmaking are also actively prosecuted. Some 300,000 tons of shipping are usually built in Glasgow yearly. The commerce of the city is commensurate in extent with the importance of its manufactures. The value of foreign and colonial produce imported in 1904 amounted to $69,730,030, that of home produce exported was $101,968,090. The rental of Glasgow in 1905–6 was $28,852,850. The combined local rates, imposed on owners and occupiers together, amount to about one-third of the rental.

Banks.—All the leading banks of Scotland are represented in Glasgow by numerous branches, and the Union Bank of Scotland and the Clydesdale Bank have their head offices here; as also have the Scottish Amicable, the City of Glasgow, and other Insurance Companies.

Government.—Municipal affairs are administered by a Town Council whose statutory designation is "the corporation," consisting of 78 members elected by the voters in 26 wards (numbering *in cumulo* 165,766), with the Dean of Guild (elected by the Merchants' House) and the Deacon-convener of the Trades (elected by the Trades' House) as *ex officio* members. The Lord Provost, 14 bailies, a River bailie, and deputy River bailie, a treasurer (honorary) and a master of works (honorary) are chosen by the councillors from their own number.

History.—The origin of Glasgow and its earliest community is beyond the reach of history. Joceline, the 12th century biographer of Kentigern, the patron saint of Glasgow, speaks of wandering through the streets and lanes of the city, and in the course of his narrative relates how its cemetery had been consecrated by Saint Ninian, the 5th century evangelist. More solid ground is touched in a legal document, which must have been compiled before the year 1124, setting forth the result of an inquiry made by King David, then Prince of Cumbria, into the possessions of the see of Glasgow, and from that time onwards a fairly continuous outline of the city's history is obtainable. The bishops and archbishops possessed a large territory, called in later times the Regality of Glasgow, of which Glasgow was the judicial centre. In 1175–8 King William the Lion authorized the bishops to have at Glasgow a burgh, with a weekly market and all the privileges of a royal burgh. Twelve years afterwards the same King granted right to the burgesses to hold a yearly fair in July, a privilege which still survives in Glasgow's annual holiday. The market cross of the new burgh occupied the spot where High Street and Saltmarket intersect Trongate and Gallowgate. A chapel dedicated to the Virgin Mary adjoined the market cross, and half a mile farther west, a few paces from the present Saint Enoch's station, another chapel was dedicated to Saint Tenew the mother of Saint Kentigern. Saint Enoch is merely a corruption of St. Tenew which local pronunciation reduced to the form of Sanct-enew (or -enoch). Another chapel dedicated to Saint Thomas the Martyr, was situated in the same locality. On the higher ground, adjoining the site chosen for the Cathedral, a British fort or rath probably existed in ancient times, giving name to Rattounraw, one of the most ancient of the existing thoroughfares; and, if so, the rath may be identified with the large earthen mound called "the know of grummell," removed in 1509 to fill up hollows about the town. The rath, or what else served as a stronghold, was in or before the 13th century, superseded by the Bishops' Castle, a structure which was not wholly removed till its site was required for the erection of the Royal Infirmary in 1792–4. The Cathedral canons and Church dependents dwelt in the vicinity of the Cathedral, while the industrial and trading community occupied the ground near the river, over which there was a primitive bridge at least as early as the year 1285. On the intervening space, somewhat precipitous, the Black Friars planted a convent and church in or before 1246. Between the years 1473 and 1479 the Greyfriars likewise settled in Glasgow, a little farther west, the site chosen by them being on the opposite side of the thoroughfare now called High Street. A church or chapel in the Gallowgate, dedicated to Saint Kentigern, was founded in 1500; about the same time another chapel was dedicated to Saint Roche on a site which is commemorated in the place name now transformed into Saint Rollox; and the collegiate church of Saint Mary and Saint Ann was founded on the site of the present Tron Church about the year 1525. Of the four pre-Reformation "hospitals," and their relative chapels, viz., the Hospital of Saint John of Polmadie, founded in or before the 13th century, the Leper Hospital, of an early but also uncertain date, Saint Nicholas Hospital, founded by Bishop Muirhead (1455-73), and Stablegreen Hospital, founded by Roland Blacader, subdean (1503-41); only some fragmentary endowments of Saint Nicholas Hospital survive, yielding small pensions to a few aged people. Glasgow was much pervaded by the ecclesiastical element. but this was to some extent advantageous as many of the church dignitaries were in favor at court, taking a prominent part in state affairs, and exerting their influence for the good of the citizens. At first the Reformation changes produced disorganization and loss of trade. An attempt to arrest decay in the district deserted by the clergy, by the transfer of some of the markets to that locality, proved unsuccessful, on account of difficulty of access. The earlier charters of Glasgow were granted to the Bishops who had the right to elect the provost and bailies. In 1611 King James VI. granted a charter to the community direct, and subsequent charters kept to that form, but it was not till 1690, after the abolition of Episcopacy, that the Town Council were allowed to elect their chief magistrates. Many of the inhabitants of Glasgow were opposed to the Union but the municipal authorities, both at that time and during the risings of 1715 and 1745, remained loyal to the government. Following the suppression of the latter rebellion, heritable jurisdictions were abolished and the regality courts were superseded by those of the sheriff, but the city retained its position as the judicial centre of the district. Shortly after this time the deepening operations on the river Clyde, to which reference has already been made, were commenced, and the city entered more fully upon that career of successful commercial prosperity which it has since continuously maintained.

Population.—The population of Glasgow has increased as follows: (1560) 4,500; (1600) 7,000; (1708) 12,766; (1763) 28,300; (1791) 66,578; (1803) 81,484; (1811), 100,749; (1841) 255,650; (1881) 511,415; (1891) 565,714; (1901) 761,709; (1907) estimated, 799,412. Number of occupied dwelling houses 165,766. Partick, Govan, and Pollokshaws, three suburban burghs, outside the municipality but connected with Glasgow by continuous lines of streets, had in 1901 a *cumulo* population of 141,762.

Bibliography.—Several histories of Glasgow have been published, those of John M'Ure, printed by James Duncan who introduced typemaking to Glasgow, in 1718 (1736); John Gibson (1777); Andrew Brown (1795); James Denholm (1797); and Dr. James Cleland (1816), being the earliest. Original research is well represented in the publications of the Maitland Club and the Scottish Burgh Records' Society, and the materials thus accumulated have been utilized in various works, such as Macgeorge's 'Old Glasgow' (1880); M'Gregor's 'History of Glasgow' (1881); and Marwick's 'Historical Introduction to Glasgow Charters' (1897). For less elaborate information, see the hand-books published in connection with the meetings of the British Association held in the city in 1901.

Robert Renwick,
Deputy Town Clerk, Glasgow.

Glasgow, The University of, a corporate body founded by a bull of Pope Nicholas V., dated 7 Jan. 1450-1, as a "*studium generale tam in theologia et in jure canonum et civili quam in artibus et in quacunque licita facultate,*" with the power of creating masters and doctors, who, together with the readers and students, were to enjoy the same privileges and immunities with the University of Bologna. A body of statutes was prepared, and the university established by the bishop and chapter in the same year. The university appears at first to have had neither property nor endowment. A purse was formed of the perquisites procured from matriculations, examinations, degrees, etc., and some of the earlier members bequeathed the patronage of a few small chaplaincies; but through the zeal of its founders and the civil and ecclesiastical immunities accorded to it, the new school of learning prospered, though in circumstances so little in accordance with modern notions of educational requirements. The clergy were induced to attend by offers of exemption from taxation and residence. The lectures in theology and in canon and civil law were read at the convent of the Dominicans; but the students of arts soon became so numerous that a house was provided for their residence called the pædagogium, and regular teachers were appointed.

In 1460 James, Lord Hamilton, bequeathed to Duncan Bunch, regent of the College of Arts, and his successors, a tenement in High Street, with four acres of land adjoining, for the use of said college. On this ground the classes of the university continued to meet for 410 years. In 1577 James VI. prescribed rules for the government of the university, and made a considerable addition to its funds. This new charter is called the Nova Erectio. It provided for a principal to teach theology and Holy Scriptures, who was also professor of Hebrew and Syriac; and three regents, of whom one taught Greek and rhetoric; another dialectics, morals and politics, with arithmetic and geometry; the third, physiology, geography, chronology, and astrology. Between this period and the Restoration the university continued to flourish, and the number of its professors increased; but at the Restoration the re-establishment of the Episcopacy deprived it of a great part of its revenues, and three of its chairs fell into abeyance. After the Revolution it continued gradually to expand the scope of its teaching, and has numbered among its professors and graduates many distinguished men. In the end of the 18th century it obtained by bequest the valuable anatomical museum, library, and other collections of the famous Dr. William Hunter. Later the old buildings became quite inadequate, and were sold. A grant for new buildings was procured from the government, a small sum was available from college funds, and public subscriptions were procured. In 1870 new buildings at Gilmorehill, which cost over $2,000,000, were erected.

The University of Glasgow comprises five faculties, namely, arts, science, medicine, law, recently added. The oldest chairs are those of moral philosophy (1577), natural philosophy (1577), logic and rhetoric (1577), Greek (1581), divinity (1630), Latin (previous to 1637), mathematics (revived 1601). In the first 20 years of the 18th century six professorships were either originally founded or revived, namely, Latin, Oriental languages, civil law, medicine, church history, anatomy; astronomy was added in 1760. The remaining 18 professorships were founded in the 19th century. The university was reconstituted by the Scottish University Act, 1858, and a similar revolution was effected under the act of 1889.

The students number about 2,000. There are numerous bursaries connected with the university, the annual total value of which is about $40,000. There are also medals and prizes given in connection with the various classes, and scholarships or exhibitions are awarded to students who prove successful in certain examinations. The Snell exhibitions, established in 1677, send 10 (or fewer) Glasgow students to Oxford. They are tenable for five years, and each exhibition yields $400 per annum. The two Eglinton fellowships, founded in 1862, tenable for three years, and each worth $500 annually, are awarded by competition to students who have just graduated in arts. Three Ewing fellowships, of the value of $400 per annum, and tenable for not more than five years, are also awarded by competition among graduates in arts. The Luke fellowship, about $400 per annum, tenable for three years, is awarded to graduates for excellence in English literature and history. The George A. Clark scholarships, four in number, are tenable for four years, their annual value being about $900. The examinations are respectively in classical literature, mental philosophy, mathematics, and natural science. The Metcalfe fellowship, founded 1870, annual value $500, tenable for three years, is designed to encourage studies in higher mathematics, practical astronomy, civil engineering, and chemistry. There is also the Black theological fellowship, worth $700 annually.

Glass, a hard, brittle, transparent substance, formed by fusing together mixtures of the silicates of potash, soda, lime, magnesia, alumina, and lead in various proportions, according to the quality or kind of glass required.

Flint glass is used in making table-ware and many articles of domestic furniture and fittings. The molten glass is taken from the pot by a ponty, and is blown or pressed into shape, or, by a combination of operations, is held in a mold while being blown.

Crown glass is taken by the ponty from the pot, and is then blown and whirled until it becomes globular. A ponty tipped with molten glass is applied to the bulb, the blowing tube is detached, leaving a hole. The globe being again whirled, the glass flashes into a circular disk, adhering by a boss in its centre to the ponty. Crown and flint glass are combined in the manufacture of achromatic lenses.

Sheet glass is glass withdrawn by the ponty from the pot and blown and whirled till it assumes a cylindrical form. The ends beings cut off, and the cylinder slit longitudinally, the sheet is heated, pressed, and rubbed until it is flattened out. This is also called cylinder glass or broad glass.

Plate glass is made by pouring it upon a table which has a marginal edge of a height equal to that designed for the thickness of the glass. A roller travels over the table, on the ledges and flattening out the glass, which is thus made of equal thickness throughout.

Toughened glass is made by heating till it is about to soften, and then plunging it into a bath of oil at a greatly lower temperature. Usually a mixture chiefly of oily substances, such as oils, tallow, wax, resin, and the like, is put in the bath; and some manufacturers who worked the process, for a time dropped the newly made glass vessels, while still hot, into the oleaginous mixture, by which plan neither reheating nor annealing by the ordinary process is required. After the articles acquire the temperature of the bath, they are removed.

Painted or *stained glass* is of two styles, enamel and mosaic glass. In enamel glass proper, certain fusible pigments are painted on a sheet of white glass, which is then fired and the result is a picture the tints of which even in the high lights are not wholly transparent. A modification of this method produces its picture partly by enameling on white glass, partly by the use of pot-metal glass the color of which is heightened or modified by the use of enamels.

Of the origin of glass manufacture we cannot speak with certainty. Pliny states that the ancient Phœnicians discovered by a happy accident how to make it. He relates that certain Phœnician merchants preparing a meal upon the seashore set their cooking vessel on a mass of natron (sub-carbonate of soda) and the union of the sand and alkali, when subjected to the fire, resulted in vitrification that drew the men's attention and led to subsequent efforts at imitation. According to Egyptologists the Egyptians made sham jewels of glass at least 5000 or 6000 B.C. In some of the most ancient tombs scarabs of glass have been found imitating rubies, emeralds, sapphires, and other precious stones, and the glass beads found broadcast in three parts of the globe were quite possibly passed off by traders on confiding barbarians as jewels of great price. As a medium of trade, beads are evidently of great antiquity. Those known as aggry have been attributed to both Egyptian and Phœnician sources. The beads vary greatly in color and pattern and some of them show fine workmanship and marked beauty. During the period when Egypt was part of the Roman empire much glass was produced in the Nile valley.

It is probable that the great centre of glass industry of mediæval and more recent times, Venice, received its early impulse and lessons from Constantinople. The art began there with the beginning of the city in the 7th century A.D. and there was a marked improvement after the conquest of Constantinople in 1204, and in 1291 the establishments were removed to the island of Murano, the manufacturers forming a guild with a register of nobility, and guarding their secret with the greatest jealousy. In 1436 their color glass came into note, and continued so till the close of the century; and in the 16th century lace patterns and mirrors were introduced. In the 15th and 16th centuries plain glass with tasteful ornaments in gilt and enamel; in the 16th, cracked lace and reticulated glass, and in the 17th century variegated or marbled glasses were produced.

The Venetian glass enjoyed for a long time the monopoly of commerce, and within recent years there has been a marked revival of the skill and enterprise of Venetian craftsmen. In Germany the oldest glass dates from the 16th century, and consists of goblets and tankards of white color, enameled with colored coats of arms and other devices, millefiori, and schmeltz glass. Engraved glass was first introduced by Casper Lehman at Prague in 1609 under imperial protection, and continued by his pupil Schwanhard; and ruby glass by Kunckel in 1679. In 1665 20 Venetian glass workers were brought by Colbert to Paris, where they set up the blowing of glass and the silvering of mirrors, the famous mirror hall in Versailles having been furnished by them. In 1688 an exclusive privilege of making large plates of glass by casting was conferred on Abraham Thevart. The name Thevart was assumed by a syndicate of capitalists formed to develop and work the invention of Louis Lucas de Nehon, who was the real inventor of plate glass and the founder of the Gobain works, one of the most extensive plate glass works in the world. In France oxide of lead flint glass was made at St. Cloud in 1784; another manufactory was subsequently established at St. Louis in 1790; and the St. Cloud establishment was removed to the vicinity of Mont Cenis, where it flourished till 1827.

It is uncertain whether glass was made in England before the 16th century, as that mentioned may have been imported from Flanders or Venice. In 644 Benedict Biscop introduced makers of glass windows into Northumbria; but window glass was not in general use for windows till the 15th century. Pressed glass was invented in the United States. See Glass Blowing; Glass, Cut; Glass Manufactures in America; Glass Staining.

George W. Hastings.

Glass Blowing, a mode of manufacturing various articles by taking a mass of viscid glass from the melting pot on the end of the blowing tube, and then inflating the mass by blowing through the tube, rolling on the marver, and exposing it at the furnace opening where its contained air is expanded and itself enlarged.

Although the forms into which blown glass is worked up are endless, the general methods of manufacture are the same, and a description of first-class lamp chimney works is illustrative of the blown glass industry in general. Perhaps the most important feature in the manufacture of lamp chimneys, or indeed of any form of glass-ware, is the mixing of the ingredients. As in the case of plate glass, the body of the mixture consists of a sand which is as nearly pure silica as can be obtained. The sand is quarried from silica rock, then thoroughly ground and sifted through a 40-mesh screen, the material being received at the works in the prepared condition. The second most important ingredient is litharge; while potash and soda are used as fluxes. When the above mixture is used for the best quality of lamp chimneys, about 50 per cent of the total is silica. The sand is melted in what is known as the furnace, the first and greatest of the glass blower's implements; it consists of two large domes set one above the other; the lower one stands over a large perforated grating (level with the ground), and is fired by gas, a large arch beneath conveying air to the furnace. In the sides of the lower dome as many recesses or mouths are made as there are workmen to make use of the furnace, and before each mouth a pot of glass mixture is placed; the pots are very large, like crucibles, and are molded from a specially prepared and very carefully kneaded pot clay; they stand 50 inches high and are generally 44 inches in their largest diameter, and will hold from three to four hundredweight of liquid glass; they are supported upon three small piers of brickwork resting on the floor of the furnace. The form of the furnace reverberates the flame from the roof down upon the pots, and they are placed at some distance within the furnace so that the flame may get between the wall and the pots. It takes about 24 hours to melt the contents of a pot.

The upper dome is used for annealing the glass, and is exactly similar to a large oven; it has three mouths, and a small flight of steps leads up to each. It is built upon the lower dome, its floor being made flat by filling up round the roof of the lower dome with brickwork; a small chimney opens from the top of the lower dome into the middle of the floor of the upper one, which conveys the fumes and smoke from it, and a flue from the upper dome leads it completely from the furnace.

The blowing is done with a long iron tube known as the blowpipe, which has a mouthpiece at one end, and is swelled out and thickened into a bell-mouth form at the lower end. In the process of blowing, the operator dips the thickened end into the melting pot and twists it around till he has gathered up a ball of molten glass of the desired size. The blowpipe is then withdrawn from the furnace and the ball of glass is rolled out to a conical shape on a plate and slightly inflated by blowing through the tube. The blowpipe is then handed to the second operator, who completes the operation of blowing. The bubble, if we may so call it, of glass is thicker and heavier at its lower end, and to secure the elongated form necessary in lamp chimneys the operator swings the blowpipe to and fro, thus causing the bubble to stretch by its own weight. By thus alternately swinging and blowing he brings the bubble to the required length, and approximately to the required diameter, and then places it within a hinged mold, which is opened to receive it, either by himself or one of his assistants. He then twists the pipe and blows at the same time, thus pressing the glass against the inner walls of the mold. The tube with the molded chimney attached is then withdrawn from the mold, and handed to another operator, who, with a pair of spring tongs, forms the flaring top of the lamp chimney and marks a sharp depression just outside its base, where it is to be broken away from the blowpipe. Although a large amount of blowing is done by hand and mouth, increasing use is being made of what is known as the Owens blowing machine, which substitutes mechanical for hand power. See Glass; Glass Manufactures in America.

Glass Crab, an immature condition of certain crabs (*Palinurus* and its allies) which for a time are flattened and perfectly transparent, as if formed of a sheet of glass, and have no resemblance to the parent form.

Glass, Cut or Incised. Glass is a singularly versatile material, at once refractory and yielding, yet lending itself to use in thousands of ways. It is as a means of artistic expression that it is chiefly interesting, for its utility is beyond all question. The iridescent chatoyant colors of antique glass — Nature's destructive action — do not distract us from the charm of perfect form. Venetian glass, the beautiful product of the lagoon-island of Murano, is so very impracticably fragile that even its possession is a care. Probably glass would have remained in a rather humble position if it had not been that a Bohemian glass-worker more than 200 years ago conceived the idea of a new invention, which was destined to change the glass product of the world. He thought of making the heavy "flint" or "lead" glass larger as regards the dimensions of the walls of the article, in order that he might have more stock to work on, so that he could deeply incise or cut the glass to form patterns, the sides of the rough cut being in turn polished to give the effect of a many-faceted jewel. The success of the new *objet d'art* was not immediate, and it was only when the crude designs and imperfect workmanship of the earlier cutters gave way to the labors of highly skilled artisans directed by talented designers that cut glass, or "art glass," as we might term it, took the place to which its great beauty entitles it. It is to America that we must look for the perfection and the superiority of design and skilful workmanship of this branch of the industry. There is no such thing as absolute interchangeability in the glass-cutting establishment, and the artistic bent of the various cutters is encouraged.

The peculiar product known as glass has as a base silica, which is fused with alkalies and metallic oxides to form a hard transparent substance. It can be wrought in various ways, and is susceptible of a high, and, when properly cut, a lasting finish. The raw materials consist of a sand, so called, of exceptional quality as regards sharpness and color. It is not a sand in the ordinary sense of the word, but is a quarried rock which has been crushed. This accounts for the uniformity of its color, which is so necessary in producing a steely-blue white glass, which is to be used for giving the prismatic colors caused by the cutting process. The red lead, saltpeter, and sodium carbonate are accurately mixed with the sand, and a small percentage of white arsenic or manganese is added to bleach or clarify it. The proportion is varied according to the nature of the finished product. A glass furnace is a large round or oval fire-brick oven, capable of holding an aggregation of melting pots, which rest under a floor in common under a dome called a crown. These pots are made of unbaked fire-clay. A mouth gives entrance for the raw material and the workmen's blowpipes, to which the molten glass adheres. A furnace may contain as many as sixteen pots arranged radially on the floor of the furnace. They are heated before setting, and are subsequently filled with about 1,600 pounds of raw material, which soon melts at a temperature of 2,500° F., caused by the intense flame of gas and air, which is deflected from the dome downward, the products of combustion passing out through a stack.

The glass gatherer receives his order for a specified size and shape for his article; and after obtaining a sample to guide his memory, takes his iron blowing-tube, and collecting sufficient of the molten glass from the pot in the furnace, rolls it to and fro on a metal plate to produce a uniformity of distribution of the mass, which is then reheated in a furnace called a "glory-hole." He then turns it over to a glass blower, who takes the pipe and blows the article to approximately its final shape. It is then reheated and given definite form and finish by the most expert workman of all three. The tender glass must now be annealed or tempered to equalize the strains, otherwise the piece would break. It is then placed in kilns or tempering ovens, where it is first reheated and then gradually cooled.

The heavy uncut articles are then ready for the cutting operation, by which they lose considerable weight. In some cases the loss is one third. The cutting operation really consists of three stages. The article is first roughed with sand and a steel grinding wheel. It is then smoothed by a stone cutting wheel, and is lastly finished by a wooden polishing wheel. A workman holds the article against the conical edge of a steel wheel secured to a shaft driven by belts and pulleys. Fine sharp clean sand and water are allowed to drip on the wheel from a cone-shaped bucket. The article is pressed against the rapidly rotating wheel, and is deeply scored or cut. The heaviest and principal lines in the pattern are roughed-in by these steel wheels and the sand. In order that all articles may stand level, the bottoms are ground on a horizontal grinding wheel, sand and water still being used. The rough article is now ready for the wet smoothing stones, which resemble steel wheels both as to size and edge, but no sand is used; these wheels follow the cuts that the steel wheels have made, and also cut in the finer lines of the pattern. The practically finished piece is now ready for the polisher, whose rouge-charged wheels are of wood, their size and edge being the same as those of the steel and stone wheels, and therefore adapted to follow every line with almost mathematical accuracy, which completes the process. While cut glass is made abroad, the examples lack shape and depth and uniformity of cut. For this reason the foreign trade in American cut glass is increasing every year.

Glass, Malleable. American glassmakers, since the beginning of the industry, have aimed to produce a glass that would have all the clearness and beauty of ordinary glass, and at the same time possess a toughness which would render it as little liable to fracture as many of the other manufactured articles of use and beauty. It is well known that the ancients discovered and made use of a process of manufacturing malleable glass; and in the glass-making world it has naturally been expected that it would be in the Old World that the process would sooner or later be reinvented. Louis Kauffeld, of Matthews, Ind., succeeded in 1903, after many years of endeavor, in producing a glass which will withstand extremely rough usage without breaking. The secret lies principally in the chemicals which are used and the proportion of ingredients which form the compound, although the furnaces and crucibles play an important part in the process.

The two chief things to be avoided in connection with the crucible are intense and prolonged heat from without and the corrosion of the raw materials within — two dangers of which nearly every glass-maker knows the ruinous effect. The effect of corrosion is readily proved by heating for a long time in a small crucible such substances as borax, red lead, or potassic or sodic carbonate. After a crucible has been in constant use for several months, and especially if it has contained flint or lead glass, the back and body will be found to be covered with innumerable small dents, which have undoubtedly been formed by corrosion.

The complaint so commonly heard of specky glass arises from the presence in the glass of white particles of an infusible aluminate formed by the combination of the alkaline or metallic ingredients of the glass with the alumina of the crucible. If the corrosion becomes concentrated at one point and prolonged for a considerable period a breach is formed, through which the molten glass escapes into the furnace. Knowing the dangers that have to be encountered in this way. Mr. Kauffeld is extremely careful in the selection and preparation of the clay as well as in the construction of the crucibles. The finely sifted raw clay, on its arrival at his manufactory, is mixed with a proportion of burnt clay considerably coarser in grain, varying in amount from one ninth to one fifth of its weight. The coarser particles tend to bind the clay and render the finished crucible less liable to crack from variation of temperature. Various tests have been made of Kauffeld's methods. For instance, a chimney was placed in a pail of ice-water, and after having remained a sufficient length of time to become as cold as the water, was taken out and immediately placed on a lamp with the blaze turned as high as possible. The blaze on the wick was turned so as to flow directly on the chimney, and the smoke which collected on the chimney ran down with the water without injuring the chimney. Next a chimney was placed over a small gas stove containing clay bricks used in heating such stoves. The fire was turned on full, the chimney remaining on the bricks. The fire finally brought the temperature to such a stage that one side of the chimney was drawn in and dropped down, and no crack was shown in the glass; but for a slight roughness on the outside, the glass was as clear as when placed in the fire.

Another test which was made was to place cold water in the chimney and hold the same over a fire until the water boiled. A large bulb was blown from the glass and filled with about one pint of water. It was then placed over the fire and allowed to remain there until it had boiled dry without apparent effect on the glass. Four chimneys were taken from the packing room and dropped one by one into a pail of boiling water. The chimneys were then hastily shifted into a pail of cold water that had just been drawn from a well, and the glass was not broken.

Glass Manufactures in America, a great industry that began in America near Jamestown, Va., in 1608. The hope of sudden wealth from the discovery of gold and silver was doubtless the chief cause for the formation of the London Company and its first attempt to colonize Virginia. It was, however, a commercial venture with the hope of profit; and this company did not forget the possibilities that were near at hand in its search for what it believed would be greater ones in the near future. The vessel which carried Capt. Newport on his second voyage in 1608 brought out also eight Poles and Germans to make pitch, tar, glass, mills, and soap-ashes, and the first exports of manufacures from what is now the United States were the results of the trials made at the first furnace erected in this country. It is said the works were destroyed at the massacre in 1622.

In 1795, the time from which this sketch is to be made, there is no record of any glass-works in Virginia. In the census of 1810 Virginia does not appear as a glass-making State. In the census of 1820 a glass-works is reported in Brooke County. It made that year $20,000 worth of glass; had $12,000 capital; paid out $8,000 for wages and $12,000 for materials and contingent expenses, or exactly the value of the product. It employed 14 men and 12 boys in 1827. It is reported that glass decanters of great beauty were made at these works, and white-flint and green-glass wares were made that rivaled the foreign. At the Tariff Convention in 1831 there were two flint-furnaces, with 12 pots, reported in operation in Wellsburg, and one, with 6 pots, at Wheeling, Va. Two window-glass furnaces were also reported at Wheeling. In 1840 one glass-works is reported in Brooke County (the Wellsburg), and three in Ohio County (the Wheeling).

The first mention of a glass-works in Pennsylvania is found in a letter written by William Penn, in August 1683, to the Free Society of Traders. In this letter he alludes to their tannery, saw-mill, and glass-works. Where these works were located, or what kinds of glass they made, is not known. In 1795 there was doubtless some glass made in Pennsylvania. A glass-house was sold on 6 March 1800, to Joseph Roberts, Jr., James Rutlans, and James Rowland, for $2,333, and was again sold in 1833 to Dr. T. W. Dyott. In eastern Pennsylvania, prior to 1831, a number of attempts seem to have been made with but little success, and the works carried on by Dr. Dyott were evidently looked upon as being of national importance. It is stated that President Jackson visited this establishment, which in 1833 consumed 15,000 barrels of rosin for fuel. From 250 to 300 men and boys were constantly employed; five furnaces were operated, which used both wood, coal, and rosin, melted 8,000 pounds of batch a day, and produced about 1,200 tons of glass a year, which was blown into apothecaries' vials, bottles, and shop-furniture. Dr. Dyott failed in 1838, and the works passed into other hands, and at this time are operated in the manufacture of green glass, and have quite a reputation for the making of demijohns.

Of early glass making in western Pennsylvania full accounts are given. It is claimed that Albert Gallatin commenced the first glass-works there at his settlement of New Geneva, 90 miles south of Pittsburg, on the Monongahela River. It seems to be generally accepted that the works were started in 1797, and were used for the manufacture of window-glass. The furnace was a small one, with 8 pots, using wood as fuel and ashes for alkali. The glass-house was 40 by 40; three sides frame and one side stone. One man could lift the pots, while now it would require four men to lift the pots used in window-glass works. The title of the firm was Gallatin & Company, but was afterward changed to the New Geneva Glass Works. It is said that for a time this enterprise was exceeding profitable, there being but two or possibly three other window-glass works in the country, most of the glass for that purpose being brought from England. The glass was sold at $14 per box of 100 feet, but was doubtless of inferior quality. A works at New Geneva was reported as late as 1832.

In 1796 Isaac Craig and James O'Hara erected the first glass-house in Pittsburg. It is claimed that these were the first works west of the mountains to make glass, and they are said to have started a month before those of Gallatin. These were the first works to use coal as a fuel, and were located at the south side of the Monongahela River, just above where it unites with the Allegheny to form the Ohio. The site, or part of it, has been continuously occupied as a glass-works. The use of coal was an innovation, and even as late as 1810 this fuel was not used in any of the glass-works in the United States other than those in Pittsburg. O'Hara and Craig were the pioneers in its use, and to them should be given the credit. As was the custom in window-glass factories in those days, one or more of the pots were used for the making of bottles, and among O'Hara's papers, found after his death, was a memorandum in his handwriting, stating: "To-day we made the first bottle, at a cost of $30,000."

As in all new enterprises, and particularly the making of glass, it is only men of perseverance and determination who succeed; and had not Craig and O'Hara been men of that character the venture would have fallen the first year. As a rule, the men who are secured from old-established glass factories are really not the best men; and not only did the early manufacturers suffer from a lack of experience, but also from the fact that their employees were not always capable of doing the work they were engaged to do. And it may be said that at the present time no new works, established in a location in which glass has not been made, can make a profit of any moment the first two or three years; and the first year must invariably be counted as a losing one. Craig wrote to Samuel Hodgson, of Philadelphia, 5 Aug. 1803:

> With respect to our glass manufacturing, the establishment has been attended with greater expense than we had estimated. This has been occasioned partly by very extensive buildings necessarily erected to accommodate a number of people employed in the manufacture, together with their families, and partly by the ignorance of some people in whose skill of that business we reposed too much confidence. Scarcity of some of the materials at the commencement of the manufacturing was also attended with considerable expense. We have, however, by perseverance and attention, brought the manufacture to comparative perfection. During the last blast, which commenced at the beginning of January, and continued six months, we made on an average 30 boxes a week of excellent window-glass, besides bottles and other hollow ware to the amount of one third the value of the window-glass, 8 by 10 selling at $13.50, 10 by 12 at $15, and other sizes in proportion.

In the fall of 1807, George Robinson, a carpenter, and Edward Ensell, an English glass worker, commenced the erection of a flint-glass works in Pittsburg, on the banks of the Monongahela. They appear, however, to have lacked capital, and were unable to finish the establishment, which, without being completed, was offered for sale. In August 1808 Thomas Bakewell and his friend, Robert Page, were induced to purchase this plant, on the representation of Ensell that he thoroughly understood the business. This was the beginning of the firm of Bakewell & Page, which by itself and successors continued in the manufacture of flint-glass until some time after the census of 1880. Bakewell experienced the trouble usual in a new business. His furnace was badly constructed; his workmen were not highly skilled, and would not permit the introduction of apprentices; and his materials were received from a distance at a time when transportation was difficult and expensive, pearl-ash and red lead coming over the mountains in wagons from Philadelphia, and pot-clay from Burlington, N. J. The sand was obtained near Pittsburg, but was yellowish, and up to that time had only been used for window-glass and bottles. The saltpetre came from the caves of Kentucky until 1825, when the supply was brought from Calcutta. These difficulties in time were overcome; good clay was procured from Holland, and purer materials were discovered, and Bakewell rebuilt his furnace on a better plan, competent workmen being either instructed or brought over from Europe. Through his energy and perseverance the works became eminently successful, and there is no doubt that Bakewell is entitled to the honor of erecting and operating the first flint-glass works in this country. The furnace built or completed in 1808 held six 20-inch pots; this was replaced in 1810 by a 10-pot furnace, and in 1814 another furnace of the same capacity was added to the works. The establishment was burned down in the great fire of 1845, but was immediately rebuilt.

Massachusetts has played a very important part in the production of glass, which was manufactured as early as 1639 at Salem. But, from all the records that exist, the history previous to the Revolution was one of failure. Shortly after the Revolution, Boston recommenced the manufacture of glass, which for many years had been one of the leading industries. The new enterprise, the Boston Crown-Glass Company, which was really the first successful glass-works in this country, was greatly helped by the liberal action of the State. In July 1787 Messrs. Whalley, Hunnewell, and others received from the legislature a charter conferring upon them the exclusive right to manufacture glass in Massachusetts for 15 years, and imposing a fine of $500 upon anyone infringing on this right. The capital stock was exempted from all taxes, and the workmen from all military duty. To counteract the effect of the bounty paid by England on the exportation of glass from the kingdom, a bounty was paid for every table of glass made. Owing to the many difficulties incident to the starting of a new industry, the operation of making glass did not commence until 1792. The company commenced with the manufacture of crown window-glass, and in 1798 produced glass to the value of $82,000 per annum. This concern was incorporated in 1809, and under the influence of the State bounty the proprietors were encouraged to continue their efforts, and became very successful. The glass was said to be superior to the imported, and well known throughout the United States as "Boston window-glass." These works were continued until 1826, when the company failed, from bad management. This early establishment led to the commencement of many others, but none of them could be considered successful. Many attempts have since been made in Massachusetts to establish the manufacture of window-glass. In 1860 a large establishment was erected for the manufacture of sheet window-glass, but its operation proved unprofitable, and at this time there is only one window-glass works in the State, located in Berkshire County.

The manufacture of flint-glass grew out of the Essex Street works. Thomas Caines, an employee there, was also a skilful blower and

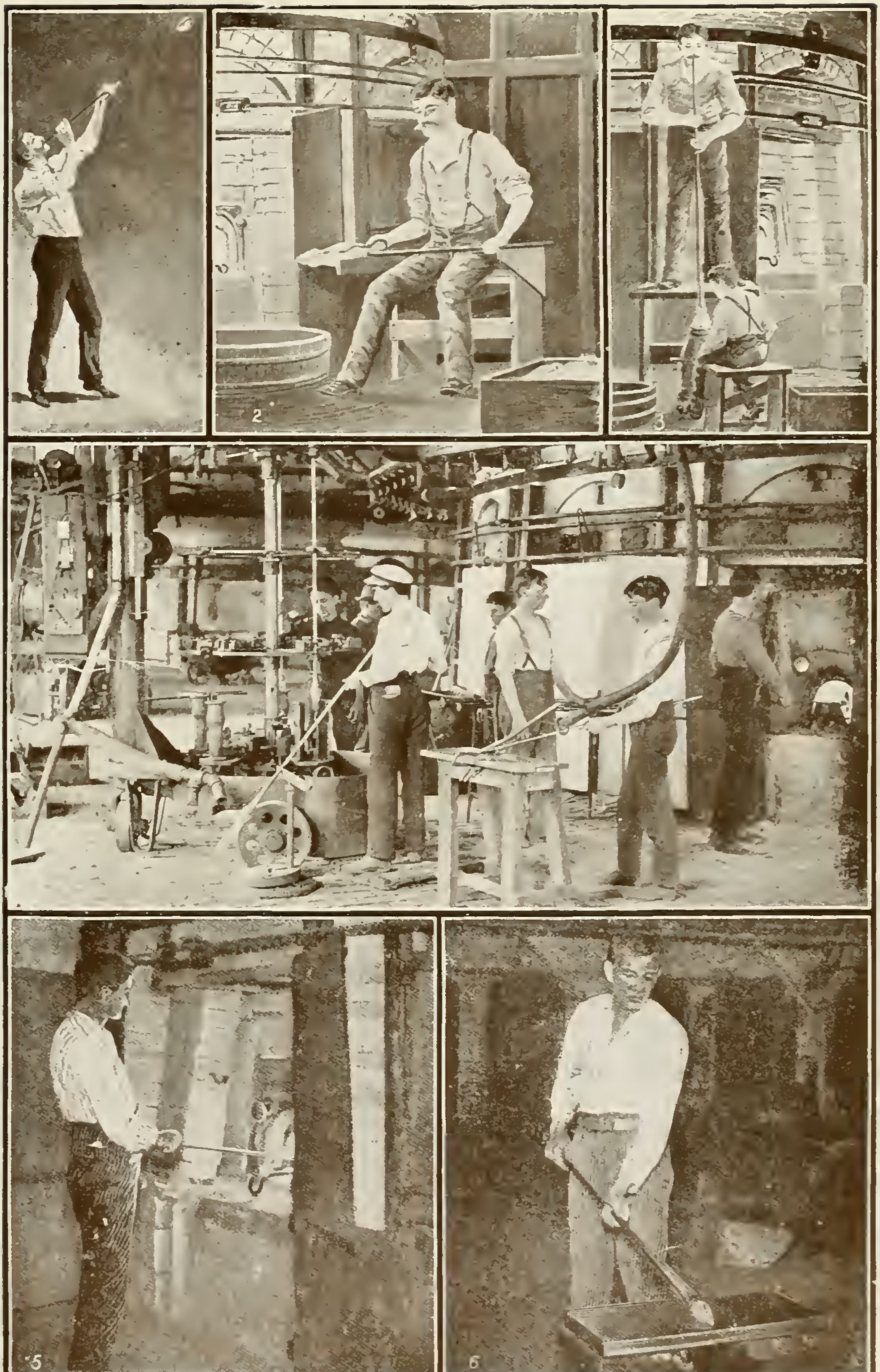

Fig. [1] Blowing. [2] Forming the Ends of the Chimney. Forming the Chimney in the Mold. [4] The Melting Furnace and Blowing Machine. [5] Gathering Molten Glass on the Blowpipe. [6] Rolling the Glass to Conical Form before Blowing.

THE MANUFACTURE OF BLOWN GLASS—LAMP CHIMNEYS.

metal mixer. He prevailed upon the management to allow him to build a small 6-pot furnace in a part of their works at South Boston. This furnace was fully employed during the War of 1812, and was the beginning of the flint-glass industry in Massachusetts; but it was compelled to cease work, and although several attempts were made to operate it between 1820 and 1840, they all failed. About the time this furnace was started, the Porcelain and Glass Manufacturing Company built a factory at East Cambridge. The furnace was a small one, containing 6 pots. Workmen were brought from abroad, but it proved a failure. The plant in 1815 was leased to a firm of workmen, Emmet, Fisher & Flowers; but they failed to agree, and in 1817 the Porcelain Company sold the property at auction to the New England Glass Company. This was the beginning of one of the most successful glass companies in this country. The works, when they commenced, had a small 6-pot furnace, the pots holding about 600 pounds; 40 hands were employed, and they produced glass to the value of $40,000. It was really the foundation of the flint-glass industry in the United States. The management was broad and liberal from the beginning; for 50 years they led in the production of flint and colored glass of all varieties. Workmen were brought from abroad, and every means employed that capital and skill could compass to produce results equal to anything in the world. In 1865, which was probably the highest point reached in their history, they operated 5 furnaces of 10 pots each, each pot holding 2,000 pounds; 500 hands were employed, and glass to the value of $500,000 was produced yearly. The influence of the New England Glass Works has been felt all over the land, as many of their employees and managers have been the means of establishing the industry in other parts of the country. Fine blown, cut, and pressed glass were made in great variety. The works are not now in existence.

When the western manufacturer commenced to make lime-glass with bicarbonate of soda and lime, in place of lead and pearl-ash, the thought in the minds of the management of the New England Works was that its success would be only temporary, and they failed to meet the changed condition. A very large proportion of their production at this time was pressed glass, and for several years, in the attempt to meet the competition of the cheap products of the western manufacturers with their more costly products, the works were run at a loss, which amounted during the last year they operated to more than $40,000. In 1888 they ceased operation.

In 1825 a plant was established at Sandwich, commencing in a small way, with one 8-pot furnace, and melted 7,000 pounds of glass. In 1865 it had been increased to 4 furnaces, 10 pots each, and a melting capacity of 100,000 pounds weekly. It was in these works that the modern invention of pressing glass was first successfully introduced, in 1827. In 1888, after several years of financial loss, the company suspended operation. They had built up quite a town at Sandwich, and up to 1865 had been prosperous and successful, employing for 63 years a large number of people, and making a fine line of cut, blown, colored, and pressed glass.

During the period in which these two Massachusetts factories were in existence they were in the lead, and while a number of others had been established, none had reached the success of these two noted works, which are now only a part of the record. Quite recently an attempt has been made to operate one of the furnaces at Sandwich, the success of which is yet to be demonstrated. At this time there are only four flint-furnaces operated in Massachusetts, two of them being at New Bedford, one at Somerville, and one at Sandwich. There are, besides, the window and part-plate works at Berkshire. So that Massachusetts, that in 1860 led the flint-glass industry in this country, has almost ceased to be a factor at this time.

Maryland was quite an important State in the early production of glass, and the attention of Congress was called to the value of the industry by John Frederick Amelung, who petitioned Congress to extend its patronage to his works at New Bremen. A motion was made in Congress to loan him not exceeding $8,000, on his giving security for its repayment. The motion was debated for several days, during which was brought out the fact that Amelung had spent over $100,000, and brought over from abroad over 200 workmen, in his attempts to establish the industry. The motion was defeated. In 1794 Amelung presented a petition for an increase of duties. These works appear to have been built at Fredericktown, but were afterward moved to Baltimore. They were not a success, and it is probable he crossed the mountains and helped to start the flint-works at Pittsburg. A plant was established for the making of window-glass in 1790, known as the Baltimore Glass Works. These are the window-glass works operated by Baker Brothers until quite recently. They have operated them since 1852. Maryland, however, since that period, has been quite a glass State. Window-glass and green and flint bottles have been made to a greater or less extent.

One of the earliest glass-works in this country was located at Allowaystown, in Salem County, N. J. It was the beginning of the glass industry in that State, and was built about the year 1760 by a German named Wister, who carried on the works until his failure in 1775. The workmen then went to Glassboro, and established the industry there. Plenty of pine-wood for fuel was found in this locality, and a very fair grade of sand, which was good enough for bottles, jars, vials, and the common kinds of green glass made by them. Glass making has been carried on at this place ever since that time. The first establishment commenced with a 6-pot furnace, but gradually extended until a town surrounded it. In 1870 there were factories at 37 different localities. Many of them ran for only a short period. The cheapness of wood and sand no doubt led to the building of many, and the fact that expensive buildings were not required, most of them being frame structures. With the exception of a flint-works at Jersey City and one at Camden, the glass made in New Jersey was bottles, jars, vials, and window-glass.

In New York State large quantities of glassware have been made, and some of the works have had a national reputation. In January 1785 Leonard de Neufville and his associates, the proprietors of a glass factory located 10 miles from Albany, at Dowesborough, in the midst of a well-wooded pine forest, applied to the legislature for aid in the undertaking, giving as a reason that $150,000 annually was sent abroad for glass. In 1793 the legislature of New York voted to loan them $3,000 for eight years without interest, and five years at 5 per cent, but by this time the works had passed out of the De Neufville family. The history of glass making in New York State shows that up to 1850 there had not been much headway made in establishing it on a permanently successful basis. Many factories were started, but ran for only a short time, and none of those in operation in 1850 are now in existence.

In 1820 some workmen left the New England Glass Works at East Cambridge and built a factory in New York city, under the firm name of Fisher & Gilland; but in 1823 the partnership was dissolved, and Gilland removed to Brooklyn, where he established what were known as the South Ferry Flint-Glass Works. Gilland up to 1850 was evidently very successful. He had the reputation of making the finest flint-glass made in this country, and at the London Exhibition in 1851 took a medal for the best flint-glass on exhibition. He afterward failed, and the works are not now in existence.

Like other industries in the United States, the history of the glass business was, between 1850 and 1860, one of great depression. Fine glass was made in New England and in New York and in one or two factories in Pittsburg, but the bulk of the product was of poor quality, and the window-glass did not in any way measure up to the imported glass. During this period, however, a great impetus was given to the flint-glass business by the making of coal-oil from coal and the later discovery of petroleum. The demand for lamps and lamp-chimneys was very extensive. One of the first to make a specialty of glass for lighting purposes was Christopher Dorflinger, who started with a capital of $1,000 in 1852, in Concord Street, Brooklyn. The furnace held 5 small pots, and was afterward increased to hold 7, until in 1861 he was operating 4 furnaces. The first year his sales amounted to $30,000, and he employed 85 people. When he left Brooklyn in 1865 his sales amounted to $300,000. The factories increased in Brooklyn, from 1858 to 1865, from 2 to 15, mostly making the same class of ware, which was principally for lighting purposes — lamp-chimneys, gas-globes, and lamps. In 1865 Dorflinger moved to White Mills, and established one of the best-known and largest of the manufactories of cut glass.

In 1860, from the best records we can get, the product of the glass factories did not exceed $7,000,000; 1861 and 1862 were off years. The excitement incident to the commencement of the War produced great depression, but from 1862 until 1870 the increase in production was very great, and the census showed 154 establishments, with 15,367 employees, producing glass to the value of $16,470,507, with a capital invested of $13,826,142. It was during this decade that great improvements were made in the making of pressed glass. The modern discovery of pressing glass was an American invention, and the credit is given to the Sandwich Glass Company, which, at the solicitation of a carpenter, in 1827 made a mold to press an article he wanted made. After that the mold increased rapidly in favor, but was used only for the commoner class of goods for many years, until the New England Glass Company, by a series of expensive molds, had produced some very fine effects in pressed glass. The triumphs of pressed glass in this country, however, came from Pittsburg. James B. Lyons, of the O'Hara Glass Works, Pittsburg, made for many years pressed glass only, and in 1867 made an exhibit at the Paris Exposition, and took the first prize for fine pressed glassware. Goblets and wine-glasses were made almost as fine and delicate as those made by the old mode of blowing and cutting. Prior to 1864 the pressed glass was either made of flint-glass, the ingredients of which were the best of sand, pearl-ash, refined saltpetre, and oxide of lead, and was a very good crystal glass, or from what was then known as German flint or lime glass, the ingredients of which were soda-ash, lime, nitrate of soda, and sand. This latter made a very inferior glass, apt to crack, and very poor in appearance. It was used principally in common tumblers and some lamp-chimneys.

In the winter of 1864, William Leighton, Sr., of the firm of Hobbs, Brockunier & Company, of Wheeling, made a series of experiments with bicarbonate of soda, with pure sand, lime, and refined nitrate of soda, and produced a very clear, brilliant glass, at a cost for the batch of not more than one third that of the lead-glass or flint batch. The result was a complete revolution in the pressed-glass business. It was impossible for the manufacturer making flint-glass to compete, and the result was that all had to adapt themselves to the change, and some were driven out of the business. Up to 1870 there had been very little change in the furnaces, which were mostly the old-fashioned type of round furnace, with the coal fired over the bench, or the Frisbie bucket-teaser, where the coal was pushed up from below. But the close competition and the desire for increased production led to the effort to get better results from the furnaces, and after 1870 larger furnaces were built, into which, by a series of flues, hot air was introduced to the combustion-chamber, and much greater heat secured with much less fuel. Many of the furnaces also hold from 13 to 15 pots, and many of the pots each hold two tons of glass.

The Centennial Exhibition held in Philadelphia gave a large impetus to so many industries. One of the great attractions was the glass-works operated by Gillinder & Sons, of Philadelphia. It was a complete establishment, showing the processes of melting, blowing, pressing, cutting, etching, and annealing. The furnace held six pots and melted double the amount of glass made by the first flint-glass works operated in this country by Bakewell & Page, in 1808. This was the first time anything of this kind was attempted in an international exhibition. The product was sold as souvenirs, and realized $96,000. Over $14,000 was paid to the Centennial Board of Finance as commission on the sales.

At the close of 1880 the glass trade was in a very prosperous condition. Prices were good, and the outlook looked promising for the future; and it is from this period we must date the wonderful progress of plate-glass making in this country. In 1880 there were but four plate-glass works in this country, and only three in operation. They were located at New Albany, Ind., Jeffersonville, Ind., Crystal City, Mo., and Louisville, Ky., the latter plant being idle. The first attempt to make plate-glass was made in 1852, when Tilton, Pepper & Scudder started a factory at Williamsburg, L. I. The works were under the management of Cuthbert Dixon, a plate-glass worker from the Thames Plate-Glass Works, London, England. They produced a good quality of rough plate, but, owing to the ruinous competition of the English and German manufacturers, at the end of two years they were compelled to close. There is some dispute as to where the first plate-glass was made in the United States, but there are existing proofs that the Williamsburg works were the first, based upon the records found in an old diary of the late William S. Dixon, of Pittsburg, who was employed there as pot maker, his father being the manager.

Attempts were made to make plate-glass at Cheshire, Mass., Lenox Furnace, Mass., and at Greenpoint, L. I., previous to 1860. There are records of polished plate-glass being made at Lenox in 1865, but it was not continued. The successful founder of the plate-glass industry in this country is James B. Ford, of Pittsburg. In the year 1869 Ford conceived the idea of making polished plate-glass, and with this in view visited the works at Lenox, gathered what information he could from the workmen who had been imported from abroad, and returned to New Albany with the determination to make plate-glass. Machinery for this purpose was imported, and the new plant was speedily successful so far as the production of plate-glass was concerned; but, like all new enterprises of the kind, it was not profitable, and in 1872 Ford withdrew. The factory was continued by William C. de Pauw until his death, and afterward by his heirs. He demonstrated, after a hard struggle, that polished plate-glass could be made here at a profit. Mr. Ford afterward built a factory at Louisville, Ky. It had two 12-pot furnaces and was equipped with the old-style French machinery. He ran these works for two years and sold out, removing to Jeffersonville, Ind., where he built a plant that he operated until he moved to Creighton, Pa., in 1881. Shortly after the building of the New Albany plant, E. B. Ward, of Detroit, and others, attracted by a very extensive deposit of sand of fine quality, originated the American Plate-Glass Company, with a capital stock of $250,000, and began in 1872 the erection of works at Crystal City, Mo. The capitalization was increased in 1874 to $500,000, and the works were operated until 1876, producing some glass of good quality; but, owing to lack of experience, the management failed to make a profit. In 1877 the works were reorganized, new capital was secured, A. E. Hitchcock, of St. Louis, president of the old company, continuing in charge. G. F. Neal, a practical plate-glass manager, took charge of the works, and a Siemens furnace was erected. The works have been largely increased, and plate-glass is made in Crystal City equal to any found in Europe. This was the condition of the plate-glass business when Ford built the Creighton Works in the midst of a rich gas-coal country. He built a factory with a capacity of 70,000 square feet per month. It was equipped with two 16-pot furnaces, 8 grinding and 16 polishing machines. This was really the first plate-glass works in this country that paid for the large investment required in its establishment.

While the success of these works was very largely helped by the experience that Ford had gained from his previous ventures, a new factor was introduced that had never been used in the making of plate-glass before. This was natural gas, which it was found could be used as a fuel. The Rochester Tumbler Works had used it in their leers, and partially in their furnaces, as far back as 1875; but not having sufficient for the furnaces, it was not a success. At about the time Mr. Ford was starting at Creighton, wells had been drilled that promised inexhaustible quantities of the new fuel. For glass making it is impossible to conceive of a more perfect fuel — no labor required for firemen, no dirt, no ashes, and a uniform heat, or just what was required. Natural gas was a great factor in the success of these works, which were sold by Ford to the Pittsburg Plate-Glass Company, who enlarged them in 1883, and increased the output from 70,000 square feet to 110,000 square feet finished product. Having a great desire to own and operate his own works, Ford, in 1884, commenced the building of a plant at Tarentum, Pa., with a capacity of 150,000 square feet per month. Before it was completed the Pittsburg Plate-Glass Company made him an offer, which he accepted, and the Tarentum plant became part of the Pittsburg Plate-Glass Works. The success of their plants resulted in the building of plate-glass works at Butler, Pa., in 1886, and at Cochran Station, Pa., in 1889.

Natural gas had been discovered in Indiana. A large plant was built at Kokomo, Ind., under the name of the Diamond Plate-Glass Company. The gas being in abundance, this same company erected another large factory 20 miles away, at Elwood, in 1891; and the extensive works at Charleroi and at Irwin, Pa., were erected the same year. The Pittsburg Plate-Glass Company in 1887 commenced the erection of what are now the largest plate-glass works in the world. The company bought 480 acres of land, and a town was laid out, and named Ford City, in honor of J. B. Ford, who is one of the largest stockholders. Under his personal supervision the works were built, which have a monthly capacity of 400,000 square feet. In 1891 the De Pauw Plate-Glass Company built a small plant at Alexandria, in the heart of the gas belt; but the panic of 1893 caused its suspension, and it has not been operated since.

The works mentioned have an aggregate monthly capacity of 1,785,000 square feet, or an annual maximum production of 21,420,000 square feet. In 1894 a movement was made by some of the companies for self-preservation, which resulted in the outright purchase by the Pittsburg Plate-Glass Works of all the plate-glass works in the United States, with the exception of those at Butler and Irwin Station and the De Pauw plants of Indiana.

The total number of furnaces is 43 of 20 pots each, and 2 of 16 pots each. Of this number there are in operation at this time only 23 furnaces, containing 460 pots. Plates of glass are made containing 180 square feet, or, say 12 by 15 feet. The success of the plate-glass business, which really dates back only 20 years, is one of the wonders of our age. Much credit must be given to J. B. Ford, and especially when we consider that when the factory at Creighton was started he was over 70 years of age, and had to impress upon the capitalists his own faith that the business could be made to pay. So far as Pennsylvania was concerned it was an entirely new venture, the census of 1880 showing that no plate-glass was then made in Pennsylvania.

From the year 1880 may be dated also the great success of window-glass making. Prior to this time, with few exceptions, the old furnaces and flattening-ovens that had been in use for 50 years were still prevailing. Fully 25 per cent of the window-glass used in this country was imported. For many years the workmen have been organized into a union, which not only takes in the blowers, but the gatherers, flatteners, and cutters; these last two being practically unskilled labor, and paid as such in European countries. Then, to mend matters and make competition worse, the manufacturers of Belgium and England had adopted what is known as the tank-furnace; no pots were required, a more uniform quality of glass could be depended upon, and a much larger production. James Chambers, of Pittsburg, who had succeeded his father in the manufacture of window-glass, was in 1887 operating 4 furnaces with 36 pots, using natural gas in his furnace and flattening-ovens. He had the improved flattening-ovens, but he came to the conclusion that something had to be done to put the window-glass business upon a better basis. He made a trip to Europe, obtained all the information possible, came back to Pittsburg and organized the Chambers & McKee Company, and, as president, planned, built, and operated the plant at a place on the Pennsylvania Railroad, 27 miles east of Pittsburg, called Jeanette. The foundation of the tanks was laid in 1888, and in the spring of 1889 they commenced making glass. Glass workers and manufacturers all over the country, with few exceptions, had predicted that the tanks would be a failure, and that window-glass could not be made that way; but the tanks were a success from the first.

Owing to financial disagreement, Chambers withdrew from the Chambers & McKee Company, and in 1892 formed a company and erected a factory at New Kensington, 19 miles from Pittsburg, on the Allegheny Valley Railroad, and built two continuous tanks that are said to be the largest in the world. They are 25 feet 6 inches wide, 130 feet long, inside measure; each furnace will hold 1,000 tons of molten glass, and has a melting capacity of 35 tons, turning out 600 boxes of single and 300 boxes of double strength every 24 hours. This is said to be the largest and most complete establishment in the world for the manufacture of window-glass.

The discovery of natural gas, and its application to the glass-furnaces, led to a very great increase in the building of flint- and green-glass works. To-day probably the largest flint-bottle works in the world are those of the Illinois Glass Works at Alton, where 4,500 people are employed. Here was blown in 1903 the largest glass bottle in the world. The next largest bottle works are those of Whitall, Tatum & Company, located at Millville, N. J. They have 13 flint-furnaces, in addition to 5 green-glass furnaces and a green-glass tank, and employ from 1,500 to 1,900 employees, according to the demand for their goods. This business has been principally built up since 1860. The Rochester Tumbler Company, at Rochester, Pa., was organized in 1872, and commenced making glass in July of the same year. They commenced with one 10-pot furnace and 90 employees, making a specialty of tumblers, and with a capacity of 12,000 dozen per week. At present they operate 7 furnaces with 88 pots, with a capacity of 75,000 dozen per week, or 150,000 tumblers each day. The melting capacity of the furnaces is 120 tons of sand per week. The pots are very large, and over 1,000 hands are employed. When they first commenced they made only common tumblers, but now they make every kind of tumblers, with a cutting, engraving, and decorating department. The works cover over seven acres of ground. They make their own barrels, boxes, and machinery, and almost everything used for the manufacture of glass. All the fuel used is natural gas. They do some export trade — probably more than any other concern in this country — and without question have the largest plant in the world making a specialty of tumblers.

The discovery of natural gas was the means of largely stimulating the erection of flint-glass furnaces, and many small towns offered land and a bonus in money to have a glass-works established in their boundaries. By this means many works were started by parties who had little knowledge of the business, so that the business was largely overdone, and prices in 1891 were such that little or no profit could be made. Labor was high, and, in view of there being so much demand for it, was aggressive and unreasonable in its claims, being backed up by its labor organizations. A number of manufacturers met together and formed a stock company under the name of the United States Glass Company, which company bought up 15 of the largest and most complete press manufacturers in the country, located in Pennsylvania, Ohio, and West Virginia. The 15 establishments had a capacity of 29 furnaces. The company afterward erected a plant at Gas City, Ind., with three 15-pot furnaces, to get the benefit of the natural gas fuel. The capital stock of the company was $4,158,100, $640,000 of which is preferred and $3,518,100 common stock. The first year of its existence as a corporation the sales amounted to very nearly $3,000,000. With a view of consolidating the plants the company bought 500 acres of land on the Monongahela River adjoining McKeesport, Pa., and erected two 15-pot furnaces. It is without question the largest flint-glass works in the world, and is almost able to supply this country with table-glass, if all the furnaces were in full operation. Quite a number of flint-glass works are operated in the making of glass for lighting purposes — arc-globes, gas-globes, and shades for electric lighting. There are six leading companies making these goods, four of them located in Philadelphia, one at Monaca, Pa., and one at Brooklyn, N. Y.

Gillinder & Sons, of Philadelphia, were the first of these works established, and operations were commenced in 1861 by William T. Gillinder, the father of the present owners. Their works have two furnaces, with 23 pots, and have a capacity of production to the amount of $400,000 per annum. It is impossible to continue further to enumerate special plants, but so far as glass making is concerned America is practically in-

FLINT OR GLASS SPONGES.

1, 3, 5, 6, 7 Various forms of glass sponges. 2, 4, 9, 10, 11, 12, 13, 14, 15, 16, 17 Specimens of flint or glass spicules which form the skeleton of the animals. 8 Cross section of a young sponge.

dependent. We have sand in almost every State of the Union fit to make glass. The sand of Massachusetts, Pennsylvania, and Missouri is equal to, if not better, than any other sand in the known world. Soda-ash and other chemicals are being made, and when the beet-sugar industry is fully established we shall be able to get pearl-ash from the ashes of the beet, so that it will not be necessary to import our potash from Germany. We have fire-clay for furnaces, which is found in many States of the Union, notably in New Jersey, Ohio, Pennsylvania, and Missouri. The pot-clay found near St. Louis, Mo., has been used for more than 40 years. It is a very superior clay, and for the making of glass-house pots is unsurpassed. It is capable of resisting a very high degree of heat, and will stand the changes of temperature much better than the most celebrated clays of Europe.

In the preparation of this article I have been aided very much in the early records by the 'History of Glass Making in the United States,' prepared by Joseph D. Weeks; and for information in regard to the various improvements in furnaces and leers, by H. L. Dixon, of Pittsburg, who has been identified with the building of many of the improved furnaces that have taken the place of the old furnaces. See Glass.

James Gillinder,
Franklin Flint-Glass Works, Philadelphia.

The following statistics from the United States census report for 1900 will be found valuable for comparison with the figures heretofore given :

COMPARATIVE SUMMARY OF THE GLASS TRADE, 1850 TO 1900.

	DATE OF CENSUS			
	1900	1890	1870	1850
Number of establishments	355	294	201	94
Capital	$61,423,903	$40,966,850	$14,111,642	$3,402,350
Salaried officials, clerks, etc., number	2,268	[2] 1,095	(3)	(3)
Salaries	$2,792,376	[2] $1,232,561	(3)	(3)
Wage-earners, average number	52,818	44,892	15,822	5,668
Total wages	$27,084,710	$20,885,961	$7,846,425	$2,094,576
Men, 16 years and over	42,173	36,064	11,505	5,571
Wages	$24,901,233	$19,546,351	(3)	(3)
Women, 16 years and over	3,529	1,885	715	97
Wages	$840,001	$332,245	(3)	(3)
Children, under 16 years	7,116	6,943	3,602	(3)
Wages	$1,343,476	$1,007,365	(3)	(3)
Miscellaneous expenses	$3,588,641	$2,267,696	(4)	(4)
Cost of materials used	$16,731,009	$12,140,985	$6,133,168	$1,556,833
Value of products	$56,539,712	$41,051,004	$19,235,862	$4,641,676

[2] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table. [3] Not reported separately. [4] Not reported.

RANK OF STATES ACCORDING TO VALUE OF PRODUCTS, 1880 TO 1900.

States	Rank			Value of Products		
	1900	1890	1880	1900	1890	1880
United States	....	....	....	$56,539,712	$41,051,004	$21,154,571
Pennsylvania	1	1	1	22,011,130	17,179,137	8,720,584
Indiana	2	4	8	14,757,883	2,995,409	790,781
New Jersey	3	3	2	5,093,822	5,218,152	2,810,170
Ohio	4	2	4	4,547,083	5,649,182	1,549,320
Illinois	5	6	6	2,834,398	2,372,011	901,343
New York	6	5	3	2,756,978	2,723,019	2,420,796
West Virginia	7	9	9	1,871,795	945,234	748,500
Missouri	8	8	5	765,564	1,215,329	919,827
Maryland	9	7	10	557,895	1,256,697	587,000
Massachusetts	10	10	7	418,458	431,437	854,345
Wisconsin	11	13	....	(1)	(1)	(2)
California	12	14	13	(1)	(1)	140,000
Virginia	13	....	....	(1)	(2)	(2)
Delaware	14	16	....	(1)	(1)	(2)
Georgia	15	12	....	(1)	(1)	(2)
Michigan	16	17	14	(1)	(1)	90,000
Colorado	17	15	....	(1)	(1)	(2)
Kentucky	....	11	11	(2)	(1)	388,405
Connecticut	....	....	12	(2)	(2)	160,000
New Hampshire	....	....	15	(2)	(2)	70,000
Iowa	....	....	16	(2)	(2)	3,500
All other states[4]	....	....	....	924,706	1,065,397	....

[1] Included in "all other states."
[2] Not reported.
[4] Includes the following states: 1890 — California, Colorado, Delaware, Georgia, Kentucky, Michigan, Wisconsin; 1900 — California, Colorado, Delaware, Georgia, Michigan, Virginia, Wisconsin.

Glass Painting. See GLASS STAINING.

Glass Snail, one of the minute, grass-haunting, hyaline land-snails of the genus *Vitrina*.

Glass-snake, or Joint-snake, a limbless, snake-like lizard of the genus *Ophisaurus* (family *Anguidæ*), which takes its name from the brittleness of the tail, which is more than twice the length of the body, and whose vertebræ are so slightly connected, that a part or all of the tail will easily break off, or may be cast off; but the lost part is quickly renewed. The head is very lizard-like. No vestige remains of limbs except two little spikes near the vent; the body is serpentiform, but the stiff armor of scales prevents the graceful movements of a serpent. The glass-snake (*O. pallasi*) of southeastern Europe may exceed a yard in length, and dwells in bushy districts where it can hide under leaves and sand, and catch snails and small animals. A smaller species (*O. ventralis*) is found in the Mississippi Valley and the southern United States. It is greenish-gray or brownish; sides largely yellow, with narrow black streaks; but the coloration varies greatly, especially in western specimens. Several nearly related species inhabit Central America. These lizards are rapacious and devour great numbers of ground-keeping insects and crayfish. They breed by means of eggs hidden in loose soil or leaves; and are of slow growth. They are said to be easily tamed, and to show intelligence.

Glass-sponges, certain silicious sponges are so-called from the fact that the fibres or spicules composing their solid framework or skeleton is like finely spun glass. The glass-sponges, such as the Venus' flower-basket (*Euplectella*) and allied forms, live in fine sandy mud in deep water. The *Euplectella* inhabits the ocean around the Philippine Islands in from 10 to 20 fathoms. It forms a hollow cylinder or basket-work of spicules, enlarging at the top, which is broad and a little convex; it grows rooted in the sandy mud, anchored by its long glass spikes, which at the extremity end in anchor-like hooks. A number of similar but shorter, more dense sponges (*Holtenia*, etc.) live at great depths in the Atlantic, one kind occurring in shallower water (100 fathoms) in the Gulf of Maine. The glass-sponge of the Japanese seas is *Hyalonema*, in which the stem is twisted, composed of fibres, like spun glass, while the body of the sponge is long and slender; it grows nearly three feet in length. These glass-sponges, with the spicules having three crossed axes, or six threads radiating from a common point, are grouped in a family (*Hexactinellidæ*). The efferent canals are loosely meshed, while the digestive chambers (ampullæ) are large and barrel-shaped.

Glass Staining and Glass Painting, the art of producing pictures on glass with vitrifiable colors; but a common extension of the meaning is to include all the make and design of ornamental glass windows. Originally there was but one method of making these, and that was to produce the pattern in outline with frames, into the grooves of which pieces of colored glass or of stained glass were fitted. In the Moslem East these frames were of plaster, or rarely of marble slabs pierced with openings. In Europe, since the 12th century, these frames have been of lead, rolled or drawn into what are called *cames*, that is, bars of an I section, the two grooves holding the glass firmly. Modern chemistry has so improved the art of glass staining, that large pictures may now be produced on single sheets of glass, but nowhere have such pictures been successful in an artistic sense. In the original painted glass windows the pictures resembled tables of mosaic work, in which there was no attempt at shading or modification of the tone. What is perhaps the earliest known application of colored glass to window decoration, in Europe, is that in the monastery of Tegernsee, in Upper Bavaria, which was secularized in 1802, and is now a private residence. The windows of this structure, executed in the latter half of the 10th century, like all the first attempts, were only tasteful arrangements of colored glass in a translucent mosaic.

In the early part of the 13th century the mosaic patterns gave way to more elaborate designs, not only in beautiful Arabesques, but even in pictorial composition. In all these the figures were composed of pieces of colored glass combined with marvelous skill and taste. The work of shading and making so-called half-tints was not attempted; but an effect not dissimilar was got by painting in opaque pigment upon the glass and breaking up this painted surface into patchings and spots, as when an artist draws in crayon or charcoal. The finest English examples of this early mosaic work are to be found in the cathedrals of Canterbury, Salisbury and Lincoln. In the 14th century the art of shading was advanced by removing certain portions of the colored surface. The first period of the art reached the culminating point in the 15th century, but with the passing of Gothic architecture, glass painting lost its artistic spirit. Subjects in which were arranged a multitude of personages with all the elaborate artifices of pictorial composition; buildings showing complex linear perspective; foreshortened figures; the play of light and shade — all this was attempted to be exhibited in painted windows. It soon became apparent that the true art was lost, and though windows continued to be painted, only a few artists acquired celebrity. Perhaps the best examples of the 15th century period are the windows of the Cologne cathedral.

About 1600, Bernhard von Linge, an artist from the Netherlands, residing in England, and who may be considered the father of the modern art of glass staining, established a school in London, whose influence is evident in the work of the present day. Francis Eginton (1737–1805), a native of England, accomplished much to restore the art during the 18th century. Among his numerous works, all of which are remarkable for brilliancy of coloring and delicacy of execution, are: 'The Banquet of the Queen of Sheba' (a copy from Hamilton); two 'Resurrections' (from Sir Joshua Reynolds); 'Christ Bearing the Cross' (from Morales); and 'The Soul of a Child' (from Peters). Other famous artists of this period were Jouffrey and Baumgartner. The Renaissance in glass painting was contemporaneous with the revival of Gothic architecture in the beginning of the 19th century. Four German artists, Mohn, Scheinert, Ligm and Frank, were prominent as glass stainers during the century. In 1850, through the generous assistance of King Louis of Bavaria, a school was founded at Munich under the direction of Gärtner and Hess, the latter a well-known historical painter, which obtained a world-wide celebrity. Still, however, the purists in Gothic art, and those who were most concerned in the Gothic Revival would have none of this glass of the early 19th century. It was seen that the smooth and clear modern glass would never do; and rough, partly opaque, flawed and bubbled glass was prepared on purpose. This material, known as "antique" and as "cathedral" glass, and by other names, allowed of a far more decorative effect.

In 1902 the chief centres of the art in Europe were at Birmingham, England; Edinburgh, Scotland; Paris and Sèvres, France, and Munich, Metz and Nuremberg in Germany.

Not until comparatively late in the 19th century did the art of glass staining obtain a place in the United States. Only a few years ago Americans were seemingly content with imported windows, or with poor imitations made here. In both cases the windows were but copies of mediæval work, seldom equaling the originals, and never showing an advance, either in artistic qualities or improvement of method over the windows of the Middle Ages. Several artists and some makers of church furniture began making fine windows, and to-day largely through their efforts American colored glass-windows have become celebrated for their color values and their color relations. John La Farge, Louis C. Tiffany and other American artists in glass painting and glass staining took up the art where the mediævalists stopped, in the study of the inherent properties of the glass, both in their color and texture, in order to obtain in the glass itself light and shade, through depth and irregularity of color, in union with inequality of surface. In this way they sought to avoid the dullness, opacity and thinness which invariably accompany the use of paint, and are marked characteristics of European glass work. It was an American idea to make glass in lumps and chip it into flakes, to corrugate it, to blow it into shapes, or to pull molten glass out of shape. By such means the artist has succeeded in obtaining effects in this obstinate material which were deemed impossible. There was introduced a few years since the use of opalescent glass, the plating of glass over glass and developing the mosaic system, substituting it for glass painting. Churches, houses, hotels, and theatres are now decorated by the mosaic stained glass which is largely a product of New York studios. Upward of $3,000,000 was invested in 1902 in the stained glass industry in the United States.

Glasse, glas, **Hannah**, English writer. She was the author of 'The Art of Cookery' (1747), a work whose claim to remembrance has depended chiefly on the mistaken reference to it of the proverbial "First catch your hare." In the fourth edition (1770) she is described as a habit-maker in Tavistock Street, Covent Garden.

Glauberite, glâ'bėr-īt, a mineral having the formula $Na_2SO_4.CaSO_4$, and crystallizing in the monoclinic system, usually in tabular forms. It is commonly pale yellow or gray in color, with a white streak. It has a hardness of from 2.5 to 3, and a specific gravity of from 2.7 to 2.85. Glauberite occurs in connection with rock salt in various parts of the world. In the United States is found at Borax Lake, San Bernardino County, Cal., and in tabular crystals in the Rio Verde Valley, Arizona.

Glauber's (glow'bėrz) **Salt**, sulphate of sodium, Na_2SO_4, so called from the German chemist, Glauber, who prepared it in 1658 by distillation of common salt with sulphuric acid, named it "sal mirabilis," identified it with the salt of a beneficial mineral water, and urged its good qualities. It occurs throughout Europe, especially at Carlsbad and Seidlitz, and in North America, notably at the Great Salt Lake in Utah. It forms oblique prisms which effloresce on the soil or on rocks. These are of a gray or yellow color, earthy, but transparent and vitreous when newly broken. It is readily soluble in water, and when heated or exposed to the air melts in its water of crystallization. Its chief use is in the manufacture of glass and sodium carbonate.

Glaucine, glâ'sĭn, an alkaloid contained in the leaves of *Glaucium flavum*, a sort of poppy. The leaves are macerated with acetic acid; the juice is pressed out, boiled, filtered and the filtrate is treated with lead nitrate, which precipitates lead fumarate. The filtrate is treated with H_2S, then the glaucine is precipitated with tannin, and the precipitate decomposed by chalk. Glaucine crystallizes out of water in small scales, is easily soluble in alcohol and ether, and forms crystalline salts.

Glaucodot, glâ'kō-dŏt, or **Glaucodote**, an orthorhombic, grayish, tin-white mineral of metallic lustre and black streak; hardness, 5; specific gravity, 6. Composition: Sulphur, 19.4; arsenic, 45.5; cobalt, 23.8; iron, 11.3. It occurs in chlorite slate in the province of Huasco in Chile, also in fine crystals in Sweden.

Glaucoma, glâ-kō'ma, a diseased condition of the eyeball characterized by a retention of the fluids within its cavity. As the fluids accumulate, pressure is exerted on the delicate lining, with resulting injury or destruction of sight. It is due to any causes operating so as to close the place of exit for the fluids of the inner chamber of the eyes. See EYE, DISEASES OF.

Glau'conite, an amorphous green opaque mineral, like earthy chlorite, with a dull or glistening lustre. It is a hydrous silicate of iron and potassium, averaging: Silica, 49.3; alumina, 3.6; sesquioxide of iron, 22.7; protoxide of iron, 6.3; potash, 8.3, and water, 9.6. Its hardness is 2, and its specific gravity about 2.3. There are two varieties of it; the one the green earth of cavities in eruptive rocks, the other the green grains in greensand formation, or anything similar.

Glaucophane, glâ'ko-fān, a mineral of the amphibole group, crystallizing in the monoclinic system, and closely resembling amphibole in form. It is a silicate of aluminum, sodium, iron and magnesium, with variable proportions of the two latter metals. It is blue or gray in color, translucent with a vitreous lustre, and has a hardness of from 6 to 6.5, and a specific gravity of about 3.10. Glaucophane occurs in certain crystalline and mica schists, and is found associated with mica, garnet, epidote and dial-lage. In the United States it occurs chiefly along the Coast Ranges of California.

Glaucus, glâ'kŭs, the name of several personages in Greek legend. (1) A sea-god, who was at first only a fisherman, and whose oracles were highly prized by fishermen, according to the legends. (2) The son of Hippolochus and grandson of Bellerophon. He assisted Priam in the Trojan war, and was foolish enough to exchange his golden armor for the iron suit of Diomed. He displayed much courage, but was killed by Ajax. (3) The son of Sisyphus, king of Corinth, by Merope, daughter of Atlas, and born in Potnia, Bœotia. He wished to make his mares swifter than others, for the purpose of vexing Venus, and Venus inspired the animals with such fury that they tore Glaucus to pieces as he returned from the games which had been celebrated by Adrastus in honor of his father. (4) The son of Minos II., and Pasiphæ, smothered in a cask of honey, and miraculously brought to life, by an herb sent by Polyidus the soothsayer.

Glaze (ceramic), a vitrified coating which gives to earthen-ware or porcelain its brilliance and impermeability.

Glazes are of three classes: the glaze proper (Fr. *couverte*), the soft glaze (Fr. *vernis*), and the enamel or opaque glaze (Fr. *émail*). The glaze proper is a silicate of calcium, potassium and aluminum, and is composed of feldspar, chalk or whiting, kaolin and quartz. It is applied either to the clay ware (Chinese) or to the soft burned biscuit (modern); the whole piece is then burned to a high temperature (about 1,500° C.). Soft glaze comprises the vast range of earthen-ware and faïence glazes, and includes the glazes of bone china and soft porcelain. A soft glaze is either a silicate or a boro silicate, and the bases employed include the oxides and carbonates of the following elements: Lead, zinc, potassium, sodium, calcium, barium, magnesium, and as coloring agents the salts of iron, cobalt, copper, nickel, antimony, chromium and manganese.

The range of temperature is very wide. A simple lead glaze will fuse at 900° C. and a hard glaze for white earthen-ware may need 1,350° of heat. Enamels are sometimes used over other glazes and sometimes upon the biscuit body. Their essential condition is opacity. Oxide of tin, alumina, calcium phosphate and calcium carbonate are used as opacifiers. The early wares made in Italy, Spain and Holland were of this type (see MAJOLICA). For convenience of application glazes are ground in water and held in suspension, the article to be glazed being plunged into the liquid. For this reason only insoluble substances can be used, and where it is necessary to introduce alkaline salts and soluble boric acid or borates these are rendered insoluble by being melted with insoluble and readily combined reagents, such as whiting and barium carbonate. This melt is called a "frit" and the operation of melting is known as "fritting." Hence some glazes, mainly of the second class, are called fritted glazes, and glazes which contain no frit are termed "raw" glazes. Fritted glazes are, as a rule, harder and clearer than those which contain no frit except in the case of porcelain glaze (couverte), which is made from natural substances without frit.

Glaze'brook, Richard Tetley, English scientist: b. 18 Sept. 1854. He was educated at Cambridge and was principal of University College, Liverpool, 1898–9, and has been director of the National Physical Laboratory from 1899. He has published various scientific text-books; 'Laws and Properties of Matter'; 'Clerk-Maxwell and Modern Physics'; etc.

Glazier, glā'zhėr, **Willard**, American author: b. Fowler, N. Y., 22 Aug. 1841; d. 25 April 1905. His works include: 'Capture, Prison Pen, and Escape' (1865), which was very popular; 'Three Years in the Federal Cavalry' (1870); 'Battles for the Union'; 'Heroes of Three Wars'; 'Peculiarities of American Cities'; and 'Down the Great River.'

Glazier, Lake, Minn., a body of water south of Lake Itasca, into which it empties through a swift and permanent stream about 6 feet wide; named for Capt. Willard Glazier, who claimed for it a geographical importance as the true source of the Mississippi. Lake Glazier has an area of 255 acres. It is estimated to be 1,582 feet above the Atlantic, and 3,184 miles from the Gulf of Mexico.

Glea'son, Elliott Perry, American inventor: b. Westmoreland, N. H., 27 June 1821; d. New York 26 Sept. 1901. Received a common school education; was one of the first to manufacture gas burners; and invented the regulating argand burner and other lighting devices.

Gleason, Frederick Grant, American musician: b. Middletown, Conn., 17 Dec. 1848. He was a pupil of Dudley Buck at Hartford, Conn., studied also at Leipsic, Berlin, and London, became an organist at Hartford, and in 1876 removed to Chicago, where he was active as composer, teacher, and musical critic of the *Tribune*. Among his works are songs, trios, sonatas; the cantatas, 'Praise of Harmony,' 'God Our Deliverer,' and 'The Culprit Fay'; and the operas 'Montezuma' and 'Otho Visconti.'

Glebe, glēb (Lat. "soil," "clod"), the land possessed as part of the revenue of an ecclesiastical benefice in England or Scotland, often scattered through the parish. Where there are arable lands the glebe must consist of 4 acres; where there is none the parson is entitled to 16 soums of grass next adjacent to the church — a soum of land being as much as will pasture 10 sheep or 1 cow — so that the actual extent will vary with the richness of the soil. The glebe must be taken as near the manse as possible; and where there is no manse, vicinity to the church is the criterion. In general, the glebe is the subject of much discussion in the ecclesiastical law of both countries. Although the incumbent is temporarily proprietor, he has no right of alienating the glebe.

Glede, glēd, an old British name for a bird of prey, the kite. See KITE.

Glee, in music, a vocal composition in three or more parts, generally consisting of two or three contrasted movements, the subject of which may be either gay, tender, grave or pathetic. It is distinguished from a madrigal by its want of contrapuntal harmony, and in the independence of its parts it differs from a part-song. It is essentially English in origin and cultivation, and the period during which its vogue was greatest and its form most perfect extended from 1760 to 1830.

Gleet, glēt, chronic urethritis; an obstinate inflammation of the urethra that follows acute gonorrhœa. The disease is evidenced by the continuation of the purulent discharge, or by a morning drop, or by the presence of shreds of mucous membrane appearing in the urine. It may be due to small ulcerated patches, the presence of a stricture, or inflammation continuing in the tiny pockets and glands. The cure of the inflammation requires astringent and antiseptic injections, usually some form of silver, and under some conditions the passage of steel sounds.

Glencoe, glĕn'kō, Minn., a village and county-seat of McLeod County, on the Chicago, M. & St. P. R.R. Stevens Seminary and St. Joseph's Academy are located here. Pop. (1900) 1,780.

Glendale, Battle of, also called **the Battle of Charles City Cross-roads, the Battle of Frazier's Farm**, and **the Battle of White Oak Swamp**. The battle of Gaines' Mill was fought on 27 June 1862. That night the Fifth corps and its supports crossed to the south side of the Chickahominy and destroyed the bridges, and the withdrawal of the Army of the Potomac to James River began. The battles of Allen's Farm and Savage Station were fought on the 29th, and on the morning of the 30th the Union army was across the White Oak Swamp Creek, covering the roads leading to James River and the immense trains on their way to Malvern Hill and Harrison's Landing. Franklin, on the right, with Smith's division of his own corps, Richardson's division of Sumner's, and Naglee's brigade of Keyes' corps, was at the bridge crossing of White Oak Swamp Creek. About two miles to the left, holding the intersection of the Charles City, Darbytown, and New Market roads, thus covering the Quaker road over which the trains must pass, was Sumner, with Sedgwick's division of his own corps. Heintzelman's two divisions of Hooker and Kearny, Slocum's division of Franklin's corps, and McCall's division. Slocum, on the right of Sumner's line, was on the Charles City road, about a mile in advance of the junction with the New Market and Quaker roads; Kearny was on Slocum's left between the Charles City and New Market roads; McCall was on Kearny's left, and Hooker to the left and rear of McCall; Sedgwick was in support to McCall, but during the forenoon, two of his brigades were sent to Franklin. Porter's and Keyes' corps were at or on the way to Malvern Hill. After making these dispositions McClellan left the field.

Gen. Lee's plan contemplated that Jackson should force a passage at the bridge held by Franklin, turn his right, and reach the Union rear; Holmes to attack and turn the Union left and prevent its reaching James River, while the divisions of Longstreet, A. P. Hill, and Huger, supported by Magruder, concentrating at the cross-roads, should cut McClellan's army in two and interrupt its retreat to the river. Early on the morning of the 30th Jackson advanced through Savage Station on Franklin, who opened upon him furiously with artillery and checked him. It was a great disappointment to Lee, and Jackson's want of enterprise on this occasion has been the subject of much criticism. Holmes advanced on the Confederate right with 6,000 men and 6 batteries, toward Malvern Hill, and was attacked by Warren's brigade of 1,50c men and 36 guns; the gunboats in the river opened upon him and he fell back in disorder, and called for help. Huger led the advance down the Charles City road; in an effort to determine the Union position and to protect his own flanks, his division became scattered, and he devoted the remainder of the day to reconnoitering and an almost harmless artillery duel with Slocum. While this division of 9,000 men frittered away the day, Longstreet and A. P. Hill were maintaining a furious contest.

Longstreet and A. P. Hill moved on the Darbytown road, Longstreet in advance, who, at noon, came upon McCall's pickets on the Frazier farm. Longstreet formed line and at 3 P.M. closely supported by A. P. Hill, attacked McCall, forced back his left brigade (Seymour's) after a hard struggle, and captured several guns. Hooker, with Grover's brigade, fell upon the flank of Longstreet's right brigade (Kemper's); Sumner's artillery, covering the opening between McCall and Hooker, opened fire, and Kemper was swept back just as Branch's and Pickett's brigades were advancing to his support, which in turn were checked, but kept up a stubborn fight until nightfall, when they were joined by Pender's and Archer's brigades of Hill's division, and held the ground from which Seymour had been driven. Wilcox's brigade, which had advanced on Pickett's left, captured Randol's and Cooper's batteries after a very obstinate fight, but was forced back by a counter-attack, and Cooper's battery was retaken. Field's brigade, coming to Wilcox's support, forced back Meade's brigade and captured some guns, but Meade rallied and drove it back. Farther on the Confederate left Pryor's and Featherston's brigades attacked Kearny's left and were several times repulsed. Slocum assisted Kearny with his New Jersey brigade, and Featherston's brigade being thrown into some disorder, Gregg's South Carolina brigade was sent to that part of the field. Late in the day Caldwell's brigade of Richardson's division moved from Franklin's position and reinforced Kearny's left. Two regiments only got into line and fired a volley; the engagement was about over, and darkness came with Kearny's line intact. Only one division, McCall's, had lost any ground during the day, and it lost its commander who was taken prisoner at the close of the engagement, and 14 guns. The Union troops had resisted three separate attacks on flank and rear, and under cover of their splendid fighting, involving great losses on both sides, the immense supply trains and the reserve artillery reached Malvern Hill at 4 o'clock in the afternoon. During the night the Union army fell back to Malvern Hill. Consult: 'Official Records,' Vol. XI.; 'McClellan's Own Story'; Webb, 'The Peninsula'; Allan, 'History of the Army of Northern Virginia'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. II.

E. A. Carman.

Glen'dive, Mont., a village and county-seat of Dawson County, on the Yellowstone River and on the Northern P. R.R. It is the centre of a stock-raising and agricultural region and has railroad repair shops. Pop. (1900) 1,200.

Glens Falls, N. Y., village in Warren County; on the Hudson River, Glens Falls Feeder to Champlain Canal, and the Delaware & Hudson R.R. and Hudson Valley Trolley System (running from Warrensburg to Troy); about 56 miles north from Albany, 50 miles from Troy, 18 miles from Saratoga, and nine miles from Lake George. The river at this point has a descent of about 60 feet with a succession of falls and rapids. Cooper in 'The Last of the Mohicans' has celebrated the falls at this place and the famous cave which lies under the limestone formation at this point. This cave cannot be seen at high water in the spring and fall; at other times it is accessible to any tourist who wishes to visit this quasi-historical spot.

Industries.— Glens Falls is in an agricultural region; in the vicinity of the river are extensive limestone and black marble quarries which have been worked for more than half a century. At the falls, are located some of the largest, most extensive, and costly paper mills in the world, as well as various other manufactories. The chief manufactures of the city are paper, pulp, wall paper, Portland cement, lime, lumber, collars, cuffs, shirts, ladies' shirt waists, flour, laths, Joubert & White buckboards, lanterns, machinery and foundry products, ale brewing, brick (ordinary and artificial), paper boxes, cigars, confectionery, gold and silver refining, and various minor enterprises. Twelve miles above Glens Falls is situated the great Spier Falls dam across the Hudson, built by the Hudson River Water Power Company, supplying electric light and power along the Hudson and Mohawk valleys as far south as Albany and west to Utica. This power is second only to Niagara in importance in this country.

Public Works, Institutions, Buildings, Etc.— Glens Falls has several miles of paved streets, a paid fire department, police, and all modern municipal equipments. The village owns its own water works system. Glens Falls has an excellent union school system and its new high school building completed in 1906 cost over $120,000. It has also Saint Mary's and Glens Falls Academies, Crandall Free Library, Parks' Hospital, Glens Falls Hospital, Glens Falls Home for Aged Women, and the Crandall Park. There are many fine buildings including the home office building of the Glens Falls Insurance Company, the State Armory of Company K, 2d Reg., N. Y. M., the Ordway Memorial Y. M. C. A. Building, the Village Hall (costing $60,000), and the Empire Theatre Building. There are 11 churches comprising all the leading denominations. Glens Falls has three national banks and a trust company with a combined capital of $436,400 and deposits of $5,636,396.

History and Population.— Glens Falls is situated on the Great War Trail leading from Lake George to Albany. Just outside the village limits at the Half-Way Brook was located throughout the French and Indian Wars and the Revolutionary War a fortified post. A tablet was erected in 1905 by the New York State Historical Association commemorating the two massacres which occurred at that spot during this period, also the encampment there of General Riedesel with Burgoyne's forces while on their way to Saratoga. Glens Falls was settled in 1763; incorporated in 1837 and again in 1874 and 1887. In 1864 the village was practically destroyed by fire. In 1884 and also in 1902 it was visited by disastrous conflagrations entailing a loss of hundreds of thousands of dollars. Pop. (1900) 12,613; (1905) 14,650.

James A. Holden.

Glen'wood, Iowa, a city and county-seat of Mills County, 20 miles from Council Bluffs, on the Chicago, B. & Q. R.R. The State Institution for Feeble Minded Children is located here. The chief industries include fruit-growing, farming, and vegetable canning. It has a city hall, court house, and several churches. Pop. (1900) 3,040.

Gliddon, George Robbins, American archæologist: b. Devonshire, England, 1809; d. Panama, Colombia, 1857. He succeeded his father as United States consul at Alexandria, and was for a long time engaged in archæological researches in Egypt and the Levant. Later he came to the United States, and lectured in many cities on Oriental archæology, and was appointed agent for the Honduras Interoceanic Railroad Company. His principal works include: 'Appeal to the Antiquaries of Europe on the Destruction of the Monuments of Egypt' (1841); 'Discourses on Egyptian Archæology' (1841); 'Otia Ægyptica' (1849); 'Ancient Egypt'; 'Types of Mankind, or Ethnological Researches Based upon the Ancient Monuments, Paintings, Sculptures, and Crania of Races, etc.,' etc.

Glinka, glĕn'kä, **Mikhail Ivanovitch**, Russian composer: b. government of Smolensk 1 June 1803; d. Berlin 15 Feb. 1857. In 1836 his opera 'Life for the Tsar' was presented with great success at St. Petersburg. He was regarded as the founder of Russian national opera, and was appointed director of the imperial Opera and Kapellmeister to the Tsar. A second operatic work, 'Russlan and Ludmilla' (1842), was inferior. His orchestral arrangements of Russian dances became well known in foreign countries. He wrote (in Russian) 'Memoirs and Correspondence with Relatives and Friends' (1887). Consult the study by Fouqué (1880).

Glisan, glĭs'an, **Rodney**, American physician: b. Lingamore, Frederick County, Md., 29 Jan. 1827. He was graduated from the medical department of the University of Maryland (Baltimore) in 1849, was assistant surgeon, United States Army, in 1850–60, afterward practised medicine in Portland, Ore., and in 1881 was a delegate to the Seventh International Medical Congress. His writings include a 'Journal of Army Life' (1874).

Globe, a sphere, a round solid body, generated by the revolution of a semicircle about its diameter. Globe, or artificial globe, in geography and astronomy, is more particularly used of a sphere made of metal, plaster, or pasteboard, on the surface of which is drawn a map or representation of either the heavens or the earth, the former being called a terrestrial and the latter a celestial globe. The celestial globe is intended as a representation of the heavens, on which the stars are marked according to their several situations. The terrestrial globe is an artificial representation of the earth, exhibiting its great divisions. The axis of the earth is an imaginary line passing through its centre, and the wire on which the artificial globe turns represents this line. The poles of the earth are the extremities of this axis. The brazen meridian is the circle in which the artificial globe turns, divided into 360 degrees. A degree of a great circle in the heavens is a space nearly equal to twice the apparent diameter of the sun, or to twice that of the moon when considerably elevated above the horizon. A degree on the equator of a terrestrial globe represents 60 geographical miles or 69.12 English miles.

Great circles, such as the equator, ecliptic, and the colures, divide the globe into two equal parts; small circles, as the tropics, polar circles, parallels of latitude, etc., divide the globe into two unequal parts. Meridians, or lines of longitude, are semicircles cutting the equator at right angles. In English maps and globes the first meridian is a great circle supposed to pass through the Royal Observatory at Greenwich. The equator, when referred to the heavens, is called the equinoctial, because when the sun appears in it the days and nights are equal all over the world. The declination of the sun, stars, and planets is counted from the equinoctial north and south. The ecliptic is a great circle in which the sun makes his apparent annual progress among the fixed stars; it is the real path of the earth around the sun. The zodiac on the celestial globe is a space which extends about 8° on either side of the ecliptic. Within this belt the motions of the planets are performed. The ecliptic and zodiac are divided into 12 equal parts called signs, each containing 30°; and the sun makes his apparent annual progress through the ecliptic at the rate of nearly a degree in a day. The colures are two great circles of the celestial sphere, one of which passes through the celestial poles and the equinoxes, and the other through the solstices and the celestial poles. The tropics are two smaller circles, each 23° 28′ from the equator, with which they are parallel; the northern is called the tropic of Cancer, the southern the tropic of Capricorn. The polar circles are two small circles parallel to the equinoctial, at the distance of 66° 32′ from it, and 23° 28′ from the poles.

Horizon when applied to the earth is either apparent or real. The sensible or visible horizon is the circle which bounds our view, where the sky appears to touch the earth or sea. It extends only a few miles. The real or true horizon is an imaginary plane passing through the centre of the earth parallel to the sensible horizon. The wooden horizon circumscribing the artificial globe represents the true horizon on the earth: it is divided into several concentric circles arranged in the following order: one containing the 32 points of the compass divided into half and quarter points; another with the 12 signs of the zodiac, with the figure and character of each sign; and another having the days of the month answering to each degree of the sun's place in the ecliptic, and the 12 calendar months. The cardinal points of the ecliptic are the equinoctial and the solstitial points, which mark out the four seasons of the year.

The zenith is a point in the heavens exactly overhead and is the superior pole of our horizon. The nadir is a point in the heavens exactly under our feet, being the inferior pole of our horizon, and the zenith or superior pole of the horizon of our antipodes.

The pole of any circle is a point on the surface of the globe 90° distant from every part of the circle. Thus the poles of the world are 90° from every part of the equator; the poles of the ecliptic (on the celestial globe) are 90° from every part of the ecliptic, and 23° 28′ from the poles of the equinoctial. The equinoctial points are in the signs of Aries and Libra, where the ecliptic cuts the equinoctial. The vernal equinox is called the first point of Aries, and the autumnal the first point of Libra. When the sun is in either of these points the days and nights on every part of the globe are equal to each other. The solstitial points are in Cancer and Capricorn. When the sun enters Cancer it is the longest day to all the inhabitants north of the equator, and the shortest day to those on the south side. When the sun enters Capricorn it is the shortest day to those who live in north latitude, and the longest day to those who live in south latitude. The latitude of a place on the terrestrial globe, or its distance from the equator in degrees and minutes, or geographical miles, is reckoned on the brass meridian from the equator toward the pole. The quadrant of altitude is a thin piece of brass divided upward from 0 to 90°, downward from 0 to 18°; when used it is generally screwed to the brass meridian. The upper divisions determine the distances of places on the earth, the distances of the celestial bodies, their latitudes, etc.; and the lower divisions are applied to finding the beginning, the end, and duration of twilight. The longitude of a place on the terrestrial globe is the distance of the meridian of that place from the prime meridian, reckoned in degrees and parts of a degree, on the equator. Longitude is either east or west, according as a place is east or west of the prime meridian. No place can have more than 180°, or half the circumference of the globe. Hour circles are the same as meridians. The brass meridian and these circles always correspond.

Globe-fish, a plectognathous fish of the family *Tetraodontidæ*, examples of which are found on all the warmer coasts of the world, especially within the tropics. Ordinarily they are oval, spinose, small-finned fishes, which nibble the barnacles and crush the small crustaceans and mollusks near shore, with the rodent-like teeth which give them the name "rabbit-fishes" in the West Indies. The moment any danger threatens they suck air or water into a large bladder-like expansion of the abdomen and distend the scaleless skin until they are as round as a ball, all the spines are rigid, and they rise and float at the surface belly upward,— a difficult and disagreeable mouthful; this odd method of self-defense has given them the names "bellows-fish," among English, and "tambor" among Spanish fishermen. Some tropical species are a foot or so in length, but those familiar as "puffers" or "swell-fish" along the coast of the eastern United States are much smaller and serviceable only as comical additions to an aquarium. The flesh of all is poor, and said to be poisonous. The two genera are Lagocephalus and Spheroides, the latter containing the familiar northern puffers. Compare DIODON.

Globe Tavern, Battle of. On 17 Aug. 1864 Gen. Grant, then investing Petersburg, directed that Warren's Fifth corps and some cavalry be sent to destroy as much as possible of the Weldon Railroad and make such a demonstration on Lee's right as would force him to withdraw a portion of his troops from the Shenandoah valley, so that Sheridan might strike a blow at the rest of them. Warren was instructed to move at 4 o'clock on the morning of the 18th and make a lodgment upon the railroad two miles south of the Vaughan road, and destroy it as far south as possible. A brigade of cavalry under Col. Spear was attached to his command. Warren moved as directed, drove back Dearing's Confederate cavalry brigade, and took possession of the railroad at Globe Tavern, about three miles south of Petersburg. Griffin's division was formed along the road, and began its destruction. Ayres' division moved up the road a mile or more beyond Griffin, and Crawford moved up on Ayres' right. About 2 P.M. Gen. Heth, with two brigades, moved out of the Confederate works, made a sudden attack upon Ayres' left, and drove it back; Ayres rallied, and retook the lost ground. The Union loss was 544 killed and wounded, and 392 missing. On the morning of the 19th Bragg's brigade was sent to the right of Crawford to support him and establish connection by a skirmish-line with the Ninth corps, and Willcox's and White's divisions of the Ninth corps were ordered to Warren's support. The woods were so dense and the roads so intricate that Bragg failed to establish a proper line, and before it could be connected and completed it was broken. A. P. Hill with Heth's two brigades, Mahone's three brigades, Fitzhugh Lee's cavalry, and Pegram's batteries, moved to the Vaughan road intersection. At 4.30 P.M. Mahone in column of fours, broke through Bragg's skirmish-line, faced to the right, and sweeping forward dispersed Crawford's division and the right of Ayres'; at the same time Heth opened on Ayres' centre and left. Warren rallied the broken parts of his line and, advancing, regained the lost ground, taking some prisoners. Willcox's division engaged Colquitt's brigade, drove it back, and captured some prisoners; and Mahone's entire command fell back rapidly in great confusion to their entrenchments, "carrying with them the parts of Warren's command disorganized by the attack on their rear in the woods, and a large portion of the pickets." Heth made repeated attempts to drive Ayres back, but failed. Warren's casualties for the day were 382 killed and wounded, and 2,518 missing. On the 20th Warren selected a position on the railroad a mile or two in rear of his line of battle of the 19th, chiefly on open ground, and entrenched. On the morning of the 21st A. P. Hill, with his own corps, part of Hoke's division, with Lee's cavalry, attacked his position, opening with 30 guns on his front and right flank, and at 10 o'clock made an assault, which was repulsed. Later Mahone attempted an assault on Warren's left, but the artillery fire broke his ranks before they came under musketry fire, and Warren, making an advance, captured 517 officers and men and six flags. Warren's loss was 301 killed, wounded, and missing. No further attempts were made upon Warren's position, and the entrenchments were extended by the Ninth corps from the Jerusalem plank-road to unite with Warren's on the Weldon Railroad. The Union troops engaged 18–21 August numbered about 20,000; the loss was 198 killed, 1,105 wounded, and 3,152 missing. The Confederates engaged numbered about 14,800; the number of their killed and wounded is estimated at 1,200. Consult: 'Official Records,' Vol. XLII.; Humphreys, 'The Virginia Campaign of 1864 and 1865'; Powell, 'The Fifth Army Corps'; Walker, 'The Second Army Corps.'

E. A. CARMAN.

Globe Theatre, the theatre in Southwark of which Shakespeare was a shareholder, and in which many of his plays were acted. The original theatre was built in 1593 on a tract of land between Maiden Lane (now New Park Street), and what was subsequently called Globe Alley; the site is now occupied by Barclay and Perkins Brewery. A patent was granted for this theatre by James I. in 1603. It was destroyed by fire in 1613 during the performance of Shakespeare's 'Henry the Eighth.' The accident was caused by the firing of the thatch roof, a cannon having been discharged during the performance, and the wadding shot from the stage pierced the roof. This was in 1613. The theatre was rebuilt the following year. In 1644 the structure was demolished to make room for dwelling houses. According to pictures and descriptions which have survived to the present day the old theatre must have been extremely dingy in the interior and uncomfortable both for the actors and spectators.

Globigerina, glŏb-ĭ-jĕ-rī'nä, one of the most common of the surface-living or pelagic Foraminifera (q.v.), a shelled protozoan of the class *Rhizopoda*. The animal is like an amœba, exceedingly simple, although throwing out a great number of long, slender thread-like pseudopods, with which it draws in and absorbs minute silicious plants, such as diatoms, etc., which serve as food. Though the animal is so simply organized, the limestone shell which it secretes is composed of several chambers, which are like their bubbles, hence the name of the commonest species, — *Globigerina bulloides*. It lives in countless numbers at the surface of the sea, floating on the top of the water, when the sea is calm, with its root-like arms or tentacles (pseudopodia) radiating from the body. The shell, which is of microscopic size, is perforated with fine openings through which the pseudopods pass out. After death the shells, when not dissolved, slowly fall or rain down to the bottom of the ocean, and so light and minute are they that it is calculated that it requires about a month for them to reach the bottom in the deeper parts of the ocean.

Globigerina Ooze.— The shells collect in such vast numbers on the floor of the ocean that a grain of the fine mud or ooze thus formed may contain nearly 50,000 of them. Chalk is formed of such foraminifers mingled with the debris of shells, corals, etc. Nummulitic limestone and greensand are mainly of foraminiferal origin. This ooze is a fine sticky mud-like sediment which covers the ocean bottom at great depths. Indeed, the ocean bottoms everywhere beyond the 100 to 500 fathom-line are free from any shore sediments. All this ooze is principally made up of the shells of this single species (*G. bulloides*) mentioned above. The more numerous these shells are at the surface, the greater is the depth at which they will accumulate at the bottom. There are only about 20 other species of these pelagic Foraminifera, yet as Murray states in his 'Report on the Scientific Results of the Voyage of H. M. S. Challenger,' so numerous are the individuals of the species that they usually make up over 90 per cent of the carbonate of lime present in the calcareous oozes of the abysses of the ocean. The remaining 10 per cent is mainly reddish clay. Great interest attaches to this subject because thick series of Tertiary and older rocks seem to have been formed out of similar oozes. Beside the globigerina oozes similar sticky deep-sea muds are formed of the shells of surface-living pteropods (q.v.), as also radiolarian oozes and diatom oozes, the latter confined to the Southern Ocean, a little to the north of the Antarctic Circle. The radiolarian ooze thus far has been detected only in the deepest abysses of the western and central Pacific. The red clay is derived by chemical changes from the globigerina ooze. See DEEP-SEA EXPLORATION for information as to the method of ascertaining these facts.

Glob'ulins, a term applied to one of the forms of proteids (q.v.) of animal or vegetable origin. The animal globulins are proteids which are insoluble in water, soluble in dilute salt solution, and insoluble in saturated solutions of sodium chloride and magnesium sulphate. They are coagulated by heat, the temperature causing the coagulation varying considerably. Fibrinogen, serum globulin of blood, paramyosinogen and myosinogen, of muscle, and vitellin, found in eggs, are examples of animal globulins. The plant globulins constitute the most important and abundant natural proteids of plants.

Glo'ria in Excel'sis, the original and Latin form of 'Glory be to God on High,' the opening words of the dismissal hymn in the liturgy of the English Church as well as of the Protestant Episcopal Church in the United States. It is used in the Roman Catholic Church at all masses excepting those for the dead. These opening words are taken from the hymn sung by the angels at the Nativity. The origin of this half-inspired composition is lost in remote antiquity. It is found in the eastern Church as early as the days of Athanasius, but was used at evening service (nocturns), and not in the liturgy, or communion office. It has been attributed to Telesphorus, bishop of Rome, 150 A.D. Pope Symmachus, 500 A.D., is said to have ordered its use at the commencement of the Sunday and holy-day services. The hymn in full is as follows: "Glory be to God on high, peace on earth, to men of good will. We praise thee, we bless thee, we worship thee, we glorify thee, we give thanks to thee for thy great glory, O Lord God, heavenly King, God the Father Almighty. O Lord, the only begotten Son Jesus Christ; O Lord God, Lamb of God, Son of the Father, that takest away the sins of the world, have mercy upon us. Thou that takest away the sins of the world have mercy upon us. Thou that takest away the sins of the world, receive our prayer. Thou that sittest at the right hand of God the Father, have mercy upon us. For thou only art holy; thou only art the Lord; thou only, O Christ, with the Holy Ghost, art most high in the glory of God the Father. Amen."

Gloria Pat'ri, the first words in their original Latin of the doxology sung or said in the services of the Roman Catholic Church, the English Church, and the Protestant Episcopal Church in the United States, and other religious bodies. It is employed as a refrain at the end of psalms and canticles as well as at other parts of the service. The complete form of the doxology is as follows: "Glory be to the Father, and to the Son, and to the Holy Ghost. As it was in the beginning, is now, and ever shall be, world without end. Amen." The doxology is common at the beginning of service in the Greek Church, and was employed at nocturns in the Western or Roman Catholic Church as early as the 6th century.

Gloss (Gr. "tongue"), the explanation of verbal difficulties in a literary work, written at the passages to which they refer. The words which are commonly the subject of these explanations are those taken without modification from a foreign language, provincialisms, obsolete and technical words, or such as are used by the author in some exceptional signification. The earliest glosses, as those in Greek, Latin, and Hebrew manuscripts, were interlinear; they were afterward placed in the margin, and extended finally in some instances to a sort of running commentary on an entire book. In Roman law the word is used also of an explanation, but the explanation is not merely of a word, but deals with the intent of the law. The glosses on the Justinian code, collected by Accursius in the first half of the 13th century, were held almost as high authority as the code.

Glossitis, glŏs-sī'tĭs. Acute glossitis is an uncommon disease of the tongue due to bites, burns, and stings. It starts in the deeper structure of the tongue, causing it to swell rapidly. The affection is very painful, but is ordinarily cured, if properly treated, in five or six days. Small or large incisions may be necessary. Chronic glossitis is a condition of the tongue, due to persistent use of tobacco, alcohol, and spices, in which the surface is reddened, cracked, and furrowed.

Glot'tis, the upper end, including the opening of the windpipe, which latter constitutes a narrow aperture covered by the epiglottis during the act of holding the breath or swallowing. The glottis contributes by dilatation and contraction to the modulation of the voice. It is sometimes called the rima glottis, a term more properly limited to the opening of the windpipe. See LARYNX.

Glottis, Œdema of the, a dangerous affection characterized by the effusion of serum in the tissues of the entrance and the inside of the larynx, causing an obstructive swelling. It is due to burns, scalds, and the lodgment of foreign bodies; to acute laryngitis or tonsilitis; to tuberculous and cancerous deposits; and to nephritis, measles, diphtheria, scarlet fever, and erysipelas. The symptoms which usually develop rapidly are pain, cough, loss of voice, and great difficulty of breathing. This difficulty of breathing, unless relieved, may go on to complete suffocation. Incision of the parts may give relief, or tracheotomy or intubation may have to be performed. See Nose and Throat.

Gloucester, Mass., a city and port of entry of Essex County, near the extremity of Cape Ann, and on the Boston & Maine R.R.; 32 miles northeast of Boston. It is one of the most important fishing ports and fish markets in the world, having over 500 vessels and 6,000 men engaged in the fisheries. Cod, haddock, halibut, herring, and mackerel are the principal catches. Besides extensive fisheries, the city has large manufactures of machinery, oil, fish-glue, shoes, twine, and cigars. Numerous vessels have been wrecked in the vicinity of Gloucester. A massive rock called Norman's Woe was the inspiration for Longfellow's famous poem, 'The Wreck of the Hesperus.' The city was founded in 1623, principally by settlers from Gloucester, England, from which it received its name; was incorporated as a town in 1642; and became a city in 1874. The city is governed by a mayor, elected annually, and by a bicameral council. The waterworks are operated by the city. It has the oldest Universalist church in the United States, founded in 1770. Pop. (1900) 26,121.

Gloucester City, N. J., a city in Camden County, on the Delaware River and on the Atlantic City and the West J. and Seashore R.R.'s. The manufactures include calico prints, woolen yarns, gas burners, and boats. The city was incorporated in 1868, and is governed by a mayor chosen every two years, and by a unicameral council. It has ferry connections with Philadelphia, and has electric lights and street railroads. Pop. (1900) 6,840.

Glove, an article of dress; a covering for the hand. Its use reaches back to remote antiquity. Laertes, the farmer-king, wore gloves to protect his hands from the thorns. Xenophon sneers at the Persians for wearing gloves to keep their hands warm. In their more robust days the Greeks and Romans scorned the use of gloves; but in later times they were used in Rome. The glove appears to have become a well-known article of dress in England about the 14th century, and corporations of glovers were in existence in the 15th century. In the days of Queen Elizabeth gloves were made with gauntlets upon which much rich and elaborate embroidery was worked.

Modern gloves are of two distinct classes, woven and knitted gloves, and those made of leather; and the making of these constitute entirely separate branches of manufacture. The manufacture of knitted or woven gloves is an industry allied to the hosiery trade, and the materials comprise all the ordinary fibres, the most important being silk and wool. In some cases these gloves are entirely made and finished by knitting; but in others, the pieces are separately fashioned and sewed together as in making leather gloves. The manufacture is widespread, but the headquarters of the thread and cloth glove trade are now Berlin and Saxony. The materials used for making leather gloves are principally the skin of deer, sheep, and lambs, goats and kids, the latter being the most important, though far more "kid" gloves are made of sheep than of kid leather. The skins for military and other heavy gloves — doe or buck leather — are prepared by the ordinary process of tanning, or are a fine kind of chamois leather. Those for what are called dressed kid gloves are subjected to a special method of tanning, by which, under the influence of heat, and treatment with a mixture of flour, yellow of egg, and alum, the material is rendered peculiarly soft and flexible. After the leather has been properly prepared it is cut into pieces of the required size, then folded over somewhat unequally, as the back should be larger than the front. Three cuts are then made through the doubled piece to produce the four fingers; an oblong hole is cut at the bending of the fold for the insertion of the thumb piece; the cutting of this of the exact shape and size requires considerable skill. The first and fourth fingers are completed by gussets or strips sewed only on their inner sides, while the second and third fingers require gussets on each side to complete them. Besides these, small pieces of a diamond shape are sewed in at the base of the fingers toward the palm of the hand.

A kind of vice or clamp, with minute teeth to regulate the stitches, is used in the making of hand-sewn gloves, by which method all the finest gloves are stitched. Sewing-machines are applied for the ornamental or embroidery stitching on the backs of fine gloves, and for almost the entire sewing of the cheaper and heavier gloves. The superiority of the French and the best English gloves depends chiefly on the adaptation of their shape to the structure of the hand by giving additional size where the flexure of the hand requires it.

Kid gloves are of two principal kinds, glacé and suède, according to the manner of dressing and finishing the leather used. Glacé gloves are those which are dressed, dyed, and polished on the hair or outer side of the skin, while suède gloves are carefully pared, smoothed, and dyed on the inner side of the skin for their purpose, and thus have the appearance of fine chamois. Paris and Grenoble are the chief seats of the French kid glove trade. Military gloves are made at Niort and Vendôme. Brussels and Copenhagen are also important glove-making centres. In England, Worcester is the principal seat of the glove industry; and in a specialty, the so-called English dogskin gloves made from tan skins of Cape sheep, the English manufacturers are without rivals. Rubber gloves are now made in both Europe and America and are largely used in operations demanding careful asepsis, particularly when the surgeon is forced to operate on a clean case after a septic wound. Gloves with roughened surfaces are made to facilitate the handling of instruments and ligatures. See Glove Manufacture in America.

Glove Manufacture, in America, dates from about the year 1760, when Sir William Johnson, chief agent of King George with the North American Indians, brought over from Scotland several families from Perthshire, which settled in the eastern part of what is now Fulton County, N. Y., calling the town Perth. Many of these settlers had been glove-makers and members of the glove guild in Scotland, and brought with them glove patterns and the proper needles and threads for glove making. The first gloves and mittens were used chiefly by the farmers and wood choppers as a protection for the hands while engaged in the rough and laborious work incident to their occupation. The entire output of the industry for many years was probably disposed of in the immediate vicinity. It was not until about 1809 that gloves were manufactured for more distant markets, and it is stated that Talmadge Edwards, a storekeeper of Johnstown, N. Y., was the pioneer in the manufacture of gloves in commercial quantities. Mr. Edwards took a bag of them on horseback to Albany when making a trip for the purpose of renewing his stock of merchandise. Finding a good demand for these articles, he had leather dressed in quantities, and secured farmers' girls to come to his factory to cut gloves, which were then sent out to farmers' wives to be sewed. In this manner the glove and mitten industry of the United States was established. During the incipient stages of this industry the goods produced were really mittens, and not gloves. A glove, as distinguished from a mitten, is a covering for the hand in which each finger is separately enclosed, the part above the hand varying in length according to fashion or convenience. About the year 1810 a glove manufacturer, who had been associated with Mr. Edwards, sold a part of his output by the dozen, and this is said to be the first instance in which they were sold by the quantity. The local demand continued to increase, and each year some enterprising manufacturer would venture to make an extended trip to dispose of his product. In 1825 Elisha Johnson, of Gloversville, N. Y., went to Boston with a load of gloves in a lumber wagon, making the journey in six weeks. This is said to have been the longest trip that had been made in connection with the industry up to that time, and the results were highly gratifying to those interested.

Until 1862 the manufacture of gloves in Fulton County, N. Y., although even then the chief manufacturing industry, was of comparatively small importance. The stimulating influence of a high protective tariff in 1862 showed itself in the increased business at Gloversville, Johnstown, and the adjoining village of Kingsborough, which became at once the leading sources of supply for the home market of gloves of medium grade. While the protective tariff stimulated home industry in one direction, it limited it in another. The domestic materials that could be used in glove making were confined practically to deer, lamb, and sheep skins. The peculiar qualities of the first established it firmly and independently of any tariff, but the others being inferior in quality to skins of foreign production, could not effectually exclude foreign made gloves, but were forced to share the market with them. Still, the demand for cheap and medium gloves was limited, and the American manufacturers saw their development arrested, while France, Germany, and England continued to supply all the finer grade of gloves used in this country. In 1872 the tariff on imported skins was removed amid intense opposition and doleful prediction of ruin to the home industry. A large number of skins came from all parts of the world, and the glovers turned their attention to tanning. Instantly experimenting began, and skill in tanning rapidly increased, so that the highest grade was attained, and to-day the various kinds of leather produced in Fulton County are unsurpassed in quality by that furnished in any other part of the world.

The introduction of free hides made American glove manufacturers far more prosperous than they had ever been previously. The quality of the product has steadily improved, and the variety has been increased until now American made gloves are steadily driving out the foreign gloves. The skill of American glovers is equal to that of foreign glove-makers, and in some respects — notably in the quality and style of the stitching, and in some grades, the shape — the American gloves are the best. The American glovers are more enterprising, and their styles are of a greater and better variety than foreign made gloves. Foreign expert workmen have been drawn over here from the great glove centres in Europe, so that the greatest skill has been secured here. The approximate value of the glove industry in Fulton County has reached about $10,000,000. Some of the firms do a business reaching as high as $1,000,000, but the majority, however, have small shops and do a small but profitable business.

Most of the work in Fulton County, as abroad, is done at the homes of the workers. The streets in Gloversville and Johnstown are lined with pretty and tasteful homes, in which the hum of the sewing-machine is constantly heard during the working hours of the day, but the workers are exceptionally fortunate in being able while earning good wages to enjoy all the comforts and surroundings of home, and in being practically their own masters and mistresses.

When the skins are received at the factory they are thoroughly soaked to open out the texture and prepare them for the removal of the hair. Then the skins are placed in vats of lime water, where for two or three weeks the lime works into the flesh and albuminous matter, and loosens the hair. The skins having thus been properly softened, the dirty but picturesque operation of removing the hair ensues. Before each beamer, as the workman is called, is an inclined semi-cylindrical slab of wood, covered with zinc. The skin is first spread upon this, and the broad curved beam of the knife glides across it from end to end, scraping and removing all the loosened hair, the scarf skin, and the small portion of animal matter still adhering to the skin. After unhairing, kid skins must be fermented in a drench of bran, whose purpose is to completely decompose the remaining albuminous matter, and also to remove all traces of the lime. The operation is extremely delicate.

With the preparation of kid leather, alum is the astringent curative agent. Its operation is accompanied by that of others, whose purpose is to secure elasticity, and pliability, and mainly to preserve that beautiful texture which makes kid leather superior to all others. These assistants in the process are eggs, flour, and salt. They are combined into what is called a custard, and there is certainly nothing repulsive in the idea of such a delicate agent being used. A proper quantity of the custard and a number of skins having been put together in a dash-wheel, where they are thrown about for some time, opens the pores of the skin, absorbs the custard freely, and becomes swelled by the chemical union of the custard and the skin. This having progressed satisfactorily, the skins are folded together with the fleshy side outward, and are dried by a gentle heat. They are now cured, but they are yet hard and rough. The breaking and "staking," as they are called, are now resorted to, to make the skins soft, pliable, and of even texture, removing the superfluous chemicals with which they have become charged, and the stiffness by manipulating the fibres. The operation of transforming the skin into leather is now finished, but age is necessary to secure perfect pliability and softness. The skins are therefore laid away to let the slow chemical operation going on within them be completed. After this has been accomplished the skins are ready for dyeing, cutting, and manufacturing.

Calf skins as well as horsehides are used in the manufacture of workingmen's gloves. They are tanned in two ways, namely, oil tan, with a preparation that makes them what is called "fire and water proof," and they are also dressed and have the same finish as the buck glove.

In the dye-rooms the skins which have already been aged are immersed in dye vats, where the delicate colors are imparted to them. The same care is not required in obtaining the ordinary range of dark colors, for these are "brushed" on, the skin being spread upon a glass slab and the dye being painted on with a brush. After they are dyed the skins are sometimes somewhat hard, and some classes have to be staked again in order to restore their pliability. The finishing touches to a kid skin are secured by rubbing the grain side over with a "size," which imparts a gloss. The experience of Gloversville manufacturers with buck gloves has enabled them to impart a special finish to a skin the same as the suède finish, which is very popular under the title of "mocha." This is the same as suède finish, which is produced in other countries, by shaving off the grain side of the skin at an early stage of its progress. The Gloversville method is much better, however, and has more perfect results. Here the grain is removed, and the velvet finish secured by buffing the surface on an emery wheel. The surface of the leather is cut away in minute particles by this process, and the result is an exceedingly even and velvety texture, superior to that obtained by other methods.

The concluding work is as follows: A marble slab lies before the cutter on a table, and every particle of dirt or other inequality is removed before "doling." The skin is spread, flesh side up, upon the slab, and the cutter goes over it with a broad-bladed chisel or knife, shaving down inequalities and removing all the fibrous portions. The dexterity with which this is done makes the operation appear extremely simple, but any but a skilled and experienced operative would almost surely cut through the skin. The most delicate part of the glove-maker's art, in which exact judgment is required, comes in preparing the "tranks" or slips from which the separate gloves are cut. The trank must be so cut as to have just enough leather to make a glove of a certain size and number. The operation would be easy enough if the material were hard and stiff, and if the elasticity were uniform, but this is rarely the case.

The gussets, facings, etc., are cut from the waste leather in the thumb opening at the same operation. In olden times an outline was traced upon the leather and the pattern was cut with shears. Modern invention has produced dies and presses, which are universally used. Similar dies are used in the cutting of the thumb pieces and forchettes or strips forming the sides of the fingers.

The gloves are somewhat unsightly as they come from the sewer's hands, and must be made trim and neat. To secure these desirable results the gloves are taken to the "laying-off" room. In this are long tables with a long row of brass hands projecting at an acute angle. These are filled with steam and are too hot to touch, but by ingenious devices they are so arranged that it is impossible to burn the glove or stiffen the leather by too much heat, a common defect in ordinary methods. The operation of the "laying-off room" is finished with surprising quickness. Before each table stands an operator, who slips a glove over each form, draws it down to shape, and after a moment's exposure to the warmth, removes it, smooth, shapely, and ready for the box.

About 25 years ago a skin called "mocha" was utilized, and has been ever since, in making fine gloves, and they are finished similar to the suède finish, giving them a very velvety appearance. They are very soft and pliable, and in fact have been almost as popular as the fine kid and lamb gloves. These mocha skins are all gathered in Arabia.

In 1900 Fulton County, N. Y., produced gloves to the value of $9,548,603, as against $17,048,658, the total value of the output in the United States. Fulton County had 166 out of the 381 factories in the United States and 7,981 wage-earners, as against 14,180, the total number in the United States.

COMPARATIVE SUMMARY OF THE GLOVE TRADE IN THE UNITED STATES FROM 1850 TO 1900.

	1900	1890	1880	1870	1860	1850
Number of establishments	397	324	300	221	126	110
Capital	$9,127,309	$5,977,820	$3,379,648	$2,340,550	$594,825	$181,200
Wage-earners, average number	14,436	8,187	7,697	4,058	1,429	1,938
Total wages	$4,217,845	$2,670,344	$1,655,695	$980,549	$330,419	$233,496
Cost of materials used	$9,554,105	$5,021,144	$4,351,469	$1,884,146	$537,589	$322,837
Value of products, including custom work and repairing	$17,048,656	$10,103,821	$7,379,605	$3,998,521	$1,176,795	$708,184

The imports of gloves from all countries amounted to $6,107,765 in 1900, of which we received $2,200,097 from France and $2,785,103 from Germany.

Benj. Lichtenberg,
Of J. Adler & Company, New York.

Glove or **Finger Sponge**, a poor variety of commercial sponge found about the Bermudas and in the Gulf of Mexico, which has a branching growth likened to the fingers of a hand or glove.

Glover, Elizabeth. See Bennett, Mary E.

Glover, John, American soldier: b. Salem, Mass., 1732; d. Marblehead, Mass., 1797. A shoemaker, and later a fisher at Marblehead, he was elected (1773) colonel of a militia regiment, known in the Revolution as the Fourteenth, or the "Marine" regiment. In 1775 he, with Stephen Moylan, was appointed director of the manning and equipment of vessels, in 1776 after the Continental defeat at Long Island superintended the transportation of the army to New York, and also directed the crossing of the Delaware previous to the battle of Trenton. Commissioned brigadier-general in 1777, he participated in Sullivan's Rhode Island expedition (1778), was a member of the court that tried André, and was retired in 1782. He sat in the Massachusetts convention that ratified the Constitution in 1788. A bronze statue of Glover stands in Commonwealth Avenue, Boston.

Glover, Richard, English poet: b. London 1712; d. there 25 Nov. 1785. In 1737 he published the epic poem of 'Leonidas,' which abounds in noble sentiments, considerably varied by incident and description; but wants interest, and is not sufficiently imaginative for lasting popularity. The 'Progress of Commerce' followed in 1739; one of the objects of which was to rouse a spirit of national hostility against the Spaniards and the ministry — a purpose which was much more effectually answered by his celebrated ballad of 'Hosier's Ghost.' In 1753 his tragedy of 'Boadicea' was performed with partial success. His 'Medea,' imitated from Euripides and Seneca, in 1761, obtained greater attention.

Glover, Stephen, English composer: b. London 1812; d. Bayswater, London, 7 Dec. 1870. He wrote nearly 1,500 compositions, including works for pianoforte, vocal duets, ballads, and songs, many of a sacred character, such as the 12 'Songs from the Holy Scriptures.' Among his published music are: 'The Monks of Old'; 'The Gypsy Countess'; 'What are the Wild Waves Saying?' and a setting for Longfellow's 'Excelsior.'

Glover, William Havard, English composer: b. Kilburn, London, 6 June 1819: d. New York 28 Oct. 1875. For several years he was musical critic of the London *Morning Post,* and in 1868 became conductor of Niblo's orchestra and a teacher in New York. His writings include the opera 'Ruy Blas' (Covent Garden 1861); a cantata, 'Tam o' Shanter,' first presented at the New Philharmonic in 1855 with Berlioz as conductor; and the overtures 'Manfred' and 'Comala.'

Gloversville, N. Y., city in Fulton County, on the Fonda, J. & G. R.R., 53 miles northwest of Albany. This is the most celebrated glove manufacturing centre in the world, producing over two thirds of the entire glove output of the United States. Here are the Nathan Littauer Hospital, the Parsons Free Library and other public institutions. Besides numerous large manufactories for gloves, gauntlets, and mittens, there are other factories of leather goods. It was incorporated as a village in 1851, although it was settled before the Revolution, being known as Stump City. It was chartered as a city in 1890. The municipal government under the revised charter of 1899 is administered by a mayor, who is elected by the people every two years, and a common council, elected for a like period. The members of the board of education and the water commissioners are also chosen by popular vote. The municipality owns and operates the water-works. Pop. (1900) 18,350.

Glow-worm. See FIRE-FLY.

Gloxinia, glŏk-sĭn'ĭ-a, a small genus of plants of the *Gesneraceæ,* distinguished by the somewhat bell-shaped corolla, the upper lip being shortest and two-lobed, the lower three-lobed, with the middle lobe largest, and also by the summit of the style being rounded and hollowed. The species are natives of tropical South America. They are now among the greatest ornaments of hothouses, owing to their handsome leaves and their graceful, beautifully colored flowers. The chief species is *G.* (*Ligeria*) *speciosa,* a Brazilian plant with large violet flowers, from which many fine varieties have been derived, usually associated under the specific name *G. hybrida.* Some species of *Sinningia* are also called gloxinias.

Glucic, gloo'sĭk, or **Glycic Acid,** an organic acid obtained from glucose or other compounds of a similar nature. When a solution of glucose is saturated with lime and allowed to stand for some weeks, the glucose is gradually decomposed, entering into combination with the lime to form a new substance known as glucate of calcium. By the addition of subacetate of lead, a bulky precipitate of glucate of lead is thrown down, and from this the free glucic acid may be prepared by separating the lead in the form of sulphid, by the action of sulphuretted hydrogen gas. Thus prepared, glucic acid is a colorless, amorphous mass, very soluble in water and in alcohol, and having an acid taste. The salts of glucic acid are mostly soluble in water, the sodium and barium salts being very hygroscopic. The formula of the acid is probably $C_{12}H_{22}O_{12}$.

Glucina, the oxid of glucinum (q.v.).

Glucinum, gloo-sĭ'nŭm, or **Beryllium,** a metallic element which occurs in the minerals beryl, chrysoberyl, phenacite, and euclase. The name "beryllium" was assigned to it on account of its occurrence in the beryl, and the name "glucinum" on account of the sweetish taste of its salts. Its chemical symbol is sometimes taken as Be, and sometimes as Gl. Glucinum is a dyad, with an atomic weight of about 9.08, and a specific gravity (when compressed) of about 1.85. It resembles steel in general appearance, and forms hard, hexagonal crystals which are unaffected by air at ordinary temperatures, and which are scarcely affected by oxygen or sulphur, even at a red heat, though when heated in chlorine the metal burns to the chlorid, $GlCl_2$. It dissolves readily in hydrochloric acid. Sulphuric acid and caustic potash or soda also dissolve it, but nitric acid, even when hot, and concentrated, acts upon it very slowly. The specific heat of metallic glucinum is about 0.400 at ordinary temperatures, but it increases rapidly as the temperature rises, and is about 0.58 at 500° F. The oxide of the metal, known as "glucina," GlO, was first ascertained to be a new earth by Vauquelin, who in 1798 obtained it from beryl, and pointed out that it differs from alumina in several important ways, notably in the fact that it does not form an alum. Metallic glucinum was first prepared by Wöhler in 1828, by the action of metallic potassium upon fused $BeCl_2$. Glucinum forms many salts, but the metal and its compounds are of interest only to the chemist, as they are not used for any purpose in ordinary life.

Gluck, glook, **Christoph Willibald**, RITTER VON, German composer: b. Weidenwang, Bavaria, 2 July 1714; d. Vienna 15 Nov. 1787. After studying six years at the Jesuit school at Komotow, where his musical talents were especially encouraged, he supported himself for a time by giving music lessons. Later he attracted the notice of Prince Lobkowitz, who enabled him to complete his musical education at Vienna. At 26 he was desired to write an opera for the court theatre at Milan and the result was his 'Artaserse,' which achieved a great success in spite of many innovations in composition introduced into the work. In 1742 he wrote: 'Demofoonte' for Milan; 'Demetrio ed Ipermnestra' for Venice; in 1743 'Artamene' for Cremona, and 'Siface' for Milan; in 1744 'Fedra' for the same theatre; and in 1745 'Allessandro nell' Indie' for Turin. His fame had now become European and he went to England to compose for the theatre in the Haymarket. On 7 Jan. 1746 that theatre was opened with 'La Caduta de' Giganti.' In London Gluck became deeply impressed with the majestic character of Handel's airs and choruses, and with the simple but natural dramatic style of Arne. Leaving London in 1746 he continued opera composition, among his later works being: 'Clemenza di Tito'; 'Le Cinese'; 'Il Trionfo di Camillo'; 'Antigone'; 'La Danza'; and 'Orfeo ed Euridice' (1762), his greatest work up to that time, and still a favorite in Germany after nearly a century and a half. It was followed by 'Alceste' (1766); and 'Paride ed Elena' (1769). In 1774 his 'Iphigénie en Aulide' was produced in Paris after a considerable amount of opposition from the musical critics of the old Italian and French school, at that time represented in Paris by Piccini. The most intense excitement prevailed: all Paris took sides, and for a long time the Gluckists and Piccinists contended with the same bitterness as did formerly the Jansenists and Jesuits, and in our own day Wagner and his opponents. The victory remained with the Gluckists. Shortly after the production of the 'Iphigénie,' the 'Orfeo' was adapted for and put on the French stage, and was followed by the 'Armide' in 1777, and by the 'Iphigenie en Tauride' in 1779, his last important work, and by many considered his greatest. It ends the series of works which directed the operatic genius of Méhul and Cherubini in France, and of Mozart, Beethoven, and Wagner in Germany. See 'Lives' by Marx (1863), Desnoiresterres (1872), Reissmann (1882).

Glu'cosan, or **Dextrosan**, $C_6H_{10}O_5$, a substance formed by heating anhydrous glucose to 340° F.; the anhydrous glucose that is required for the purpose being prepared by crystallizing ordinary glucose from its solution in 95 per cent alcohol. Glucosan is a colorless substance with a faint sweet taste. It is soluble in water and in alcohol, and is not fermentable by yeast. By the action of dilute mineral acids it is reconverted into glucose; and when heated for some time to 400° F. it turns to a brownish black color, and passes into caramel (q.v.).

Glucose, gloo'kōs (from Gr. γλυκυς sweet), a liquid substance obtained from corn, sometimes called "cereal syrup" when in solid state, known as grape-sugar or "cereal sugar." In Europe it is chiefly made from potato starch. Men noted nature's process of changing the starch stored in the cells of plants into different forms of sugar. In the case of cane-sugar (sucrose) they knew that the plant absorbs carbonic acid from the air; other acids from the soil; and by the aid of the sun's heat a chemical process is evolved that puts into the sugar-plant sucrose or cane-sugar, and into fruits and vegetables fruit-sugar which is found more plentifully in the grape than in any other fruit.

The chemist seeks to obtain sugar from starch by a somewhat analogous process, and one similar to that carried on in the human system during the process of digestion, when starch is changed into sugar. Cane-sugar and fruit-sugar as they exist in cane and fruits are natural products, but whether nature's order of combining the various articles composing fruit-sugar as found in fruits is the same as the order of combination followed by the chemist in making sugar from starch is a puzzling and debatable question. Some claim that while the glucose of fruits and glucose as obtained by the chemist may be identical so far as their constituent elements are concerned and the proportion of each which is present, it does not follow that they are the same thing, or that their dietetic value is as great. Neither does it follow that because the chemical composition of glucose (dextrose) is almost identical with that of cane-sugar (sucrose) its food value is quite as evenly matched.

Theory and Fact on Sugar.— A committee of experts of the National Academy of Sciences, reporting to the United States government in 1884 on glucose said: "Starch-sugar is in no way inferior to cane-sugar in healthfulness"; in answer to which a dealer asked: "How is it then that I can feed a hog on cane-sugar and make him fat; but if I should feed him on glucose he would not put on an ounce of fat as long as he lives?" Here theory ran against fact, and to this day there is a conflict over the question which will not be settled until the physiologist has made elaborate studies of the effect of glucose on the human system, a task almost impracticable, because the chemical condition of each individual stomach is an unknown quantity, and because each person is a law unto himself in the use made of food.

Nature and Chemist.—In the laboratory of nature the starch or gum ($C_6H_{10}O_5$) which is formed in the plant is treated by carbonic acid taken from the air, and by other acids absorbed from the soil and carried into the plant by the sap, and through the action of light and heat is changed into cane-sugar (sucrose) $C_{12}H_{22}O_{11}$.

Art or chemistry takes starch from corn (maize), treats it with hydrochloric or other acid, which is neutralized or removed by alkali, the resultant product being glucose $C_6H_{12}O_6$, differing in its constituent elements from cane-sugar in that it contains one more equivalent of water. If to $C_{12}H_{22}O_{11}$ (cane-sugar) is added H_2O, it is equal to twice $C_6H_{12}O_6$ or glucose $C_{12}H_{24}O_{12}$. "It remains," said a prominent manufacturer of glucose, "for some one to discover means for eliminating from glucose the one equivalent of water; and, that found, 'chemistry can make from starch an article the chemical formula for which is exactly like cane-sugar. And somebody will some day stumble over the method."

History of Glucose.— It was in 1792 that Lowitz announced that there was other than cane-sugar, he having obtained dextrose, a different variety, from grapes. In 1811 dextrose was obtained from starch by the action thereon of dilute sulphuric acid. By similar process Braconnot, in 1819, obtained it from linen rags, sawdust, or other vegetable fibre. During the reign of Napoleon Bonaparte starch-sugar was made to make good the deficiency which the continental blockade caused in the supply of cane-sugar. Early in the 19th century it was made from potato-starch in Germany, and during the latter half in France. From 1825 to the present time the chemists of France, Germany, and the United States have studied to improve processes, but nowhere in the world is glucose made so perfectly and at so low a cost as in the United States, where raw material is cheap, and the processes of manufacture so perfected that this country is fast meeting the European demand for glucose and causing the industry to dwindle in continental Europe. This country can manufacture glucose, send it to Europe, pay a 30 per cent tariff, and then undersell the makers of Europe, the proof of which is the statement which follows showing the exports of glucose from the United States. From 1838 the number of factories in France and Germany increased until 40 years later there were 85, and in the Austrian empire, where the industry began about 1840 or a few years earlier, over 100. In 1889 Germany had 30 glucose factories which produced 34,684,100 kilos glucose syrup; 2,748,000 kilos couleur.

The manufacture of glucose or grape-sugar from starch has been a prominent American industry for about 30 years. In March 1865 Dr. Goesling made glucose under a patent he had procured. The sample exhibited led to the formation of a stock company which purchased of Goesling, Bradley & Briggs their patent for manufacturing sugar and syrup from Indian corn. The company began the manufacture of glucose in the old sugar-refinery in Rose Street, New York. Unfortunately Dr. Goesling, the German chemist who was to superintend the manufacture of glucose, died before the first lot of glucose was marketed, and with him perished some of the secrets of manufacture. The small stock of glucose made was stored in the refinery, where later upon examination it was found in a solid condition, which alarmed the stockholders, for they knew of no use for grape-sugar, the name given to starch-sugar in its solid form. Neither knew they how to manufacture the glucose as a liquid substance. Their main dependence, Goesling was gone, and there seems to have been a lack of push, courage, and foresight on the part of the officers and stockholders of the Union Sugar Company in that they failed to secure expert chemists to work out the secrets of a process known only to Goesling. The few barrels of glucose the company owned were sold to the Tribune Association for a nominal sum, for use in the printing-rooms, after which the company came to grief, having paid $600,000 for the patents subject to a right to manufacture that belonged to a man named Fox. In 1877 the receiver of the Union Sugar Company sold for $2.50 the patents it controlled. A. W. Fox & Company did better. They improved the process and, while at first they used 200 to 300 bushels of corn per day, they gradually increased the quantity until thousands of bushels were daily required. In 1874 the Buffalo Grape-Sugar Company was organized: it grew into a vast concern, and might be said to be the parent of the present industry.

In 1884 there were 29 factories engaged in the manufacture of sugar or syrup from corn and having a combined capacity for absorbing 40,000 bushels of corn per day. At present there are five factories which in 1902 used an average of 175,000 bushels of corn every day. Four of the five companies are constituent properties of the Corn Products Company. The other, the New York Glucose Company, Shadyside, N. J., is of recent construction and is the only independent establishment in the country. The authorized capital of the Corn Products Company is $80,000,000. The process of manufacture has been greatly improved, so much so that, while in 1882 26 to 30 pounds of glucose was obtained from one bushel of corn, 40 pounds is now obtained. Glucose forms one of the leading exports, besides being very extensively used by brewers, candy-makers, preservers, honey-dealers, and manufacturers of vinegar.

Manufacture, Composition, and Commercial Standard.— The manufacture requires 80 hours, and includes 18 processes of manipulating the corn and starch obtained therefrom: (1) steeping; (2) grinding; (3) separation of the starch; (4) cleaning the starch; (5) collecting the starch; (6) washing the starch; (7) conversion by the action of hydrochloric acid; (8) neutralization; (9) bag-filtration; (10) bleaching with acid; (11) bone-black filtration; (12) concentration; (13) second bag-filtration; (14) acid treatment; (15) second bone-black filtration; (16) final concentration; (17) final filtration; (18) final treatment. After the corn is steeped it is ground in water, and the wet starch separated and converted in copper converters by the action of hydrochloric acid, which is later neutralized by chalk or other alkali; subjected to filtration, then concentrated in a vacuum-pan until it tests 41° Baumé or higher, the difference being in the amount of water eliminated; the product, glucose, a liquid substance, or grape-sugar if the process of conversion is carried farther.

The following observations are taken from a paper on 'The Determination of Glucose,' by Edward Gudeman (1902), Bulletin No. 73, Bureau of Chemistry, United States Department of Agriculture. Glucose is a thick amber-colored syrup 41° to 45° Baumé, containing 13 to 22.5 per cent of water. Grape-sugar is a solid 41° to 45° Baumé, containing 11 to 21.0 per cent of water. The old standard Baumé scale is still used in this industry, and the determinations are made at 140° F., results reported at 100° F., a correction of one degree being made for every 40° F. The standard accepted by the manufacturers and the trade is specific gravity 1.41152 — 42° Baumé. The conversion of starch with acids gives the commercial products known as dextrin, glucose, grape-sugar, and anhydrous grape-sugar (dextrose). Starch and its conversion products do not contain over 1 per cent impurities.

"If the conversion of starch with acid is carried to a point where a dilute iodine solution will just give a distinct color-reaction, we have glucose; continued to where 95 per cent alcohol gives a faint cloud, hardly a precipitate, we have grape-sugar containing about 85 per cent reducing-substance. For still higher converted sugars a time-factor must be introduced. Carried beyond a given point, a back conversion takes place, with strong decomposition and loss of purity.

"The ratio of the reducing-substance to non-reducing substance depends on the accuracy in stopping the conversion, for neutralization, at the exact point decided upon. This ratio determines whether the product is glucose or grape-sugar, and no sharp dividing line exists. The rotating powers of glucose and grape-sugar depend absolutely on this ratio. Actually no two batches of commercial glucose or grape-sugar are identical; for all practical purposes they are alike, as a few points either way from the standard decided upon will make no difference in the appearance, taste, or working qualities of these products."

Non-crystallization.— Glucose does not crystallize, as does cane-sugar (sucrose). A chemical process was devised by Dr. Arno Behr for the crystallization of glucose, but it is regarded as impracticable by reason of being too expensive. Dr. Behr added to the liquid glucose a very small quantity of crystallized anhydrous dextrose. The mixture is filled into molds, and in 72 hours will be a solid mass of crystals of anhydrous dextrose. The blocks are next placed in a centrifugal machine to throw out the still liquid syrup, and the anhydrous dextrose remains as a crystalline mass.

Varieties of Use.— Because glucose does not crystallize it is used extensively in the preserving industry. Fruit put up in a syrup wholly or partially made of glucose has a more plump and natural appearance than if preserved in sugar. Comb-honey, when put into glass jars, is surrounded by glucose which does not change in color or character, and therefore the honey always remains pleasing to the eye. It is very largely used for mixing with cane-sugar molasses; in the manufacture of table-syrup; as a substitute for malt in brewing; and very freely in the manufacture of candy. It is said to have from one half to two thirds the sweetening power of cane-sugar. The extent to which glucose is used in the making of jams, jellies, marmalades, preserves, and canned fruit, together with tables showing the composition of commercial glucose and the composition of the ash of glucose, has recently (1902) been stated in Bulletin No. 66, Bureau of Chemistry, United States Department of Agriculture; also with extensive tables showing the composition of the jams and other preserves in comparison with such as contained no glucose. This bulletin was prepared under the direction of W. D. Bigelow, chief of food laboratory.

Glucose is very largely used in the manufacture of confectionery. Some candies are nearly all glucose, particularly such as are sold for a penny. In the high-grade confections the finest grade is used, not as a substitute for sugar, but in the place of cream of tartar to "kill" or soften the grain of sugar, for which purpose only a small quantity is used. It is also used as a substitute for malt in the brewing of ale or beer, it being claimed that a lighter beer results than when pure malt is used, and that it is more palatable. It is assumed that commercial glucose is the same as the glucose which comes from the action of diastase in changing the starch in malt into maltose sugar. By using glucose direct, trouble and expense are saved to the brewer, as he is not compelled to use cereals which are, in the process of the brew, converted into glucose or grape-sugar. It is claimed that 100 pounds of glucose or grape-sugar is equal to 123 pounds of barley-malt, and is much cheaper. Various publications of the United States Department of Agriculture and the reports of Congressional committees contain a great deal of information on the use of glucose in brewing.

The Wholesomeness of Glucose.— This is really the most important question connected with glucose, and one that is still unsettled. It is a problem for the physiologist rather than the chemist. Owing to many improvements made in the last 20 years, the conclusion rendered by the government's experts in 1884 could be made much more emphatic in 1903. It was as follows: "The starch-sugar thus made and sent into commerce is of exceptional purity and uniformity of composition, and contains no injurious substance. Though at best having only about two thirds the sweetening power of cane-sugar, yet starch-sugar is in no way inferior to cane-sugar in healthfulness, there being no evidence before the committee that maize starch-sugar, either in its normal condition or fermented, has any deleterious effect upon the system, even when taken in large quantities."

On the other hand, E. H. Bartley, M.D., professor of chemistry and toxicology in the Long Island College Hospital, in a paper read before the American Chemical Society, 12 Jan. 1895, claims that glucose promotes gastric disturbances. "The principal forms," he says, "in which sugar is presented to the stomach by nature's foods are either milk-sugar or cane-sugar. These sugars are very different in properties from dextrose, and require digestion before they can be used in the body. They are not capable of assimilation as such, and must be converted into a glucose before they can be used, and this is only done in the intestine. From this it would seem that it was not intended that dextrose and levulose should be taken in any considerable amount in our food. They are not natural, but artificial foods. . . . It is not a rare thing to find persons who can eat rock-candy or maple-sugar with no unpleasant after effects, but the same amount of ordinary glucose-candy will cause distress or produce what is known as 'bilious vomiting.'" Dr. Bartley adds that he has "known several cases of death produced in this way, and in every case it was with candy containing glucose." On 4 Sept. 1903 Dr. Bartley confirmed the statement quoted above, and expressed the opinion that "glucose is not a wholesome food," and that "much damage is done by a too free use of it. The fact is that diabetics lose flesh rapidly. I can therefore believe the statement that while we know that cane-sugar, maltose, and milk-sugar will fatten, glucose will not."

Other authorities give an opinion similar to that of Dr. Bartley: but doctors disagree, and some of them certify that glucose is pre-eminently a fat-forming, heat-producing food; not only not injurious, but an essential article of food, without which in some form man cannot enjoy life. Such statements are based on the theory that chemistry and nature work by identical methods and produce identical substances. Says Dr. Cyrus Edson of New York: "Chemistry has shown man how to imitate exactly the product of nature. The honey of the flower and numerous other products of nature's laboratory can not only be imitated by man, but exactly reproduced by him through the agency of chemistry."

Dr. H. W. Wiley, chief chemist of the United States Department of Agriculture, testified before a committee of the United States Senate as follows: "I have had occasion to make careful examinations of almost every variety of food that has ever been exposed upon our markets for sale. In my opinion glucose is not deleterious to health. It is wholesome, somewhat sweet, readily digested. I have always found, from the time I first began to investigate food products, that the series of foods known as glucose or grape-sugar, when properly made, are valuable food material and not injurious."

The settlement of the vexed question of the wholesomeness of glucose, and its dietetic value as compared with cane-sugar, may be left to the physiologists. It is sufficient to add here that at least $50,000,000 is at present employed in its manufacture; that the industry is a great boon to the farmer, and adds materially to the revenue of the corn-producer; that official figures indicate that 1,200,000,000 pounds of cereal sugar and cereal syrup are annually consumed in the United States, while the foreign demand for them is constantly growing; that the exports of glucose or grape-sugar more than doubled from 1893 to 1901, rising from 101,546,814 pounds to 204,209,974 pounds; that in seven months of 1903 they reached 91,267,920 pounds, valued at $1,727,969, or 1.9 cents per pound; and that during 10 years, 1893–1903, the total exports were 1,708,201,551 pounds, valued at $28,139,768, or 1.06 cents per pound.

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F. N. Barrett,
Of the 'American Grocer,' New York.

Glucosides, gloo'kō-sīdz, a large class of substances occurring in plants, which are distinguished by decomposing under the influence of ferments, acids, and alkalies into sugar and usually one other substance the nature of which differs with different plants. The composition of the glucosides varies, sometimes nitrogen is present, but in general the compound consists only of carbon, hydrogen, and oxygen. Their constitution is practically unknown; they have never been formed synthetically; only a few seem to be of the nature of compound ethers. When decomposed by the agents above mentioned they assimilate water, and usually yield glucose or dextrose, but some glucosides furnish other kinds of sugar. Of these naturally occurring compounds may be mentioned æsculin, colocynthin, which yields sugar and colocynthein; convallarin; convolvulin; crocin; daphnin; datiscin; digitalin; euxanthic acid; fraxin; gallotannic acid or tannin; glycyrrhizin; jalappin; phloridzin; populin; quercitrin; salicin; scammony; and xanthorhamnin. The following contain nitrogen; amygdalin; chitin; gelatin or isinglass, which when boiled for a long time with dilute sulphuric acid decomposes and yields a sugar; solanin; and myronic acid, in which sulphur is also present. The majority of these bodies are described under their respective heads. Amygdalin (q.v.) was the first known glucoside.

Glue, an impure gelatine, used as an adhesive, and commonly prepared from the clippings of hides, hoofs, horns, and sinews. These are steeped in lime-water, to remove the hair and blood, and then drained and dried in a current of air, that the lime may absorb carbonic acid, and thus prevent the injurious effects of the alkali upon the gelatine. The clippings are then boiled in water until the solution is found to gelatinize firmly on cooling. The impurities are allowed to settle, and the residuum to gelatinize in shallow wooden boxes; it is then cut into slices and dried upon nets. Good glue is semi-transparent, and free from spots and clouds. Marine glue, a composition used for cementing materials that are exposed to moisture, is made by dissolving 1 part of india-rubber in 12 parts of mineral naphtha, and adding 20 parts of powdered shellac; it resists wet, and cements glass and metals as well as wood. White fish-glue, or diamond cement, is made of isinglass dissolved in alcohol.

The glue industry in the United States was founded by Peter Cooper in 1827, when he established a factory in Brooklyn. About the same time a factory in Philadelphia was started by Charles Baeder and William Adamson. At present glue factories are centralizing near the great slaughter-houses of the Middle West, the sources of raw supplies, and the larger packing concerns, notably the Armours and the Swifts in Chicago and the Cudahy Company in Omaha, have their own glue plants. (See Packing Industry.) The factories still in the East are largely supplied with imported hides. The export trade is steadily growing and has passed the $500,000 mark per annum. France alone surpasses America in the quality of its finer glues, and these are imported for use in making straw hats. The finest glues made in the United States are prepared from sinews, and it is likely that continual experiment upon them will result in a product equal to the best imported from France. The following statistics show the growth of the industry since 1880:

GLUE FACTORIES IN THE UNITED STATES, 1880-1900.

	1880	1890	1900
Number of establishments	82	62	61
Capital	$3,916,750	$4,859,266	$6,144,407
Wage earners	1,801	1,697	1,618
Wages	$600,018	$676,089	$685,096
Cost of materials	$2,786,342	$2,510,927	$3,767,023
Value of products	$4,324,072	$4,270,460	$5,389,006

Glut-herring, or Blueback, a herring (*Pomolobus æstivalis*), abundant in the Southern States, and very similar to the alewife (q.v.), but it is more elongated, is darker on the back and has a black peritoneum and comparatively small eyes. The quality of its flesh is poor.

Gluten (Lat., glue), that constituent element in the vegetable kingdom which makes muscle and builds tissue. It is a combination of two substances, glutenin and gliadin, the latter forming about two thirds, the former one third, as found in wheat. It is a variable constituent of cereals that is now separated from the grain and used for human food and animal feeds. It has been designated as the spinal column in all vegetable life, and is a nitrogenous substance, belonging to the albuminoids, such as the white of egg, the lean of meat, etc. The "hard" wheats are richer in gluten than the "soft" varieties, and the gluten obtained from wheat is of higher dietetic value than the gluten of corn or rye, the latter being soft and of peculiar odor.

To obtain gluten from wheat, the grain is reduced to dough, and the starch removed by mechanical processes, the resultant product being a grayish, tough, elastic, sticky substance which, when produced in its purity and rightly proportioned in its gliadin-glutenin content, is capable of being drawn out into long bands or shreds.

In its highest refinement, gluten exhibits a fine molecular structure, delicate and sensitive to atmospheric conditions, and requires, after separation, immediate handling in its preparation for food.

About 16 pounds of gluten is obtained from 200 pounds of wheat-flour. On account of its high content of nitrogen, gluten soon deliquesces, sours and spoils after the separation from the starch, and demands an immediate treatment if desired for food purposes.

There is great variation in the character of the so-called gluten foods on the market, some of which are almost worthless and a fraud upon the public. Analyses made by the United States Department of Agriculture, by the Maine agricultural experiment station, and other agricultural stations, the results of which may be found in various bulletins issued by these organizations, show that many of the so-called glutens generally found on the market are scarcely better than ordinary white flour or bread.

The glutinous and other residues from the manufacture of starch and glucose are dried and made into cattle-feed, having a nutritive value about equal to brewer's grains. The glucose and starch makers assume that maize or corn consists of starch, gluten, germ, and bran, all but the starch being by-products, which are separated by injurious mechanical processes. The wet or free germs of the corn are dried, ground to meal, the oil extracted by hydraulic pressure, leaving oil-cake, a cattle-feed extensively used. The wet starch is run over vibratory sieves and over long wooden tables, the starch and gluten forming the mixture which passes through the sieves; the starch being deposited by gravity, the gluten passes off at the ends of the tables, forming wet gluten, which, when pressed and dried, constitutes the gluten-meal of commerce. About 5½ pounds is obtained from one bushel of corn.

The composition of gluten-meal is, protein 38 per cent, fat 3 per cent, and starch 40 per cent. This is one of the richest and best food products on the market. The nutritive value is very high, and the factor of digestibility ranges from 92 to 96 per cent. The gluten-meal is treated for the recovery of its starch, and gives two new products, a concentrated foodstuff, characterized by the large amount of proteids (60-70 per cent) it contains, and a maltose syrup. This foodstuff is suitable for animal consumption, and also for raising the percentage of proteids in feeds that have a small amount of these substances. When the wet bran and the wet gluten are mixed in the proportions as obtained from the original corn and the mixture dried, the resulting feed is known as gluten. This is the most common food product in the starch and glucose industry, and represents about 80 per cent of the food output. Its feeding value is very high, and its digestibility above 90 per cent. Its composition is about 28 per cent protein and 3 per cent fat.

Corn oil cake and gluten-meal are exported extensively. The bran and gluten feed is used almost exclusively in the United States. The production per bushel of corn is about 12½ pounds of food.

The New York agricultural experiment station Bulletin No. 198, November 1901, gives the result of analyses of feeding stuffs. The gluten-feed was of sorts ranging in price from $19 to $22 per ton. They show a protein content of from 14.8 per cent to 28.7 per cent; fat, 2.4 per cent to 5.6 per cent; some contained as high as 11.7 per cent crude fibre. Gluten-feed, made in Buffalo, from 24.9 per cent to 27.4 per cent of protein, sold under guarantee of 28 per cent; fat, 2.7 per cent to 4.2 per cent, sold under guarantee 3.3 per cent. Prices, $20 to $21 per ton. Gluten-meal, made in Chicago, 36.8 per cent to 39.1 per cent protein; 3.0 to 4.8 per cent fat; price $24 to $25 per ton.

The waste product in the manufacture of starch or sugar is relatively much richer in oil and protein than is corn. Most factories are removing part of the corn-oil from the waste, so that nearly all the gluten-meals carry much less oil than they did a few years ago. Gluten-feeds differ from gluten-meals in that they contain a good deal of the corn-bran, and hence less of protein and digestible carbohydrates, and more of the indigestible woody fibre. The relation of gluten to bread making is set forth in detail in Bulletin No. 67, United States Department of Agriculture. The food value of gum-gluten has been outlined by Prof. Nelson Clark Parshall in a pamphlet published by the Pure Gluten Food Company, New York.

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Glut'ton (*Gulo*), a genus of carnivorous quadrupeds related to the sables and martens, but larger and distinguished by the moderately elongated head and the long, rather low body. Intermediate between the plantigrades and digitigrades, it has rounded, very short ears, and a simple fold below the tail, which distinguishes it from the badger, which is pouched and which the glutton otherwise resembles. The commonest species in America is the *Gulo borealis* or *luscus*, better known as the wolverine; it is about 28 inches from the tip of the nose to the root of the tail, which is about 8 inches long, if the hair at the extremity, 3 or 4 inches long, be included. The body is covered with thick, long hair. In summer its coloring is: face blackish as high as the eyebrows, and between these and the ears whitish or brownish; ears covered with coarse hairs; the lower jaw and the inside of the fore legs spotted with white; the back, thighs, and belly, brown or brownish black; sides, chestnut color. Its fur is of value and is used in northern Asia, where the wolverine is a native, for making and ornamenting robes. The animal, however, does not breed in sufficient numbers to furnish much fur to the traders. It is very voracious — although more so in fable and legend than in actual fact — at the same time slow and heavy in its motions, but remarkably acute in sight and hearing. It is of powerful frame, a match for any animal of its own size, and makes a strong resistance when attacked. It is one of the most destructive quadrupeds found in the northern part of America, killing numbers of young foxes and other animals; it is also a great enemy to beavers, watching for them as they come out into the open, or even breaking into their habitations.

Glycerin, glĭs'ē-rĭn, or **Glycerol**. In 1783 Scheele showed that by acting upon olive oil by oxid of lead a substance may be obtained which has a sweetish taste; and in the following year he showed that the same substance may be had by acting in a similar manner upon other oils and fats, such as butter. He also observed that the substance in question may be obtained in the form of a syrupy fluid: that although it has a sweetish taste like sugar, it cannot be fermented; and that although it gives oxalic acid by oxidation, it differs from sugar in many respects. He failed, however, to ascertain its true relation to the oils which furnish it, and to the lead plaster (or «lead soap») which accompanies its formation. The true explanation of the reactions was given some 30 years later by Chevreul, as a result of his famous researches upon the animal fats, which were begun about 1811, and were concluded about 1823. In the course of these researches Chevreul showed that an animal fat consists, in general, of a mixture of several definite chemical substances, each of which is itself a fat, and each of which consists of Scheele's sweetish substance (which is now called «glycerin»), combined with an organic acid. When the fat is treated with an alkali, or with lime or oxid of lead, the organic acid that is present combines with the alkali, or the lime, or the lead, to produce a new substance called a «soap,» the organic base (glycerin) which was previously combined with the acid being thereby set free. Since the time of Scheele and Chevreul much attention has been paid to glycerin and its compounds, and it is now universally agreed that glycerin is a triatomic alcohol (see ALCOHOL), having the formula $C_3H_5(OH)_3$; and that it forms an acid and an oxid, and various substitution compounds and esters, of which latter class the fats (q.v.) are the most important members, and are distinguished by the name of «glycerides.»

Glycerin sometimes occurs in nature in the uncombined form, notably as a constituent of palm-oil, and it is also a product of fermentation; but it is obtained on the large scale only by the decomposition of the fats. In soap making the fat is decomposed by heating with an alkali, the soap which is formed by the combination of the alkali with the organic acid of the fat remaining in solution until it is precipitated by the addition of common salt. The fluid that remains after the soap has been so precipitated contains the liberated glycerin, which can be separated by distilling in a partially exhausted boiler, the glycerin passing over with the water vapor, from which it may be subsequently separated by re-evaporation.

Glycerin is obtained in large quantities as a by-product in the manufacture of so-called «stearin» candles. In this case the fat is not saponified by an alkali, but beef fat, or some other fat that is rich in stearin, is acted upon by superheated steam, by which the stearin, or stearate of glycerin, is resolved into free stearic acid and free glycerin. Fat undergoes a similar transformation when treated with a mineral acid; but this method of producing glycerin has the disadvantage that the mineral acid is likely to combine to a certain extent, either with the glycerin, or with the liberated fatty acid, necessitating a subsequent treatment for its removal.

Pure glycerin is a colorless, odorless, syrupy liquid, with a pronounced sweet taste, and a specific gravity of about 1.27. It is insoluble in ether, but it mixes in all proportions with water and with alcohol. It has a considerable affinity for water, and absorbs moisture from the air quite readily. It boils at about 600° F., but with partial decomposition. Under reduced pressures it boils at lower temperatures. At a pressure of 12.5 millimetres of mercury, for example, it boils at 356° F., and may be distilled without change. By freezing, absolutely pure glycerin may be obtained in the form of deliquescent crystals, belonging to the trimetric system, and melting at about 68° F. Glycerin burns with an almost colorless flame, and dissolves many organic bodies that are insoluble in water. It also dissolves iodine, and many of the metallic oxids.

The solvent properties of glycerin render it valuable in pharmacy. It is also greatly used in the manufacture of nitroglycerin (q.v.), as a constituent of various toilet soaps, creams, and washes, as a preservative medium, and for use in gas meters and other mechanical appliances in which a liquid is needed which will not readily freeze nor evaporate.

Glycin, glī sĭn. See GLYCOCOLL.

Glycocholic (glī-kō-kŏl'ĭk) **Acid**, an organic acid, whose sodium salt is one of the main constituents of the bile of certain of the vertebrates. It may be most conveniently prepared by the following method: A drop of hydrochloric acid is added to fresh bile, and the mixture is shaken and filtered. The filtrate is allowed to stand after being shaken with hydrochloric acid and ether, until the glycocholic acid separates in the form of a bulky mass of needle-like crystals. These are collected upon a filter, washed with water containing hydrochloric acid and ether, and finally purified by recrystallization. Glycocholic acid is slightly sweet and bitter in its aqueous solution. It is readily soluble in alcohol, but dissolves sparingly in water, ether, and other solvents. It forms numerous salts, known as glycocholates, which are all soluble in alcohol. Those of the alkalis are also soluble in water, and yield lathers, like soap. Glycocholic acid has the formula $C_{26}H_{43}NO_6$, and when heated with potash it is resolved into cholic acid ($C_{24}H_{40}O_5$) and glycocoll ($C_2H_5NO_2$), apparently according to the equation $C_{26}H_{43}NO_6 + H_2O = C_{24}H_{40}O_5 + C_2H_5NO_2$.

Glycocoll, glī'kō-kŏl, **Glycin, Glycocin, Amido-Acetic Acid**, or **Gelatin Sugar**, a singular chemical substance obtained by heating glycocholic acid (q.v.) with an alkali, or by the long-continued boiling of gelatin, glue, or gelatinous tissues, with sulphuric acid, or with potash or baryta. When perfectly pure it crystallizes in tabular, monoclinic crystals; but slight quantities of certain impurities induce remarkable changes in its crystalline form. It is insoluble in alcohol and in ether, but is sparingly soluble in water, its solution having a sweet taste. According to its mode of formation from glue, glycocoll is a sugar, the glue acting the part of a glucoside; but it resembles an acid (although it is neutral to litmus paper) inasmuch as it combines with metallic oxids to form salts. It does not form salts with the metals of the alkalis, and probably not with those of the alkaline earths. In combining with acids, glycocoll acts as a base, forming definite salts such as the nitrate, acetate, oxalate, sulphate, and hydrochlorid. In these compounds the glycocoll has strongly basic properties, and, indeed, it is usually described as a base. The chemical formula of glycocoll is $C_2H_5NO_2$; or $CH_2(NH_2).COOH$.

Glycogen, glī'kō-jĕn ($C_6H_{10}O_5$), animal starch, a substance found in the livers of most animals, and to a very large extent in the muscles and other parts of fœtal animals. It is extracted from the liver of a newly killed animal by cutting the liver in pieces, plunging it into boiling water, triturating it to a fine paste, and extracting with water. The filtered fluid is mixed with moderately strong alcohol, which throws down a flocky precipitate. This is purified from coloring and nitrogenous matter, and at last the glycogen is obtained as an amorphous white powder, without taste or smell. It dissolves in water, but the solution is not absolutely clear; it is insoluble in alcohol. By boiling with acids, or by the action of ferments, glycogen is readily converted into sugar. By nitric acid it yields oxalic acid. The chief interest attaches to the physiological function of this substance, and the very discordant views taken with regard to it by different writers. Thus it is said to be the substance in the liver mainly concerned in the conversion of starch into sugar. Other physiologists affirm that no such transformation takes place, there being no proof of the increase of sugar after the action of the liver; so that at the present time its exact functions are unknown. It has been suggested that the sugars that are taken into the system with the food are stored up in the liver in the form of glycogen, to be drawn upon subsequently, according to the needs of the system.

Glycol, or **Ethylene Alcohol**, the most important of the dihydric alcohols (see Alcohol and Fatty Compounds) may be regarded as derived from the hydrocarbon ethane, C_2H_6, by the substitution of two molecules of hydroxyl (OH) for two molecules of hydrogen. It therefore has the formula $C_2H_4(OH)_2$. Glycol may be prepared by acting upon ethylene dibromide, $C_2H_4Br_2$, by potassium carbonate, K_2CO_3. The reaction is $C_2H_4Br_2 + K_2CO_3 + H_2O = C_2H_4(OH)_2 + 2KBr + CO_2$. Glycol is a colorless, odorless liquid, having a specific gravity of about 1.12, and a sweetish taste. It boils at about 388° F., and solidifies at 11° F. It mixes in all proportions with water and alcohol, and is used to some extent as a solvent. A great many compounds have been derived from glycol, but they are not of general interest. The word "glycol" is also used as a generic name for all the dihydric alcohols.

Glycollic (glī-kŏl'ĭk) **Acid**, or **Oxyacetic Acid**, an organic acid having the formula $HO.CH_2.COOH$, whose potassium salt (that is, potassium glycollate) exists in the grease obtained from sheep's wool, and in the juice of unripe grapes. It may be prepared by heating a mixture of glycerin, water, calcium hydrate, and precipitated silver oxid for four hours, after which the fluid is filtered, saturated with carbon dioxid, boiled, filtered again, and finally evaporated until calcium glycollate crystallizes out. The calcium glycollate is next decomposed by oxalic acid, and the filtered solution is neutralized with carbonate of lead. Upon evaporation, well-developed crystals of lead glycollate separate out; and a solution of these, when treated with the proper amount of sulphuric acid, yields free glycollic acid. By evaporation in a vacuum over concentrated sulphuric acid, and subsequent recrystallization from solution in anhydrous ether, the acid may be obtained in a very pure form. It is freely soluble in water, in alcohol, and in ether. Concentrated nitric acid oxidizes it to oxalic acid; and when distilled with excess of quicklime it decomposes with liberation of methane and hydrogen. Glycollic acid forms an extensive series of salts called glycollates, and it also yields numerous esters and other organic derivatives.

Gly'cosides, a class of vegetable principles which under the influences of heat, enzymes, or chemical action split into some form of sugar and some other body. Those glycosides which split into sugar and some other body are known as glucosides. When the sugar is rhamnose they are known as rhamnosides; if arabinose, they are known as arabinosides, etc. There are a great many glycosides in nature, and within recent years a large number have been made artificially. The chemical composition of the artificial glycosides is well understood, since they are the result of synthesis, but the make-up of the natural glycosides is not well understood. Glycosides play a very important role in nature. By reason of their bitterness and of their often being poisonous, they preserve seeds from destruction by animals, man included, until they shall have ripened, and then on germination plant enzymes or ferments acting on the glycosides set free a certain amount of sugar, which is of much service to the young developing plant. An excellent illustration of their protective qualities is seen in persimmons, which, when green, are so puckery by reason of the glycoside tannic acid that they are left severely alone. When ripe, however, the tannic acid is converted largely into sugar, and the fruit, then eaten and carried about by animals, can distribute its seed. In wild-cherry bark and in bitter almonds there is a glycoside amygdalin which is converted into sugar and hydrocyanic acid. In mustard the glycoside sinagrin acted upon by the plant ferment also found in the seed develops into sugar and the volatile oil of mustard plaster. Many fungi are capable of accompanied by its special ferment. Many glycosides are affected by heat. Some are split by cooking in water, but a boiling temperature is apt to destroy the action in many. Thus it is necessary to use cold water if one desires to obtain the volatile oil of mustard in making a mustard plaster. Many fungi are capable of breaking down glycosides, which fact is of a great deal of practical importance in medicine, for many active remedies which contain glycosides, if kept too long on the druggist's shelf, develop molds within them. These destroy the active principle of the drug and thus render it useless. In medicine the most important glycoside containing drugs belongs to what is known as the "digitalis group." Thus digitalis contains four or five, strophanthus two, apocynum two, and squills the same number. These bodies are all heart tonics in small doses and heart poisons in larger amounts. Consult Van Rijn, 'Die Glycoside' (1900).

Glycosuria, the presence of glucose in the urine. See Diabetes Mellitus.

Glycyrrhizin, glĭs-ĭ-rī'zĭn, or **Liquorice Sugar,** a peculiar organic substance which occurs in liquorice root (*Radix Glycyrrhizæ*), together with starch, malic acid, and various other matters. It may be prepared by extracting the dried and pulverized liquorice root with boiling water containing a small quantity of milk of lime, and precipitating the concentrated extract with cold acetic acid. The gelatinous precipitate is purified by dissolving it in 50 per cent alcohol, filtering through charcoal, and finally evaporating at 212° F. When dry, glycyrrhizin is an amorphous solid, which swells up in cold water but does not dissolve. It is only slightly soluble in alcohol or ether, but dissolves in hot water, and also in boiling glacial acetic acid. It reduces Fehling's solution when heated, and has been regarded as a glucoside; but although boiling with dilute acids decomposes it, it does not appear that any glucose or other sugar is formed, the chief products of the decomposition being parasaccharic acid and a brownish resin called glycyrrhetin. Glycyrrhizin is now more commonly regarded as a tribasic organic acid, and the name "glycyrrhizic acid" has been assigned to it. It has the probable formula $C_{44}H_{63}NO_{18}$, and forms numerous salts, which mostly have a sweet taste.

Glyoxal'ic Acid. See Glyoxylic Acid.

Glyox'aline, a substance having the chemical formula $C_3H_4N_2$, and prepared by acting slowly upon cold glyoxal with strong ammonia in slight excess. Glycosine is thrown down as a precipitate, and the filtrate, which contains glyoxaline, is boiled with milk of lime (to expel the ammonia), after which it is evaporated to a syrupy consistency, treated with absolute alcohol, and filtered. The liquid so obtained is distilled, yielding pure glyoxaline in a crystalline mass of dazzling whiteness. Glyoxaline melts at 192° F., and boils at 491° F. It is freely soluble in water, alcohol, and ether, and has an alkaline reaction. It acts as a base, and forms salts. It is also the starting point for a series of organic compounds of analogous composi-glycollate and calcium oxalate.

Glyoxyl'ic or **Glyoxalic Acid,** an organic acid having the formula H.CO.COOH, and existing in the unripe fruits of many plants. It may be prepared (along with glyoxal) by oxidizing alcohol with nitric acid. It is a thick, syrupy liquid having a specific gravity of about 1.3, and when allowed to stand over concentrated sulphuric acid it crystallizes in trimetric prisms containing water. Glyoxylic acid is very soluble in water, and can be distilled in a current of steam. It is a monobasic acid, forming crystalline salts called glyoxylates. By oxidizing agents it is converted into oxalic acid; by nascent hydrogen it is reduced to glycollic acid. It has also the properties of an aldehyde, reducing ammoniacal solutions of silver salts, forming a metallic mirror; also unites with alkaline bisulphites. Glyoxylic acid, when boiled with excess of lime water, yields calcium glycollate and calcium oxalate.

Glyp'todon, the typical genus of the extinct glyptodontia, or tortoise-armadillos, of South America. The back was covered by a solid bony carapace, without any movable rings such as the armadillo possesses, so that the animal was unable to roll up into a ball for protection; but the tail was protected by a succession of overlapping bony rings, and the head by a stout bony casque, while there was usually more or less armor on the under side of the body. The legs and feet were short and stout, and had hoofs on the toes instead of claws. The animal was 10 to 12 feet in length.

Gmeiner, John, American Roman Catholic clergyman: b. Barnau, Bavaria, 5 Dec. 1847. He studied at St. Francis' Seminary, Milwaukee, Wis., was ordained priest in 1870, was professor in the seminary, and later in St. Thomas' Seminary, St. Paul, Minn. In 1899 he became rector of St. Francis' Church, Buffalo, Minn. In 1893 he addressed the World's Parliament of Religions at Chicago on "The Primitive and Prospective Religious Unity of Mankind." His published writings include the volumes: 'Modern Scientific Views and Christian Doctrine Compared'; 'Emmanuel: the Saviour of the World'; 'Mediæval and Modern Cosmology.'

Gmel'inite, mĕl'-ĭ-nīt (for Prof. Charles Gmelin), a native hydrous silicate of aluminum, calcium and sodium, crystallizing in the rhombohedral system, usually with a hexagonal aspect. It is colorless or white, often with tinges of yellow, green or red, and transparent to translucent, with a vitreous lustre. It is brittle, with a hardness of 4.5 and a specific gravity of about 2.1. It loses much of its water of crystallization when heated in a closed tube, and dissolves in hydrochloric acid, with separation of free silica. Gmelinite occurs in the Harz Mountains, in Cyprus, and in parts of Italy and Ireland. It is also found at Cape Blomidon and at other points along the coast of Nova Scotia, and fine white crystals of it occur at Bergen Hill, N. J. The mineral was formerly called "hydrolite."

Gnadenhütten, gnā'dĕn-hüt-tĕn, **Massacre at.** For the westward retreat of the Delawares, and their partial conversion to Christianity by the Moravians, see their name. In 1772 their Great Council settled the Christian Indians on the Muskingum in three villages, Salem, Schönbrunn, and Gnadenhütten (Tabernacles of Grace), the latter being that of the Delawares. Through the Revolution these Indians as a body took no part in warfare, quietly cultivating their farms; but some of the younger ones joined the war-bands, which forced the Moravian villages to give them supplies and shelter. The whites were wrought up to frenzy by their atrocities, in which they accused the Christian Indians of being secret participants; and in 1781 a successful foray against the hostiles was only prevented from involving the Moravians by the efforts of Col. Brodhead. But the first blow against them was struck by the wild Indians and British. In the fall of 1781 Capt. Matthew Elliott, under orders from the British commandant at Detroit, with a body of white rangers and a miscellaneous horde of Indians from a half-dozen different tribes, forced them to leave their villages, which were half destroyed; the missionaries were taken to Detroit, and the Christian Indians left on the Sandusky plains, where the wild Indians would have massacred them but for the English. A few escaped and returned to the villages; they were captured by the Americans under Williamson, and taken to Fort Pitt, whose commandant, Gibson, their firm friend and attempted protector, sent them back to the villages unharmed. During the winter the rest suffered much from cold and hunger around Sandusky, and by the spring of 1782 some 150 had returned to the villages. Meantime the fiendish Indian outrages were going on; the borderers accused the Moravians of being privy to them, and denounced Gibson and Williamson for letting them go; and after a woman and child had been impaled alive by an Indian gang, who afterward refreshed themselves among the Moravians, the whites formed a party of near a hundred under Williamson to exterminate the latter. In March they gathered those in Salem and Gnadenhütten into two houses at the latter — those at Schönbrunn had been warned and escaped — under promises of good treatment; a council was held, at which 18 protested against the contemplated murder and withdrew, taking an Indian lad with them; the rest went in and killed the 96 inmates, after the latter had prayed and kissed each other farewell, only two other boys escaping. The best men of the borders denounced the cowardly butchery in unsparing language.

Gnat, năt, a somewhat indefinite term applied to various forms of small two-winged flies, especially those annoying to man and domestic animals. In England mosquitoes are known as "gnats," but in America the term is more restricted to species of the genus *Simulium*, known also as "buffalo gnats," "black-flies," and "turkey gnats," or midges. One of the most remarkable of these species on account of its minute size is the so-called punky or "no see um" of northern woods. The buffalo gnat is quite as bloodthirsty as the mosquito, but is most annoying to domestic animals, including poultry, which are frequently worried to death by swarms of it. These gnats differ from mosquitoes in that they are diurnal, while the latter normally fly by night. The larvæ of most of the gnats, with the exception of the gall and fungus gnats (qq.v.), are aquatic and do no harm in this stage. There is also a distinctive form of gnats which occur throughout our country, but reach their highest development in the Gulf States. The common species are *Hippelates flavipes* and *H. plebejus*, which in Florida occur in great numbers, and are the direct cause of the disease "sore eye" which from time to time becomes epidemic in the rural districts.

Gnat-catcher, or Gnat-snapper, any of various little birds that snap up minute insects on the wing. Specifically, in the United States, a small bluish-gray flycatcher (*Golioptila cærulea*), common from Maryland southward, and noted for the exquisite finish of its soft, lichen-covered nest, saddled upon a horizontal tree-limb. See Maynard, 'Birds of Florida' (1872).

Gnathobdellida, năth-ŏb-dĕl'ĭ-da, an order of leeches (q.v.), distinguished by the absence of a proboscis.

Gneiss, nīs, a metamorphic rock, consisting of orthoclase, quartz, and mica. It is akin to mica schist, but contains more orthoclase and less mica; it has the same components as granite, but is stratified or foliated. The geological genesis of gneiss is obscure. One theory is that gneiss is the result of the metamorphosis of sedimentary rocks; on this hypothesis gneiss is closely related to conglomerate, which is a mixture of sedimentary pebbles and fine grains resulting from the action of water, while gneiss owes its stratified form to other causes. In some cases this sedimentary theory may hold, but in others it is evident that gneiss is the production of eruptive forces, occurring, as it does, in purely igneous rocks. In the United States gneiss, in the ordinary usage of the term, is common, notably in New England and New York, the strata running northeast and southwest. It abounds in the mountains of central and northwestern Europe and in the ranges of South America. Gneiss is used as a building stone and for flagging.

Gnomé, nō-mā (Gr. "judgment," "adage"), a short, pithy saying, often expressed in figurative language, containing a reflection, a practical observation, or a maxim. Gnomés are a common form of early literature. In religious literature the proverbs of Solomon, those of Jesus, son of Sirach, and the sermon on the mount, are examples. The Sæmundian Edda has preserved excellent proverbs whose authorship is attributed to Odin. The word generally connotes Greek maxims or monitions, and Theognis, Phocylides, and others, are called the Gnomic poets, from their excellence in this sententious manner of writing.

Gnome (nōm) **Owl**, one of the burrowing or "elf" owls of the American plains: specifically, *Glaucidium gnoma*.

Gnomes, in European folk-lore, spirits which dwell in the interior of the earth, where they watch over hidden treasure, and hence are the patrons of miners. Ugliness is their appropriate quality, though the females, gnomides, are beautiful. Among them all Rubezahl (Number-nip) has obtained, by means of Musäus' popular tales, the greatest celebrity in Germany. The native country of these poetical beings is the East, whence they were introduced into Europe between the middle of the 15th and the beginning of the 16th century by the cultivators of cabalistic philosophy, Pico of Mirandola, Marsilius Ficinus, Paracelsus, Cardanus, and Reuchlin. The gnomes make a part of Pope's machinery in the 'Rape of the Lock.'

Gnomon, nō'mŏn, an astronomical instrument for measuring the altitudes and declinations of the sun and stars. It is usually a pillar or pyramid, erected upon level ground or on a pavement, and is especially used for making the more important observations. Many have preferred it to the smaller quadrants, both as more accurate and more easily made and applied. The most ancient observation of this kind extant is that made by Pytheas, in the time of Alexander the Great, at Marseilles, where he found the height of the gnomon was in proportion to the meridian shadow at the summer solstice, as 213½ to 600. This method of observation was by no means accurate in ancient times, since observers did not take into account the sun's parallax, which makes his apparent altitude less than it would be if the gnomon were placed at the centre of the earth; they also neglected refraction, by which the apparent height of the sun is somewhat increased; and made their calculations as if the shadows were terminated by a ray coming from the sun's centre; whereas it is bounded by one coming from the upper edge of his limb. These errors, however, may be easily allowed for; and, when this has been done, the ancient observations are generally found to coincide nearly with those of the moderns.

Gnomon, in geometry, is the space included between the lines forming two similar parallelograms usually squares, of which the smaller is inscribed within the larger, so as to have one angle in each common to both. For the gnomon of a dial see DIAL.

Gnossus. See CNOSSUS.

Gnosticism, nŏs'tĭ-sĭzm (Gr. γνῶσις, knowledge; γνωστικός, devoted to knowledge), the teaching of various sects in the first Christian century, who hovered on the borderland between Christianity and heathen thought. The systems they founded attempted to grapple with the most profound problems of philosophy, such as the creation of the world and the origin of evil. They taught that a series of divine emanations connected the Supreme Being with the visible universe: that human nature was dual, and that the acts of the body had no influence on the spirit. They blent their ideas of Christian truth with pagan and Jewish elements, or even with those received from the common belief in magic. They taught that the earthly life of Christ was unreal, that is, he was a phantom and incorporeal, and they held that knowledge (γνῶσις) as they possessed it, was superior to faith.

Thus there was a general tendency to trace the same religious idea through different mythologies (which were held to be the popular expression of religious ideas originally revealed), and the new religion which aimed at the redemption of the whole world was eagerly seized on as the embodiment of their unifying principle. Christianity was believed to be the full revelation of the deeper truth embedded in all the nature-religions. By adapting their presentation of Christianity to the form of the ancient mysteries the Gnostic teachers the more easily fastened themselves upon the Christian congregations, and succeeded in taking up a position within them as specially initiated persons, for which they found a natural support in the prevalent ascetic views and the powerful influence of free prophecy. But these were in time forced to separate themselves, and form sects, whose great diversity becoming the more apparent greatly counteracted the influence of the Gnostic leaven in the Christian communities. To maintain their theories in the face of the traditional doctrine of the churches they had recourse to the sources of that doctrine. They claimed to have special traditions from certain of Christ's disciples, and applied their exegetical skill to the allegorical interpretation of the written monuments of the apostolic age. Marcion (about 150), believing himself to be a consistent follower of Paul, rejected the authority of the earliest apostles, as well as the gospels emanating from the circles of their influence, and professed to hold "the gospel" known to Paul only. His collection of 10 epistles of Paul was the first attempt to fix the canon of the apostolic Scriptures. Such arbitrary treatment of the Scriptures led the Church to resort to a more through study of the historical tradition. In the struggle with Gnosticism it obtained a firm hold of the principle that that alone is to be held true Christianity which can be shown to be historically derived from Christ and his apostles, and it found the only means to check the license of Gnostic speculation in the development of a Christian theology in accordance with the positive character of historical Christianity.

The general principles of Gnostic thought may be here summarized, as fuller accounts of the principal schools are given under their own names or under those of their founders. For the practical doctrine of the redemption of men's souls from sin by Jesus Christ the Gnostics substituted a speculative doctrine of the redemption of the human spirit from matter by religious knowledge. The realistic eschatology of the primitive Church they entirely set aside. The evangelic element in their teaching was obscured by a cloud of heathen mythologies and philosophic subtleties. The Divine Demiurgos and Lawgiver of the Old Testament was distinguished from the Supreme Being, and the Hebrew idea of creation was superseded by that of a continuous process of emanations from the divine first cause. The present world was believed to be the result of a catastrophe in which the spirit fell under the power of matter, or of an original destiny that powers hostile to God should bring into existence a world in which the spirit born of God should be held in unwilling estrangement from him. All the Gnostic systems are more or less dualistic. In these dualistic theories a philosophical foundation was secured which was by the Gnostics developed to an extreme. The highest duty of man was to become united to the First Source of Spirit through *gnosis* and the absolute alienation of the human spirit from the body. Others, like Carpocrates and his son Epiphanes, expressed their contempt for the flesh and the ordinances of the Demiurgos in unbridled license. The contrasts of the flesh and the spirit and of the world and the kingdom of God are interpreted as the physical conflict of vast cosmic forces.

and are thereby stripped of their moral and religious significance. The intervention of Christ is the crisis, not only of the religious history of mankind, but of the whole development of the universe. As the final and perfect Æon he is distinguished from his visible manifestation. This is held to be (1) a real human life with which he was connected for a time, or (2) a heavenly or "psychical" creation, or (3) a mere phantasm. Men are divided into two classes: the Pneumatic or "spiritual," who are constitutionally receptive of Christ's revelation and life everlasting, and the Hylic or "material," who are doomed to perish. Valentinians and others add a third, or intermediate class, the Psychical, or men of "soul," who are not capable of apprehending a divine revelation, but only of the popular faith (*pistis*), yet thereby may attain to a degree of knowledge and salvation.

The 'Pistis Sophia,' edited by Schwartze and Petermann (Berlin 1853), is the only Gnostic work that has come down to us in a complete form, except those apocryphal Gospels and Acts of the Apostles which show a Gnostic tendency. Tatian's 'Diatessaron' was used in the Syrian Church down to the 5th century. The Gnostic Bardesanes of Edessa, one of the last of the Syrian Gnostics, was the founder of Syrian hymnology. See Mansell, 'Gnostic Heresies'; Neander, 'Genetische Entwickelung der vornehmsten gnostischen Systeme' (1818); Möller, 'Kirchengeschichte,' Vol. I. (1889); Renan, 'Origines du Christianisme'; King, 'The Gnostics and their Remains' (1887).

Gnostics, a religious philosophical sect, who boasted of a deeper insight into the origin of the world, and of the evil in the world, than the human understanding, so long as it remains in equilibrium, can deem admissible, or even possible. Simon the magician, of whom Luke speaks in the Acts of the Apostles, was the first among them. Even in his dogmas we discover the traces of ideas which were common to all the Gnostics. They may be reduced to the following principal heads: The world and the human race were created out of matter by one æon, called the *demiurge*, or, according to the later systems of the Gnostics, by several æons and angels. The æons made the bodies and the sensual soul of man (*sensorium, psyche*) of this matter; hence the origin of evil in man. God gave man the rational soul; hence the constant struggle of reason with sense. What are called gods by men (for instance, Jehovah, the God of the Jews), they say, are merely such æons or creators, under whose dominion man became more and more wicked and miserable. To destroy the power of these creators, and to free man from the power of matter, God sent the most exalted of all æons, to which character Simon first made pretension; he was followed in these pretensions by Menander, a Samaritan, the most celebrated of his scholars, who, toward the end of the 1st century, founded a sect at Antioch in Syria. Simon and Menander were enemies to Christianity. Cerinthus, a Jew, of whom John the Evangelist seems to have had some knowledge, combined these reveries with the doctrines of Christianity, and maintained that the most elevated æon, sent by God for the salvation of man, was Christ, who had descended upon Jesus, a Jew, in the form of a dove, and through him revealed the doctrines of Christianity. In the 2d century, during the reign of Hadrian and both the Antonines, these principles were adopted by certain Christian philosophers, who are more particularly known under the name of Gnostics, and still further refined, extended, and systematized. Saturninus, a Syrian, speaks of an unknown supreme God, who had generated many angels and powers; seven of these æons were, according to him, creators of the world, and soon fell from God; one of them, the God of the Jews, had seduced man to him, whence originated the difference between good and bad men. Saturninus also calls Christ the Saviour sent by God, and the Son of God; but the opinion that Christ was not actually born, and had not a real human body, but only an incorporeal image, is peculiar to him, on which account his followers and other later Gnostics who agreed with him in this respect were called *Docetæ* (from Greek δοκεῖν, to seem) and *Phantasiasts.* The system of Carpocrates, an Alexandrian, who also flourished during the reign of Hadrian, was distinguished from the one which we have just described in this respect only, that he considered Christ as a mere man, whose purer and more powerful soul had more accurately remembered what it had seen with God before its union with the body. The fathers of the Church, Clement of Alexandria, Irenæus, Eusebius and Epiphanius, from whom, in general, we derive all our information concerning the Gnostics, accuse the moral system of Carpocrates of destroying all distinctions between good and evil, and inculcating an unlimited indulgence of the sensual appetites. Certain it is that his followers practised the most detestable vices, and were the cause of many of the calumnies of the heathen writers concerning the Christians of this century. The Valentinian party, which rose toward the middle of the 2d century in Rome, and especially in Cyprus, and which was distinguished by its austere manners, was the most numerous of all the Gnostic sects, and continued until after the commencement of the 4th century. Marcion of Sinope, and Cerdo, a Syrian, renounced many of the absurdities of the earlier Gnostics, and formed a regular system, the characteristic of which was the rejection of the Old Testament. Bardesanes, a Syrian, and Hermogenes, an African, who, in the reign of the Emperor Commodus, apostatized from Christianity and established sects, bordered, in their hypotheses concerning the origin of good and evil, upon Gnosticism. On the whole, when we take into consideration the philosophical tendency of that age, the passion for the marvelous that had taken possession of the effeminate nations of the Roman empire, and the custom of pretending to a deeper insight into the secrets of nature and the divinity, it is not to be wondered at that a religious philosophy which adopted the most brilliant parts of Platonism, and which afforded nourishment alike to the imagination and to the vanity of secret wisdom, should have met with such universal success. By the austerity of its precepts, and its care for the well-being of the soul, it even prepossessed good men in its favor. The Gnostics were the Pietists of the 3d and 4th centuries. The Roman Catholic Church took occasion from their heresy to give greater precision to the articles of the orthodox faith. There have been no Gnostic sects since the 5th century; but many of the principles of their system of emanations reappear in later philosophical systems, drawn from the same sources as theirs. Plato's lively representation had given to the idea of the Godhead something substantial, which the Gnostics transferred to their æons: and Leibnitz's 'Effulgurations of God,' Ploucquet's 'Real Presentations of God,' St. Martin's 'Pictures and Mirrors,' and the like, as well as the Gnostic æons, are a proof that the essays of the human understanding to explain the creation and the origin of imperfect beings from the perfect always end in similar results. See GNOSTICISM.

Gnu, nū, a Hottentot name of one of the two species of wildebeest. The wildebeests are African antelopes, forming the genus *Connochetes.* The white-tailed gnu or "horned horse" (*C. gnu*) resembles, in form, partly the horse, partly the buffalo, and partly the stag. It is as large as a middle-sized horse, and its neck is adorned with a stiff erect mane. On the forehead the face is covered with an oblong tuft of stiff black hairs, turned upward. Beneath the lower jaw is also a thick, shaggy beard. The legs are long, and elegantly formed, like those of the stag; the space between the fore-legs is covered with long bushy hair. The tail is long and white. The horns are rough, and are enlarged at their base like those of the buffalo; they spring from the hinder part of the head, and, after bending forward beyond the eye, turn suddenly upward. Both sexes are furnished with these appendages. In the young animal they are perfectly straight, acquiring their flexure as the animal grows older. The gnu is affected by the sight of scarlet, like the buffalo or bull. When irritated, it expresses its resentment by plunging, curveting, tearing the ground with its hoofs, and butting with its head. The flesh is juicy, agreeable, and nourishing. This animal was formerly widespread and numerous, roving in small bands with zebras, etc.; but it is now nearly or quite extinct.

Another species, whose habitat was north of the Zambesi, has still escaped extirpation in the interior. It is named *C. taurina*, and has no long hair in front between the fore-legs; there are dark stripes on the sides, and the tail is shorter and black. Consult: Bryden, 'Nature and Sport in South Africa' (London 1897); Millais, 'A Breath from the Veldt' (1895); and the writings of South African sportsmen travelers from Gordon-Cumming (1850) onward.

Goa, a Tibetan gazelle.

Goa Powder, a substance found in the wood of the *Andira araroba*, a leguminous tree growing in Brazil and the West Indies. It derives its name from Goa, a Portuguese colony on the southwest coast of British India, to which it was imported from Bahia for the first time in 1852. It has a bitter taste, is considered efficacious in certain skin diseases, and is used in the preparation of chrysarobin.

Goajira, gō-ä-hē'rä, a peninsula in Colombia, which forms the most northerly point of South America. It lies west from the Gulf of Maracaibo, or Venezuela, and runs northeast from the Sierra Nevada de Santa Marta to the volcanic Sierra Macuira, which forms its apex, rising to a height of 2,800 feet. The coast is edged with sandbanks, but there is good anchorage at Bahia Honda. Its exports are dyewood, dividivi, pearls, and wood for cabinet work. Up to 1891 Venezuela laid claim to the peninsula, which in that year was formally ceded to Colombia.

Goajiros, gō-ä-hē'rōs, an Indian tribe inhabiting the peninsula of Goajira (q.v.). They are reckoned at 25,000 souls, are subdivided into numberless septs or clans, and for the most part are nomadic, but cultivate the soil and keep flocks and herds (sheep, goats, horned cattle, horses and asses). They also trade in dividivi and fine woods. They are good horsemen, and warriors, arming themselves with bow and poisoned arrows, and are also expert in the use of firearms. They are of fine physical build, especially the women, who are held in high esteem. They wear little clothing, but paint their bodies, and love fine harnesses for their horses. The Roman Catholic mission has been very successful in evangelizing them. Their language is a branch of the Arowak and Maipure group, and connects them ethnologically with the aborigines of the Bolivian Andes, and the plains of the Mahaica and Surinam rivers.

Goat. There is probably no other species of domestic animal that is so widely distributed over the earth as the goat, not excepting the horse, or the cow, or the sheep, yet there is none of them concerning which we have so little scientific information. We are told, however, that there are 10 species of wild goats, all but one of which (the Rocky Mountain goat) are confined to Europe and the Himalaya Mountains. These 10 species are divided into two groups — the ibexes and the goats proper. The ibexes are composed of two sub-species — *Capra falconeri* and *Capra ægagrus.* The *C. ægagrus* is the Paseng, or Bezoar goat, or wild goat, of Persia, and is the progenitor of *C. hircus*, through which are descended all of the domestic goats of all countries. These are numerous in kind and variable in characteristics. Of these only the Angora and the Cashmere breeds and the several breeds of milch goats are of special economic importance, and these only will be treated here.

The Angora Goat.—The history and development of the Angora goat can not be traced to the beginning, but there is evidence that it belonged to a distinctive breed even in the days of Abraham. So far as can be stated definitely at this time, this breed is a native of the vilayet of Angora, in Asia Minor. The capital of the vilayet is Angora, or Eugurieh, the ancient city of Ancyra, where it is believed that the Apostle Paul established one of the western Christian Churches.

The geographical distribution of this breed is not extensive, their raising as an industry being confined to Turkey in Asia, South Africa, and the United States. They have been transplanted to many of the European countries, but without successful result. Australia has had a small number for 50 years, but it is only at the present time that a strong effort is being made to build up an industry of importance there.

A few Angoras are thriving in Canada and experiments are being conducted with them in Porto Rico and Cuba. Approximately stated, there are 3,700,000 of these goats in Turkey, 5,000,000 in South Africa, and 800,000 in the United States. At this time they may be found in every State and Territory, including Alaska.

Angoras were introduced into the United States from Asia Minor in 1849 by Dr. James B. Davis, of Columbia, S. C. There were nine goats in this importation, and at that time and for several years later they were regarded as belonging to the Cashmere breed, but one only was a Cashmere, while the remaining eight were Angoras. Several other importations, usually in small lots, have been made from Asia Minor and South Africa. For ten years previous to the outbreak of the Civil War considerable effort was made to exploit this proposed new addition to the animal husbandry of the country, but this failed for various causes, and for many years after the war it seemed that the Angora goats were to prove an absolute failure here. The war had scattered or destroyed nearly all that were in the Eastern and Southern States, but a few that had found their way to California and the Southwest increased rapidly in numbers by crossing upon the long-haired Mexican goats. The redivivus of the industry came about the year 1900, when it was discovered that this country not only had the mills to consume all of the mohair of domestic production, but was also importing over a million pounds annually. The organization in the same year of the breeders into a registry and fair association gave to the industry its first impetus; and then the government assisted largely in exploiting the qualities of the animals. About this time, too, the ability of goats for destroying brushwood became widely known. These two leading features have tended to bring about a rapid growth of the industry.

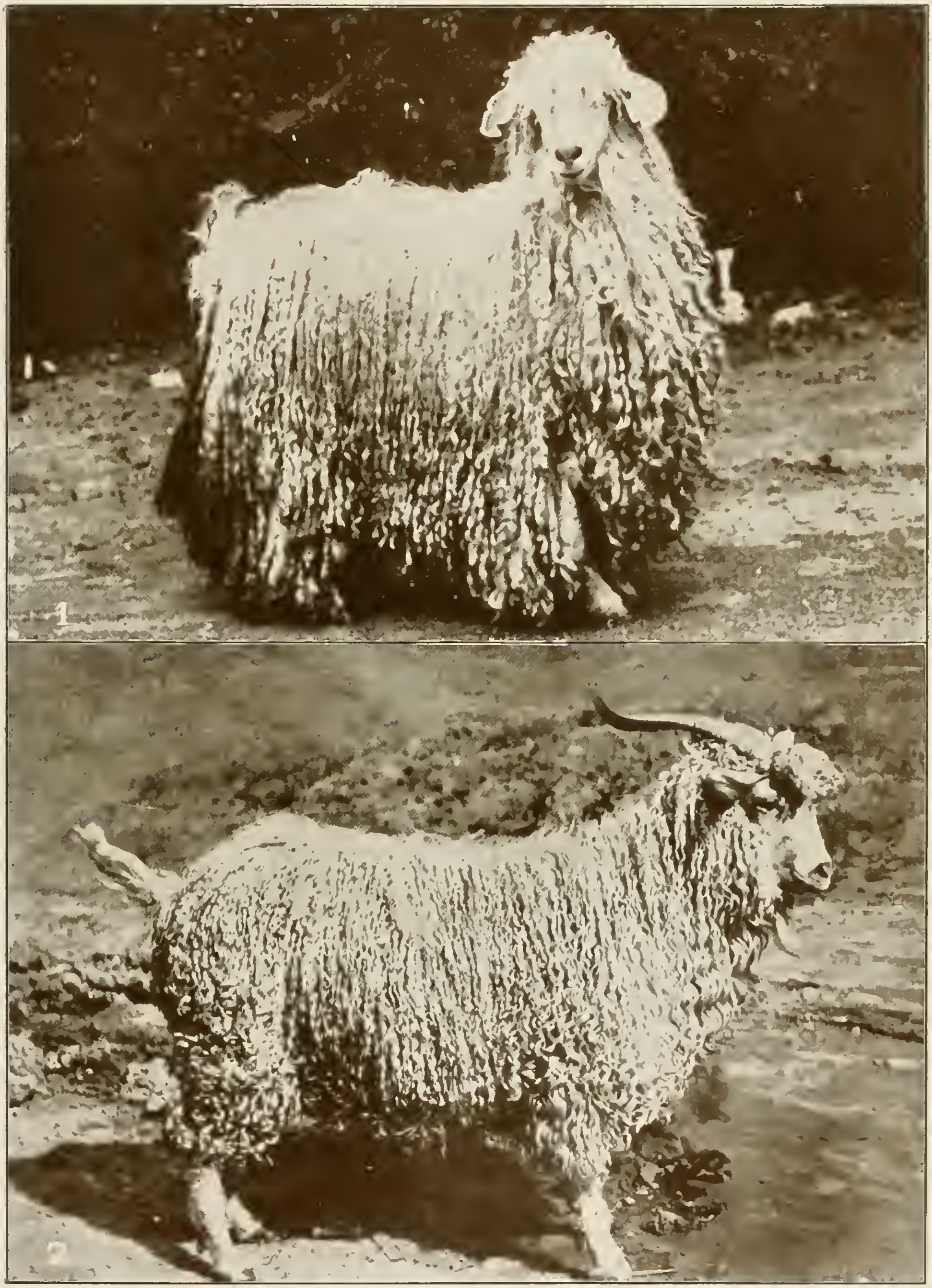
The Angora goat is small, weighing generally from 60 to 100 pounds, although many may be found in the United States that weigh as much as 140 pounds, and occasionally one much heavier than this. Males and females alike have horns and beards, except that in rare instances one without horns may be seen. The horns of the male grow to a length of 18 to 20 inches and turn upward, outward, and backward, while those of the female, which grow to a length of 8 to 10 inches, grow upward and point backward with only a slight inclination to twist. The ears are usually medium long and pendant, but there are frequent specimens having ears that are short, pointed, and pricked. Except in rare instances, the fleece is pure white, growing to an annual length of 10 inches and covering the entire body down to the knees and hocks. There is no goat odor with this breed except with the bucks at rutting time. The Angora usually has one kid at a birth; two are not uncommon, and three are seldom dropped.

The uses of the Angora goat in the United States are three: (1) For the production of mohair (see Mohair); (2) for the production of meat; and (3) for the destruction of brushwood and weeds. It is used rarely as a milch animal, owing to the uncertain quantity of milk which it yields.

The uses of mohair are many already and new ones are being invented frequently, so that there has been a constant and increasing demand for this product, with no indication that the supply will ever equal the demand. This feature of the industry is elaborated under the head of Mohair. The natural result of the many uses of this staple has been an increase in the number of goats and the breeding of animals of better quality. The average weight of the fleece at this time is about 3 pounds, but there are many animals of exceptional merit that will yield 12 pounds and even more and occasionally a flock that will average 5 pounds per head. A few more years of careful breeding will very likely increase the average per head for the whole country to 5 or 6 pounds. Within the last four or five years, during which time there has been intelligent effort made to increase the quantity of the fleece, there has been marked improvement, and the weight of the average fleece has probably gained 40 per cent. The future should show even better results. The goats yield heavier fleeces in the colder parts of the country than in the warmer sections; and those animals taken from the southwestern States to the northern part of the United States show an increase the first year.

The Angora is the only one of the numerous breeds of goats that yields a carcass that is edible at all ages. The Angora kids, like those of other breeds of goats, are considered a delicacy, and the mature animal is free from the strong taste that is characteristic of other breeds. The size, shape, and quality of the Angora carcass make it to resemble so much that of the sheep that the packers slaughter large numbers of the low grade Angoras and sell them as sheep mutton. A peculiarity of Angora mutton is that it requires a longer time for cooking than does sheep mutton. In the southwestern part of the country, especially on the large ranches, where it is difficult to keep meat fresh, many grade Angoras are slaughtered for food; but in other parts of the country, where the animals are usually of high grade, they are not generally slaughtered, being regarded as of more value for mohair production.

The predilection of goats for brushwood and weeds is characteristic of all breeds, but the Angoras are employed principally for this use because they are able to produce a marketable fleece at the same time they are cleaning up the land. In many parts of the United States they are regarded as of more value for clearing brushland than as mohair producers. This is especially true where the land cleared is suitable for raising large crops or growing vigorous orchards. The total area of land so cleared of brushwood by these goats aggregates many thousands of acres, and their work is done in a most satisfactory manner. The goats first eat every twig and leaf within their reach while standing on their hind legs, seldom making any choice as to species of tree, and later, if not given new pasture, will peel the bark from the saplings. If they are again placed upon land the second year, so that they may destroy the sprouts that put out from the stumps, their work will be completed, for the stump and roots then die. As the brushwood and weeds are destroyed and the sunlight thus permitted to reach the soil, the grass, if any variety is indigenous to the locality, will soon be



1. ANGORA GOAT — YOUNG DOE.
2. ANGORA GOAT — BUCK

observed to spring up and thereupon spread rapidly. Where a good variety is not indigenous, a common practice is to sow the seed. This method insures a grass pasture sooner than depending upon the natural grasses and their natural distribution over the cleared area. The goats prefer browsing upon the brushwood to feeding upon the most luscious grasses and clovers and will give the latter very little attention if there is enough of the former to satisfy their hunger. Their presence upon the soil and their indirect assistance in producing the pasture do not make the grass objectionable in any way to horses, cattle or sheep. It should be stated, however, that goats will thrive upon grass and clover if it becomes necessary, and there is no better rough feed for them in winter than clover hay.

The Cashmere goat flourishes in Kashmir, in India, whence it receives its name, and in Tibet. Its color is usually white, and in many other ways it resembles the Angora; but its heavier and outer coat is coarse and not of economic value. Its under coat, called pashm, is very fine and light in weight, and brings very high prices. The amount of pashm produced by each goat annually is between two and three ounces. Most of this fibre is secured by combing the animals when it loosens from the skin, but a considerable amount is picked from the bushes where the animals have rubbed in an effort to remove the sloughing hair. The famous Cashmere shawls, which, a half century and more ago sold at $100 to $2,000, were made of pashm. Dr. Davis brought one Cashmere doe to the United States with his Angora flock in 1849; a buck of this breed died on the voyage. Nine others came in the Brewer importation about 1858. The Cashmeres appeared not to be able to survive the climatic conditions to which they were subjected here, and at this time there is probably not a single specimen in this country. It is not known to the public whether any pashm finds its way to America in the raw state, but it is not likely that it does.

Milch Goats.—No one has attempted to state how many breeds of milch goats there are in the world; one writer says that there are no less than 16 in Switzerland. They are found in their pure state in all European and Asiatic countries and in several of the countries of northern Africa. Specimens of good milking qualities are numerous in South Africa and Australasia, and a very few may be found in the United States. Probably the deepest milker among all breeds is the Nubian, but it is suited to very warm climates only. With reference to their adaptability to our climate and soil, the following are probably of about equal merit: Toggenburg and Saanen of Switzerland, Maltese of Malta, and the Syrian of Palestine. Nearly all of the Swiss breeds are excellent, and also some of those of France and Spain.

In May 1904 there was an importation of 26 Toggenburg and Saanen goats into the United States, and at this time they are thriving well in Massachusetts, New York, New Jersey, and Maryland. So far as any records show, these are the only goats of pure blood that have been received, except four that came in 1893, which did not thrive well: but it is believed that a few kids of Italian goats have been brought here by immigrant families from Italy, and that these have matured and been crossed with the common goats that are usually found in the suburbs of the large cities, thus lending something of their milk characteristics to these latter goats. It is not difficult to find good milkers among these common goats.

A good milch goat should have the same leading characteristics that are possessed by a milch cow. The goat should be level on the back, with slightly dropping hips; the hair, whether long or short, should be kept trimmed close on the udder; the udder should have a shriveled appearance immediately after milking, and the teats should be long and slim.

Milch goats are prolific, seldom having fewer than two kids at a birth, and sometimes four of them. If not restrained they will breed three times in two years.

The quantity of milk that they give varies; a goat that will give two quarts of milk daily for six months is a good milker, but there are many of the best breeds that will yield four quarts a day with a lactation period of six to nine months. Thus it will be seen that, when body weight is considered, the goat is a larger producer of milk than the cow. The milk has a slightly different taste from that of the cow; the strong, acrid taste so often noted by those who have drunk it is due to unclean methods of milking. If the milk is drawn perfectly clean and kept clean, it does not have either taste or smell that is offensive. It is highly regarded in the Old World for its health-giving properties and as a food for children. It is used quite largely in the hospitals in the Swiss and French Alps for tuberculous patients and for those suffering from stomach troubles. The advocates of a milch goat industry in the United States base their arguments principally upon the healthfulness of the milk, although a large use of the goats by the poor in the suburbs of the great cities and in mining districts, it is believed, would prove very economical as well as healthful. Tuberculosis is seldom found in goats, and therefore the germs of the disease, which may be found in the milk of a very large percentage of cows, has never been reported in goat's milk. This fact gives to this milk its highest recommendation.

Kids that are not to be kept for breeding are disposed of for slaughter, and there is a good demand for them among certain classes in the large cities. The flesh is exceedingly delicate, and nothing but the prejudice of people against a matter which they have not tested prevents a larger production and consumption of kids. The kids should be from one to two months old when slaughtered, as after two months the flesh begins to grow tougher and stronger.

Common Goats.—According to the census report of 1900, there are over 1,000,000 common goats — that is, goats of no special line of breeding — in the United States. They can hardly be referred to as an industry, for they have thrived and increased in numbers in spite of neglect. They have been useful in an incidental manner only. A considerable number are used as pets for children, and occasionally a fair milker is found among them. Since the Angoras have demonstrated the ability of the goat to destroy brushwood, the common goats have been brought together in flocks in some localities and there employed also as brush destroyers. The greater number of common goats are simply tolerated.

Goat-skins.—During the fiscal year of 1904 the United States paid to foreign countries $25,962,020 for goat-skins, not including $4,636,213 paid for gloves, a large part of which was for kid gloves. These importations have been increasing in value annually because of the increased use of goat-skin leather in this country. These imports come chiefly from British India, Mexico, Germany, Russia, and Brazil. With this large expenditure for goat-skins, many persons have thought that the goat-skin industry ought to be developed in the United States, since we have here all that is desirable in the way of climatic, soil, and market conditions; but a recent investigation by an authority in the government service shows that the United States can not compete for this business, for the reason that in all of the countries where the skins are produced in large quantities the wages of goatherds is a mere pittance, and the carcass, however poor, is consumed for food. These two features preclude a goat-skin industry in this country. However, in connection with the milch goat industry there will be a considerable number of skins, and the prices paid are large enough to pay for caring for them. Goat-skins are used in the manufacture of shoes, gloves, music rolls, morocco for book bindings, etc. The skin of the Angora goat is used as rugs and robes with the hair intact, and also for children's muffs, capes, and for boas for ladies. The leather, like that from all skins having long hair, is not suitable for shoes or fine gloves, but is used largely for workmen's gloves and morocco.

The government, through the Department of Agriculture, has been lending encouragement to the goat industry in all its phases, and its publications on this subject are sent free to all applicants.

George Fayette Thompson,
Bureau of Animal Industry, Washington, D. C.

Goat-antelope, a term applied to certain small mountain-climbing ruminants, which in structure and habits are intermediate between typical goats and antelopes. Such are the white goat of the Rocky Mountains; the chamois of Europe; and the gorals, serows, etc., of the Himalayan and other Oriental mountain regions. For description see their English names.

Goat-fish, one of the gaudy and edible fishes, allied to the surmullets, of the genus *Upeneus*, which abound in the West Indies and Gulf of Mexico, and take their popular name from a fancied likeness of their bearded profile to a goat's. There are several species. The English sometimes call their filefish (q.v.) by this name.

Goat Island, (1) an island in the Niagara River which separates the Horseshoe and American falls. (2) A large island in San Francisco Bay, where there is a lighthouse and government station.

Goat-louse, a parasite living in the hair of goats. It is a biting louse of the genus *Trichodectes*, and that which infests the Angora goats (*T. limbatus*) is often troublesome. Various species occur in various parts of the world.

Goat-moth, a large European malodorous moth (*Cossus ligniperda*), whose caterpillar, the "auger-worm," feeds upon decayed wood, boring a tunnel at the end of which, after three years of growth, it forms a cocoon of chips gummed together by a secretion, and transforms within it.

Goatsbeard, a small rosaceous plant of American woodlands (*Aruncus aruncus*), closely allied to spiræa, with minute white flowers in dense panicles blooming in June, in rich woods of the Mississippi valley; and also on the northern Pacific coast and in Europe and Asia. The name is also given to a saxifrage (*Astilbe biternata*), and to dandelions of the genus *Adopogon* and some other plants.

Goatsuckers, a family of birds, defined under *Caprimulgidæ*, so erroneously named that the term should be abandoned. See Nightjar; Nighthawk; Whippoorwill, etc.

Gobat, gō-bä', **Samuel**, English missionary: b. Bern, Switzerland, 26 Jan. 1799; d. Jerusalem 12 May 1879. After completing a course in Oriental languages in the Mission House at Basel, he became a missionary, going to Abyssinia in 1826 for the English Church Missionary Society. In 1829 he had reached Gondar, but in 1832, upon the outbreak of war in that part of the country, he returned to England. In 1834 he made another journey to the same country, but owing to illness again had to go home. In 1839 he was sent to Malta, where he translated the Bible into Arabic, and in 1845 was appointed a director of the Protestant College. In 1846 Friedrich Wilhelm IV. of Prussia placed him in charge of the See of Jerusalem, an appointment which he held until his death. It was in the orphan schools and hospitals of Jerusalem, Nazareth, and other cities of Palestine that he did his greatest missionary work. He wrote: 'A Journal of Three Years in Abyssinia' (1847).

Gobelin (gōb-lăn') **Manufactory**, a tapestry manufactory at Paris, established by Colbert in 1667. The Gobelin tapestries excel everything of the kind in Europe. Many celebrated paintings of the Italian, French, and Spanish schools have, in the most marvelous manner, been transferred to tapestry. Among the more celebrated of these may be mentioned the portrait of Louis XIV., by Rigaud (the original of which is in the Louvre); 'The Assumption' of Titian, a large work, 23 feet in height; a head by Nicholas Poussin, copied by Marie Gilbert, etc. The first two of these are to be seen in the Gobelin Gallery. All are characterized by splendor of coloring and delicacy of execution. The establishment is now carried on at the expense of the government.

Gobi, gō'bē, **Desert of**, China, the Shamo, or "sand-sea" of the Chinese, an immense tract of desert country, occupying nearly the centre of the high tableland of eastern Asia, between lat. 35° and 45° N., and lon. 90° and 110° E., and extending over a large portion of Mongolia and Chinese Turkestan. Its length is probably about 1,800 miles; mean breadth, between 350 and 400 miles; area, 300,000 square miles. Its general elevation is over 4,000 feet above sea-level. The East Gobi is occupied by different tribes of the Mongolian race, who have numerous herds of camels, horses, and sheep. In the West Gobi are some nomadic tribes of the Tartar race. This tract is supposed at one time to have been a great inland sea.

Gobin, Hillary Asbury, American educator: b. Terre Haute, Ind., 25 March 1842. In 1862–5 he was in the Union army, was graduated from Indiana Asbury College (the present De Pauw University) in 1870, was admitted a licensed preacher of the Northwest Indiana conference of the Methodist Episcopal Church, and held various pastorates in Indiana. In 1880–6 he was professor of the Greek language and literature at De Pauw, in 1886–90 president of Baker University (Baldwin, Kan.), in 1890 became dean of the theological faculty at De Pauw. He was elected president of De Pauw in 1896. His writings comprise articles and reviews in religious and secular periodicals.

Gobineau, gō-bē-nō', **Joseph Arthur, Count de,** French diplomat and author: b. Bordeaux 1816; d. Paris 17 Oct. 1882. He served in the French diplomatic corps in the various capitals of Europe, at Athens in 1868, at Rio Janeiro, South America, and at Stockholm. Chief among his writings are: 'Troi ans en Asie' (1859); 'Les religiones et les philosophies dans l'Asie centrale' (1865); 'Historie des Perses' (1869), etc.

Goblet, gō-blā', **Albert Joseph,** Belgian soldier and statesman: b. Tournai 1790; d. 1873. He participated in the battle of Waterloo, and after the Revolution became minister of war, remaining in that position until he was made minister of foreign affairs in 1832. In 1837 he was appointed ambassador of Spain, a post he held for two years, and it was then that the title of Count d'Alviella was bestowed upon him by the Queen of Spain. In 1843 he was again appointed minister of foreign affairs and for two years in this capacity, his influence on all public matters was felt to a marked degree. He also planned the fortifications along the frontier of northern Belgium, and extended those already built around Antwerp. He wrote: 'Des cinq grandes puissances de l'Europe dans leurs rapports politiques et militaires avec la Belgique' (1863); 'Dix-huit mois de politique' (1865), etc.

Goblet, D'Alviella, Eugène, COUNT, Belgian archæologist and religious historian: b. 1846. He became professor of the history of religions at the University of Brussels, afterward being elected a Liberal member of the Belgian Chamber of Deputies. In 1892 he was elected to the Senate. After traveling through the Sahara Desert he began his writings, the more important of which are: 'Sahara and Lapland' (1875); 'Inde et Himalaya'; 'The Contemporary Evolution of Religious Thought in England, America, and India' (1885): 'The Migration of Symbols' (1894); and 'Ceque l'Inde doit à la Grèce' (1897).

Goblet, René, rē-nā gō-blā, French statesman: b. Aire-sur-la-Lys, 26 Nov. 1828; d. Paris, 13 Sept. 1905. He practised law at Amiens, and entering in 1871 the National Assembly, identified himself with the left Republican group, and became known as an orator, particularly through his part in the discussion respecting the revision of the pension-list for officials under the empire. In 1882 he became minister of the interior, in 1884 of education, and in 1885 of education and public worship. Prime minister in 1886–7, he was minister of foreign affairs in 1888–9, was elected senator in 1891, and sat in the Chamber of Deputies as a Radical in 1893–6.

Goby, gō'bĭ, any one of the 400 species of fishes belonging to the family *Gobiidæ*. They are small carnivorous animals, occurring chiefly on the bottoms of tropical seas and ponds. Most of the species have the ventral fins united into a sucking disk. Most interesting of the gobies are the mud-skippers (*Periophthalmus*) of the western Pacific, which hop about the shores by aid of their pectoral fins, feeding upon insects and naked mollusks. Many of the gobies make nests for their eggs.

God, the Supreme Being, the First Cause, and as considered nowadays throughout the civilized world, a spiritual being, self-existent, eternal and absolutely free and all-powerful, distinct from the matter which he has created in many forms, and which he conserves and controls.

There does not seem to have been a period of history where mankind was without belief in a supernatural author and governor of the universe. The most savage nations have some rudimentary ideas of God. Man is a religious as well as a rational animal. The instinct of belief in God is asserted by philosophical theists to be reconcilable with reason, although no competent apologist now stakes the existence of God on any one argument, or exhibits the proof as a series of syllogisms. It is rather maintained that the study of human history, of human nature especially on its moral and spiritual side, and of the world as far as science reveals it to us make for the existence of a God, demand such a postulate as the key to the universe, and render the belief in a personal God greatly more probable than any other thesis — a subject vastly too wide for discussion here. But it is necessary to name what are often referred to as the four great arguments for the existence of God.

(1) The *ontological* argument first formulated by St. Anselm proceeds from the notion of a most perfect being to infer his existence; without actual existence the idea would fall short of perfection. The argument was re-stated in a different shape by Descartes (q.v.) and by Samuel Clarke, and, though very contemptuously treated by Kant, is still an element of the argument that without a God the world is a chaos.

(2) The *cosmological* argument, employed by Aristotle, Aquinas, and a host of Christian authors, is an application of the principle of Causality (q.v.). We cannot conceive an infinite regression of finite causes; therefore beyond the last or first of the finite causes is the Infinite. From motion the argument is to a mover.

(3) The *teleological* argument, or argument from design, proceeds from the order and arrangement of the universe, the reign of law and beauty and adaptation, to the intelligent and supreme fountain of order. This is the most familiar of the arguments, especially on the lines laid down by Paley.

(4) The *moral* argument was that relied on by Kant (q.v.) when he destructively criticised the other three, and forms a part of most modern theistic arguments. God is a postulate of our

moral nature: and the moral law in us implies a lawgiver without us.

Consult: Flint, 'Theism' (1877); Harris, 'The Philosophical Basis of Theism' (1883); 'The Grounds of Theistic and Christian Belief' (1883); the Duke of Argyll, 'The Reign of Law' (1800); Kant's 'Critique of Pure Reason'; Mill's 'Three Essays'; Janet's 'Final Causes' (trans. 1878); Gifford Lectures (1888); Ronayne, 'God, Knowable and Known' (1898); Driscoll, 'Christian Philosophy — God' (1902).

God, Name of, in Different Languages, may be seen from the following list: Elohim, Hebrew; Gott, Swiss and German; Eilah, Chaldaic; Goed, Flemish; Eleah, Assyrian; Godt, Dutch; Alah, Turkish and Syriac; Alla, Malay; Goth, Teutonic; Allah, Arabic; Gude, Danish and Swedish; Teut, old Egyptian; Teun, new Egyptian; Gude, Norwegian; Teuti, Armarian; Bogo, Polish; Theos, Greek; Bung, Pollacca; Jubinat, Lapp; Sire, Persian; Magatal, Tartar; Deus, Latin; Diex, Latin, low; Diu, Gallic; Dieu, French; Dios, Spanish; Deos, Portuguese; Diet, old German; Diou, Provençal; Doue, low Breton; Dio, Italian; Dia, Irish; Deu, Olala tongue; Thios, Cretan; Jumala, Finch; As, Runic; Fetiyo, Zemblian; Istu, Pannonian; Rain, Hindostanee; Brama, Coromandel; Prussa, Chinese; Goezur, Japanese; Zannah, Madagascar; Puchecammac, Peruvian.

God Save the King (or **Queen**), the burden and common title of the English national anthem. Concerning the author and the composer opinions differ. It has been asserted that Henry Carey, who lived about the middle of the 18th century, was both; but, being ignorant of the rules of composition, employed Dr. Thornton, of Bath, or, according to some, Christopher Smith, Handel's clerk, to correct his rough draught, and add the bass. This story gave rise to the assertion that Handel was the composer. It appears to have been first published, together with the air, in the 'Gentleman's Magazine' in 1745, when the landing of the young Stuart called forth expressions of loyalty from the adherents of the reigning family. After Dr. Arne, the composer of "Rule Britannia," had brought it on the stage, it became very popular. According to a notice in the 'New Monthly Magazine,' Vol. IV. page 389, there is a copy of this national song, published without date by Riley and Williams, in which Antony Young, organist in London, is called the author of the air. There is also a story that this national song, as Burney, the author of the 'History of Music,' maintained, was not made for King George; but that, in the older versions, it ran thus, "God save great James our king"; and Burney adds, that it was originally written and set to music for the chapel of James II., but that no one dared own or sing it after the abdication of James, so that the song lay dormant 60 years before it was revived for George II. Another account ascribes the air to John Bull, who was organist to the chapel of Queen Elizabeth in the last years of her reign.

Godavari, gō-dä'va-rē, a large river in India. Its source is in the Western Ghauts, about 70 miles northeast of Bombay, and flows southeast into the Bay of Bengal. About 50 miles from the sea the river divides into two channels, the most northern of which flows into Coringa Bay. In the rainy season these branches are navigable, but only for small craft. Before the river divides there are three great obstacles to navigation, caused by three rocky barriers. Between 1861 and 1871 large sums of money were expended by the government on an attempt to open up the navigation of the river by canals going round these barriers, but finally the project was abandoned as involving too great an expenditure.

God'dard, Calvin Luther, American inventor: b. Covington, N. J., 22 Jan. 1820. He was graduated from Yale in 1845 and subsequently devoted his attention to the invention of labor-saving contrivances employed in the wool industry. Among his various inventions of this character may be cited feed rolls for carding machines, a burring picker for the purpose of cleansing wool, and solid packing burring machines.

Goderich, gŏd'rĭch, Canada, capital of Huron County, Ontario, port of entry, on Lake Huron at the mouth of the Maitland River, and the terminus of a branch of the Grand Trunk Railway; 119 miles west-northwest of Hamilton, 125 miles west of Toronto. It has a good harbor, steamship lines to various ports, and its people trade largely in fish, salt, and lumber. It is in a good farming district, lumbering and boat-building are important industries, its fisheries are extensive, and large salt-wells make salt refining its chief industry. There are also manufactories of foundry products, machinery, woolens, leather, boots and shoes, wooden ware, etc.; flour and saw mills; and large grain elevators. Pop. (1901) 4,158.

Godet, Frédéric, frā-dē-rĕk gō-dā, Swiss theologian: b. Neuchâtel, Switzerland, 25 Oct. 1812; d. 1900. After having been tutor to the crown prince of Prussia, he became in 1850 professor of theology at Neuchâtel. In 1873 he left the state Church and was appointed professor by the Free Church of Neuchâtel. He is best known for his great commentary on St. John's Gospel (1863–5; Eng. trans. 1877), followed by commentaries on Luke (trans. 1875), Romans (trans. 1881), and Corinthians, besides 'Conférences Apologétiques'; 'Etudes Bibliques' (trans. as 'Old Testament Studies and New Testament Studies' (1875–6); 'Introduction to Paul's Epistles' (1893).

Go'dey, Louis Antoine, American publisher: b. New York 6 June 1804; d. Philadelphia 29 Nov. 1878. He founded the periodical, 'Godey's Lady's Book,' the first of the kind in the United States, at Philadelphia, in 1830, and continued its editor and proprietor until its sale to a stock company in 1877. His other publications included 'Jarvis' Musical Library,' and the *Daily Chronicle*.

Godfather and Godmother (also, in infant baptism, called sponsors), the persons who, by presenting a child for the sacrament of baptism, and taking upon themselves the vows of faith and obedience, as proxies for the child, and in the name of the child, are reputed to contract toward the newly baptized the relation of spiritual parentage. In the Roman Catholic Church this spiritual relationship is regarded as a species of kindred (whence the name *gossip* or *God-sib*, "spiritually akin"), and constitutes an impediment of marriage between the sponsors upon the one hand and the baptized and the parents of the baptized on the other. Anciently, this impediment arose between the sponsors themselves; and it still extends much further in the Eastern than in the Western Church, although in the former it can arise only from baptism, whereas in the Roman Church the candidate for confirmation also is presented by a sponsor, though usually one of the same sex.

In the Church of England, by whose rule two godfathers and a godmother are required at the baptism of a male, and two godmothers and a godfather at that of a female, no impediment of marriage arises from the relation of the sponsors to the baptized. The parents of the baptized are not permitted to act as sponsors in the Roman Catholic Church, one of the objects of the institution being to provide instructors in case of the death of parents; but the rubric of the American Prayer-book does so allow.

The institution of sponsors was very ancient, and Tertullian (192 A.D.) speaks of the promises made by sponsors in baptism. In the early Church no more than one sponsor was required, a man for a man and a woman for a woman. In adult baptism, the godfathers and godmothers are not sponsors, but only "chosen witnesses," as the person to be baptized takes the vows himself and in his own name.

Godfrey, Elizabeth. See BEDFORD, JESSIE.

God'frey, Thomas, American poet: b. Philadelphia, Pa., 4 Dec. 1736; d. near Wilmington, N. C., 3 Aug. 1763. He is remembered as being the author of 'The Prince of Parthia' (1759), a tragedy, considered to be the first drama published in the United States. In 1763 appeared 'The Court of Fancy; a Poem,' and in 1767 his poems were collected in a volume by his friend, Nathaniel Evans.

Godfrey, Thomas, American mathematician and mechanician: b. Philadelphia 1704; d. December 1749. He was a glazier in his native city; but accidentally meeting with a mathematical treatise, was delighted with the study, mastered all the books on the subject that he could obtain, and instructed himself in Latin in order to read mathematical works in that language. He borrowed a copy of Newton's 'Principia' from James Logan, secretary of the commonwealth, and in 1730 communicated to him an improvement that he had made in the quadrant. In 1732 Logan gave an account of the invention to Dr. Edmund Halley, of England, in a letter. No answer was received after an interval of a year and a half, and then the invention of Godfrey was laid before the Royal Society by the botanist Peter Collinson. Meantime, in 1731, Halley had presented a paper containing a full description of an improvement of the quadrant similar to that of Godfrey. The rival claims were investigated by the Royal Society, and it was decided that they were both entitled to the honor of the invention, and a reward of £200 was bestowed on Godfrey. Franklin observed of Godfrey that, like most great mathematicians whom he had met, he was not a pleasant companion, since he expected universal precision in everything said, and was perpetually denying or distinguishing on trifles, to the disturbance of all conversation.

Godfrey of Bouillon, boo-yôn, king of Jerusalem: b. Baisy, in the Walloon Brabant, near Nivelles, 1061; d. Jerusalem 15 July 1100. In 1076 he succeeded his uncle in the duchy of Bouillon. He distinguished himself by his heroic courage at the siege of Rome, and the fame of his exploits procured him, in 1095, the command of one of the armies of the first crusade. In 1096 Godfrey, with his brothers Baldwin and Eustace, commenced his march to Constantinople, the meeting-place of the crusading armies. So great had been the difficulties of the way that it was only a short time before Christmas when he reached Constantinople. Here new delays occurred. The Emperor Alexius Comnenus would not consent to allow the crusaders to cross into Asia Minor until the leaders had sworn to give up to him all the lands which they should conquer which had previously belonged to the Roman empire, and to remain his faithful vassals for all time coming. This Godfrey at first indignantly refused to do, but after a long course of hostilities finally yielded to the demands of Alexius. On 1 May 1097 they crossed the Bosporus, and before the end of the year the crusaders encamped before Antioch. The town fell into their hands on 3 June 1098, but the citadel held out much longer. In the following year (15 July 1099) Godfrey took Jerusalem itself, after a five weeks' siege. The infidels were indiscriminately massacred, notwithstanding the endeavors of Godfrey to put a stop to the slaughter. Eight days after the capture of Jerusalem the leaders of the army elected him king of the city and the territory; but Godfrey declined the kingly title, contenting himself with that of duke and guardian of the holy sepulchre. The sultan of Egypt now raised an army of 400,000 men for the purpose of expelling the crusaders, but Godfrey gave him battle in the plain of Ascalon, on which occasion 100,000 men were left dead upon the field. This victory placed him in possession of nearly all the Holy Land. Godfrey now turned his attention to the organization of his newly established government, dying just a year after the capture of Jerusalem. He was buried in the Church of the Holy Sepulchre.

Godfrey of Strasburg. See GOTTFRIED OF STRASBURG.

Godhaven, gŏd'hävn, or **Lieuely,** Greenland, on Disco Island. It is the capital of the Danish Northern Inspectorate. Pop. 220.

Godiva, gō-dī'va, a legendary English heroine. She was the wife of Leofric, Earl of Mercia and Lord of Coventry in the reign of Edward the Confessor. The inhabitants of Coventry having on one occasion offended their master, he punished them by inflicting so heavy a fine that they were unable to pay it. In their distress they appealed to Lady Godiva to intercede for them, saying that if they paid the fine they must starve. Godiva, sympathizing with the people, went to her lord to plead that, for her sake, the tax might be remitted. Leofric, when she persisted in her entreaties, at last said half jocularly and half contemptuously, that he would grant her request if she would ride naked through the town of Coventry. Having first received permission from her lord to fulfil the condition imposed Godiva caused it to be made known on what terms the earl had agreed to relieve the people from the tax, and then proclaimed that on a certain day no one should leave his house before noon, that all windows and other apertures in the houses should be closed, and that no one should even look out until noon was past. She then mounted naked on her palfrey, rode through the town, and returned; and Leofric, in fulfilment of his promise, and in admiration of his wife's heroism, freed the inhabitants from the burdens he had imposed on them. Only one person, the story says, attempted to look out, and he was immediately struck blind. A mediæval pageant celebrating Godiva's ride was a feature of Coventry fair for several centuries, and an attempt was made to revive the pageant as late as 1883. See Tennyson, 'Godiva.'

God'kin, Edwin Lawrence, American journalist and essayist: b. Moyne, Ireland, 2 Oct. 1831; d. England 20 May 1901. He was graduated from Queen's College and subsequently was correspondent during the Crimean war for the London *Daily News* (1854–6). He came to the United States as correspondent of that journal and after some time spent in travel was admitted to the New York bar in 1858. During the Civil War period he corresponded both for the *Daily News* and the New York *Times,* and in 1865 established 'The Nation,' which was merged with the New York *Evening Post* in 1882. He continued to edit both papers from that date until shortly before his death. He published a 'History of Hungary' (1856); 'The Problems of Modern Democracy'; 'Reflections and Comments'; 'Unforeseen Tendencies of Democracy' (1898). He was an able, forceful writer who often strenuously opposed dominant political tendencies or principles, but whose entire conscientiousness was never disputed. Under his management the *Post* and the 'Nation' acquired a great influence over the more thoughtful members of the community.

Godless Month, the 10th month of the year with the Japanese, so called by them because then the lesser divinities were considered to be absent from their temples for the purpose of paying the annual respects to the celestial Dairi, a word which, in Japanese means "the Great Interior," that is, of the imperial palace, and in a general sense the person of the Mikado, whose title, "King of Heaven" or "Son of Heaven," implies his divine right to such homage.

God'man, John D., American naturalist and medical writer: b. Annapolis, Md., 1794; d. Germantown, Pa., 17 April 1830. In 1813 he entered as a sailor in the flotilla then stationed in Chesapeake Bay, but in 1815 left the service, and commenced the study of medicine. After lecturing for some time at Baltimore in the room of the professor of anatomy in the University of Maryland, and holding a chair of anatomy for a short time at Cincinnati, he settled in Philadelphia as a physician and private teacher of anatomy. His chief work is his 'American Natural History' (1828). He also wrote: 'Anatomical Investigations'; 'Account of some Irregularities of Structure and Morbid Anatomy'; 'Rambles of a Naturalist'; etc.

Godmother. See GODFATHER.

Godol'phin, Sidney, 1ST EARL OF, English statesman: b. near Helston, Cornwall, June 1645; d. Saint Albans 15 Sept. 1715. He was an opponent of James, Duke of York, and a supporter of Shaftesbury during the exclusion agitation, but nevertheless continued in office after the accession of James II. On the flight of that monarch, Godolphin voted for a regency, yet was, after the settlement of the crown on William and Mary, made first commissioner of the treasury. During the reign of Anne he was appointed lord high-treasurer of England, and did much to improve the public credit, and check corruption in the administration of the public funds. In 1706 he was made Earl of Godolphin, and four years afterward was obliged to retire from office.

Go'don, Sylvanus William, American naval officer: b. Philadelphia 18 June 1809; d. Blois, France, 10 May 1879. Appointed midshipman in 1819, he was active in the Mexican war, and in the Civil War, in command of the Mohican, with rank of captain, took part in Du Pont's attack on Port Royal (1861). In 1863 he was promoted commodore and in 1864–5 commanded the fourth division of Porter's fleet in the attacks on Fort Fisher. Having commanded the South Atlantic squadron in 1866–7 and the Brooklyn navy-yard in 1868–70, he was retired in 1871 with rank of rear-admiral.

Godowski, gō-dŏv'skē, **Leopold,** Polish-American pianist: b. Vilna, Russian Poland, 13 Feb. 1870. A pupil of the Hochschule of Berlin and afterward of Saint-Saens, he made concert tours in the United States in 1884–5 and 1890–1. In 1895–1900 he was director of the pianoforte department of the Chicago Conservatory, to which post he was again appointed in 1902. His compositions include concert arrangements of well-known works, concert studies, pianoforte works, and songs.

Godoy, José Francesco, hō-sā' frän-thēs'-kō gō-doi', Mexican diplomat: b. Tampico, Mexico, 9 Aug. 1851. He studied law, was admitted to the bar in California, and practised in California and Mexico. He was also active as a journalist, represented Mexico at the San Antonio International Fair (1889–90) and other gatherings of importance, was Mexican *chargé d'affaires* in the Central American republics (1893–6), and became first secretary of the Mexican embassy to the United States in 1896. He wrote various works in English and Spanish.

Godoy, Manuel, DUKE OF ALCUDIA, Spanish noble: better known as the Prince of Peace: b. Badajoz 12 May 1767; d. Paris 4 Oct. 1851. He entered the Guards in 1787, and was admitted to the presence of the queen, whom he at once captivated by his handsome person and pleasing manners. The imbecile king, Charles IV., was as much pleased with him as his spouse, and he was thus established as a favorite. In 1795, as a reward for the part he had taken in concluding peace with France, he was presented with a large landed estate, and made a knight of the Golden Fleece. It was on this occasion also that he was named by the king Prince of Peace. Other honors and largesses continued to shower upon him, till at last the whole power of the Spanish monarchy was concentrated in his hands. As he used it in the promotion of French rather than Spanish interests, he became extremely unpopular, and an outbreak took place in 1808. He in consequence sought an asylum in France, where he employed the influence which he still possessed over the Spanish king to induce him to abdicate in May 1808. Notwithstanding the enormous wealth which he had at one time accumulated, he lived a long time in Paris in poverty, maintained chiefly by a small pension from Louis Philippe. He was the author of a work published in a French translation made under his supervision (1836-8) under the title of 'Mémoires du Prince de la Paix, Don Manuel Godoy, duc de l'Alcudia.'

God's Truce, a mutual agreement between territorial nobles confirmed and sanctioned by the Church by which war and violence were to be abstained from for a certain period. In the 9th and 10th centuries the empire of Charlemagne had become broken up into small territories, dukedoms, baronies, counties. The right of private war was a settled principle of the times, and dissensions were frequent and bitter. The peasantry and farmers, especially, were sufferers from the ravages of this petty warfare. Even the monasteries, cathedral colleges and seats of learning were not left in peace and everything threatened anarchy and dissolution. It was at this point that the Church stepped in, as the minister of justice and the guardian of moral order. Stern ecclesiastical penalties were fulminated against all who in the reckless feudal warfare should disturb the peace of churches, priests, and tillers of the soil. The Truce of God was instituted and by its provisions no fighting men should go forth to war on certain days. The little border province of Roussilon was the place where this truce was first agreed upon in the year 1027. Fourteen years later the movement had spread over the whole of France, and later it extended to Germany, Italy, Spain, and England. The Truce of God in 1041 provided that peace was to last from Wednesday evening to Monday morning of each week; there was to be no war during Advent and Lent nor on certain specified holy days; the punishments for contumacy and disobedience were money fines, banishment for a long term of years, and excommunication; protection was specially extended to all women, pilgrims, priests, travelers, merchants, and agriculturists, and also to the farm implements and live stock of the peasantry. The Peace of God was confirmed by several councils of the Church, more especially by that of Clermont (1095), when Urban II. proclaimed its universal extension throughout Christendom.

Godthaab, göt'häb (Danish, "Good Hope"), Greenland, seaport, on the west coast, capital of the Danish Southern Inspectorate. It is the oldest town in Greenland, and was founded in 1721 by Hans Egede, a Norwegian missionary. Pop. 950.

Godunoff, Boris Feodorovitch, Russian czar: b. 1552; d. 13 April 1605. He was the chief member of the regency during the reign of the imbecile Feodor Ivanovitch (1584-98) who had married Godunoff's sister Irene. He was accused of having caused the death of the czarevitch Demetrius in 1591, but in 1598, upon the death of Feodor, was elected to the throne. In 1591 he had defeated the Khan of the Crimean Tartars and in 1589 was largely instrumental in effecting the separation of the Russian Church from the Patriarchate of Constantinople. His policy was in the main progressive, but much popular discontent, especially in Southern Russia, was caused by the favors shown by him to foreigners and by his introduction of numerous innovations and reforms.

God'win, or Godwine, Earl of the West Saxons, an Anglo-Saxon noble: b. about 990; d. 15 April 1053. Godwin became the leading Englishman in the first half of the 11th century, and was father of the last king of the English native stock. He ingratiated himself with Ulf, brother-in-law of King Canute, the latter gave him his daughter in marriage, and he soon became one of the most powerful of the English nobles. He was the most powerful factor in procuring the English throne for Edward the Confessor and from that time headed the national party in opposition to the Norman court favorites. He was enormously wealthy and Earl of Wessex; his son Harold (afterward king) was Earl of East Anglia; his son Swegen was Earl of Hereford, Gloucester, and Oxford; his wife's nephew, Beorn, was Earl of Hertfordshire and Buckinghamshire; and for the service he had rendered to the king Edward had married his daughter Editha. This union, however, was not happy. Editha was cruelly neglected by Edward, and her father, by his dislike of the Normans, incurred the royal enmity. A quarrel afterward arose between the king and Godwin, occasioned by the partiality of the former for Norman favorites, and Godwin in consequence headed a rebellion, but was compelled to submit and with his family quit the kingdom. His estates were confiscated and then given to favorites. Queen Editha was made to feel even more bitterly the misfortunes of her family. Her husband seized her dower; he took from her her jewels and her money; and allowing her only the attendance of one maiden, he closely confined her in the monastery of Wherwell, of which one of his sisters was lady-abbess. In September 1052, however, Godwin returned with an army, forced Edward to enter into negotiations with him, re-established himself triumphantly in his old supremacy and caused the expulsion from the kingdom of most of the Norman intruders.

Godwin, Francis, English bishop and author: b. Havington, Northamptonshire, 1561; d. 1633. He was graduated from Christ Church, Oxford, in 1580; took orders, and became successively rector of Sampford-Orcais in Somersetshire, vicar of Weston-in-Zoyland, and subdean of Exeter in 1587. In 1601 appeared his 'Catalogue of the Bishops of England since the First Planting of the Christian Religion in this Island,' a work which procured him the bishopric of Llandaff from Elizabeth. Revised editions of this work appeared in 1615 and in 1616 with a dedication to King James I, who in 1617 transferred him to the bishopric of Hereford. Godwin also wrote: 'Rerum Anglicarum, Henrico VIII, Edwardo VI, et Maria regnantibus, Annales' (1616, later published as the 'Annales of England'); 'Nuncius Inanimatus in Utopia' (1629); 'Computation of the value of the Roman Sesterce and Attic Talent' (1630); and 'The Man in the Moon, or a Discourse of a Voyage Thither, by Domingo Gonsales' (1638).

Godwin, Mrs. Mary Wollstonecraft, English writer, wife of William Godwin (q.v.): b. (place uncertain) 27 April 1759; d. London to Sept. 1797. Her father was Edward John Wollstonecraft, son of a wealthy manufacturer of Spitalfields, London. Her mother was Elizabeth Dixon, an Irish woman. The brutality of her father made Miss Wollstonecraft's home life almost unbearable; and when their mother died in 1780, she and her two sisters left their father's house. One of these sisters married a Mr. Bishop. He proved not less brutal than her father, drove her into hiding, and forced her, in 1783, to obtain a legal separation. The misfortunes of Mrs. Bishop, however, provided Miss Wollstonecraft with material for her posthumous unfinished novel 'The Wrongs of Women.' From 1783 to 1785 Miss Wollstonecraft conducted with this sister a school at Newington Green. From this work, she went to Lisbon to nurse a friend, Fanny Blood, with whom she had lived from 1780 to 1783, and who had since married a merchant, Hugh Skeys. The death of this friend, from childbirth, 29 November 1785, suggested to Miss Wollstonecraft a pamphlet entitled 'Thoughts on the Education of Daughters.' This pamphlet was accepted by Johnson the publisher, and so opened the way for a remunerative business connection.

In 1788, after an unpleasant year as governess in the family of Lord Kingsborough, Miss Wollstonecraft removed to London and found employment with Johnson. In the five years that followed, she worked for him as reader and translator, published the first and only volume of her 'Vindication of the Rights of Women' (1792), and made the acquaintance of many literary people, among whom was the man she afterward married, William Godwin.

Her interest in the principles of the French revolution led her in 1792 to Paris. There she met Gilbert Imlay, a former captain in the American revolution. Without the formality of a marriage, which both professed to disapprove, they lived as man and wife; and to them, at Havre, 14 May 1794, was born a daughter. Next year Miss Wollstonecraft followed Imlay to England. He sent her to Norway on business connected with his commercial speculations, and took the opportunity to carry on an intrigue with another woman. Returning, she first attempted suicide by drowning; then, reconciliation with Imlay. Finally, in March 1796, she agreed to a separation.

Her resumption of literary work brought her again in contact with William Godwin. Despite her experience with Imlay, she, like Godwin, still objected to a legal marriage. At length, however, both set aside their scruples; and on 29 March 1797, they were married. Mary, the future Mrs. Shelley, was born August 30. The mother, however, died of a fever a few days after—10 Sept. 1797. In her memory, her husband published, the following year, 'Memoirs of the Author of a Vindication of the Rights of Women.'

Her works include: 'Thoughts on the Education of Daughters' (1787); 'Vindication of the Rights of Men' (1790); 'Vindication of the Rights of Women' (1792); 'Historical and Moral View of the French Revolution' (1794); 'Letters written in Norway, Sweden, and Denmark' (1796); 'Posthumous Works' (1798).

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Godwin, Parke, American journalist: b. Paterson, N. J., 25 Feb. 1816; d. New York 7 Jan. 1904. He graduated at Princeton College in 1834, and having studied law in his native town was admitted to practice at the bar in Kentucky, but did not pursue the profession. From 1837 to the close of 1853, with the exception of one year, he was the coadjutor of his father-in-law, William Cullen Bryant (q.v.), in the editorial management of the New York *Evening Post.* In 1843, he issued for a time the 'Pathfinder,' a weekly periodical of a literary and political character. While connected with the *Evening Post* he contributed frequently to the 'Democratic Review,' and he also edited 'Putnam's Magazine' for a time. His acquaintance with German literature was exemplified by his translation of Zschokke's tales and of the first part of Goethe's autobiography. Other works of his are: 'A Popular View of the Doctrines of Charles Fourier' (1884); 'Constructive Democracy' (1844); 'Vala, a Mythological Tale' (1851); 'Handbook of Universal Biography' (1851); 'Political Essays' (1856); 'History of France' 1st vol. (1861); 'Cyclopædia of Biography' (1865); 'Out of the Past' (1870); 'A New Study of Shakespeare's Sonnets' (1900). He has also edited 'The Life and Works of William Cullen Bryant' (1884).

Godwin, William, English writer and political philosopher: b. Wisbeach, Cambridgeshire, England, 3 March 1756; d. London 7 April 1836. He attended various schools, and in 1771 became an usher in that of Robert Akers at Hindolveston. The next year his father, John Godwin, a dissenting minister, died; and in 1773 William removed with his mother to London where he entered Hoxton Academy. Four years later he began preaching; and between 1777 and 1783 he was minister at Ware in Hertfordshire, at Stowmarket in Suffolk, and, for a brief trial, at Beaconsfield.

Unsuccessful as a minister, he turned in 1783 to literary work. In the ten years that followed he supported himself—not over-successfully—by hack work, made many friends, especially among the Whig politicians and the sympathizers with the French Revolution, and formulated those radical opinions which he embodied in his 'Political Justice,' 1793. He had for some years been satisfied, he says in his Preface, "that monarchy was a species of government essentially corrupt." He owed this conviction to the political writings of Swift and to a perusal of the Latin historians. Nearly at the same time he derived much additional stimulus from several French productions on the nature of man . . . the 'Système de la Nature,' the works of Rousseau, and those of Helvetius. The work, he says, "was projected in the month of May, 1791: the composition was begun in the following September, and . . . occupied a space of 16 months." The book appeared in February 1793, when England was at a white heat over the execution of Louis XVI. and the French declaration of war against England and Holland. Godwin feared, not without cause, that he would be prosecuted for such a publication; but the government seems to have judged that a book costing three guineas would prove harmless. The book met immediate success, running through three editions within five years; but its author, repenting the radicalism of the first edition, made the second and third editions increasingly moderate. Godwin's political philosophy attracted wide attention; and although he never again attempted so large a subject as in his 'Political Justice,' yet he continued to have a following especially among young men. Of these, a few years later, Shelley is a notable instance.

Godwin's first and ablest novel, 'Caleb Williams,' appeared one year after 'Political Justice' (1794). The story, although since ridiculed by DeQuincey, enjoyed high success at the time. 'St. Leon, a Tale of the 16th Century' (1799), was also successful. Meanwhile, in 1796, Godwin had become intimate with Mary Wollstonecraft, then known as Mrs. Imlay. Both held that a legal marriage was undesirable; but, lacking the courage of their conviction, they were married 29 March 1797. Mrs. Godwin died September 10th after giving birth to a daughter, the future Mrs. Shelley. Four years later, having been rejected by at least two other women, Godwin married a Mrs. Clairmont. The union brought unhappiness and financial difficulties. In 1805, his wife undertook a publishing business. Under the name of Baldwin, he wrote children's books for her; and the Lambs gave them their 'Tales from Shakespeare.' By 1807, increasing business warranted a removal to a larger shop in Skinner street, Holborn. Godwin's circle of acquaintances included Coleridge, the Lambs, and Wordsworth. In 1811, the young Shelley was added. When, however, in 1813, Shelley put some of Godwin's moral theories into practice by eloping with Mary Godwin, the philosopher was enraged. A check for £1000 silenced him. When Shelley and Mary were married, three years later, Godwin was openly reconciled. He had need of the financial countenance of so wealthy a son-in-law. The publishing business was becoming less remunerative. In 1822, Godwin became bankrupt. Literary and political friends tried to aid him, but succeeded only in part. In 1833 they secured him the position of yeoman usher of the exchequer—an office without duties. He died 7 April 1836. Nine years later, DeQuincey wrote of him: "Godwin's name seems sinking out of remembrance; and he is remembered less by the novels that succeeded, or by the philosophy that he abjured, than as the man that had Mary Wollstonecraft for his wife, Mrs. Shelley for his daughter, and the immortal Shelley as his son-in-law."

His works include: 'Enquiry Concerning Political Justice and its Influence on Morals and Happiness' (1793); 'Things as they are; or the Adventures of Caleb Williams' (1794); 'The Enquirer . . . a series of Essays' (1797); 'Memoirs of the Author of a Vindication of the Rights of Women' (1798); 'St. Leon, a Tale of the 16th Century' (1799); 'Antonio, a Tragedy in Five Acts in Verse' (1800); 'Life of Geoffrey Chaucer' (1803); 'Lives of Edward and John Philips' (1815); 'Mandeville, a Tale of the 17th Century' (1817); 'Of Population . . . in answer to Mr. Malthus' (1820); 'History of the Commonwealth . . . to the Restoration of Charles II.' (4 vols. 1824–8).

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Godwin-Austen, a mountain peak said to be among the highest in the world; in the Mustagh range of the Himalayan system. Its height is 28,250 feet. Distinguished in the records of the great trigonometrical survey only by the sign K2, it was named in 1888 after Lieut.-Col. Godwin-Austen of the Trigonometrical Survey of India.

Godwin-Austen, Henry Haversham, English topographer and geologist: b. Teignmouth, 6 July 1834. He is the son of R. A. C. Godwin-Austen, the distinguished geologist; was educated at the Royal Military College, Sandhurst; joined the 24th Regiment of Foot in 1851; in 1852 went with his regiment to India and served with distinction in the Second Burmese War and Punjab. He then became topographical assistant in the Trigonometrical Survey of India, and in 1857 joined the Kashmir Survey party. While connected with this he surveyed a large part of Kashmir and Baltistan and discovered the enormous glaciers at the head of the Shigar River and Hunza Nagar frontier including the important Baltoro glacier. In 1862 he surveyed the Rupshu and Zaskar districts in Ladakh during July and August of that year making 13 ascents of mountain peaks, the highest of which was Mata, 20,607 feet. He then surveyed the Pang Kong Lake district nearly to Rudok in Chinese territory but was stopped in 1863 by the Lhassan governor; during the winter of 1862–3 was on special duty, with the last mission to Bhutan and mapped out the country between Darjeeling and Bunakha. In 1874 he served with the Bhutan Field Force and was present at the capture of Dalmgkote and Chamurchi forts; took part in the expedition against the Dafia tribe in the Eastern Himalayas; and in 1877 was retired from the army with the rank of lieutenant-colonel. In 1883 he was president of Section E (Geography) British Association, and from 1897–9 was president of the Malacological Society. Besides numerous scientific papers on geology and physical features he has written: 'On the Land and Freshwater Mollusca of India' (1882–99), in nine parts.

God'wits, a group of wading-birds allied to the sandpipers but with longer legs and bill, and distinguished from curlews by the straight not decurved bill. They constitute the genus *Limosa*, of which five species are known. All of them are summer residents of the northern part of the northern hemisphere, but on their migrations reach northern Africa and South America, while one species extends its flight to New Zealand. Our most common American species are the marbled godwit (*L. fedoa*) and the Hudsonian godwit (*L. hæmastica*), both known to gunners as "marlin." They are not nearly so common as are many other shore-birds on the Atlantic coast. In England two other species occur,— the black-tailed godwit (*L. limosa*) and the bar-tailed godwit (*L. lapponica*).

Goepp, Philip Henry, American musician: b. New York 23 June 1864. He was graduated from Harvard in 1884, and was admitted to the bar in Philadelphia in 1888, but turned his attention exclusively to music in 1891, and became active as organist, composer, and instructor. He has published anthems, songs, and part-songs, written some instrumental works yet in MS., and is the author of 'Annals of Music in Philadelphia' (1896); and 'Symphonies and Their Meaning' (1898).

Goes, goiz, **Pero de**, Portuguese colonist: b. Lisbon 1503; d. 1554. He was the leader of De Sousa's Brazilian expedition of 1530, and in 1532 began the successful cultivation of sugar-cane on a plantation not far from the coast of Brazil. Appointed by the king lieutenant to the governor-general, Sousa, he was of great service in the suppression of Indian depredations. It is stated that he carried to Europe (1547) the first specimens of the tobacco-plant seen there.

Goessman, gĕs'man, **Charles Anthony**, American chemist: b. Naumburg, Hesse-Cassel, Germany, 13 June 1827. He was educated at Göttingen, where he was assistant in the chemical laboratory in 1855–7; came to the United States in 1857; in 1857–69 held positions in commercial companies, and in 1866–8 was professor of chemistry in the Rensselaer Polytechnic Institute (Troy, N. Y.). In 1869 he became professor of chemistry in the Massachusetts Agricultural State College, Amherst, Mass., in 1882–94 was director of the State agricultural experiment station there. In 1886–7 he was president of the American Chemical Society. His papers on salt and the chemistry of natural brines, sugar and sugar manufacture, and his experiment station reports, are of particular value.

Goethe, Johann Wolfgang, yō'hän vŏlf'gäng gė'tė, German poet and critic: b. Frankfort-on-the-Main 28 Aug. 1749; d. Weimar 22 March 1832. He attended the University of Leipsic 1765–8 and in 1770 went to Strasburg where he met Herder and familiarized himself with Shakespeare, and in 1771 took his degree. After publishing two dramas anonymously, 'Götz von Berlichingen' in 1773 announced the dawn of a new era in German letters, and in 1774 'The Sorrows of Werther' made him world-famous. In 1775 he accepted the invitation of Duke Carl August and went to Weimar, his home for the rest of his life. His Italian journey, which marked an era in his career, occurred 1786–7. His friendship with Schiller, of far reaching influence in his poet's life, began in 1794, and ended only with Schiller's death in 1805. In 1806 Goethe married Christine Vulpius. For some years after going to Weimar he wrote but little, but his drama of 'Egmont' appeared in 1785, and thenceforward his leisure was devoted to composing, in prose, his great tragedy 'Iphigenie,' recast in verse in 1786; in writing the novel 'Wilhelm Meister'; and in building up his greatest work, 'Faust.' The succession of his works from 1789 forward was: 'Tasso,' a drama (1789); 'Metamorphosis of Plants' (1790); 'The Grand Cophta,' a dramatization of the affair of the 'Diamond Necklace'; 'Wilhelm Meister's Apprenticeship' (1796); 'Hermann und Dorothea' (1796–7); 'Elective Affinities' (1808); 'Fiction and Truth' (1811); 'West-Eastern Divan' (1814); 'Wilhelm Meister's Years of Travel' (1821); second part of 'Faust' (1831: the first part had appeared as 'A Fragment' in 1790).

His great life, extending over upward of four-score years, makes him a man of the 18th century and also of the 19th. He belongs not only to German but to European literature. And in the history of European literature his position is that of successor to Voltaire and Rousseau. Voltaire fought to enfranchise the understanding. Rousseau dreamed, brooded, suffered, to emancipate the heart. Here then were Goethe's two great predecessors: one a most vivacious intelligence, the other a brooding sensibility; one aiming at an emancipation of the understanding, but deficient in reverence and in love; the other aiming at an emancipation of the affections, but deficient in sanity of thought. In what relation stood Goethe to these great forces of the 18th century?

In his old age Goethe, speaking of Voltaire, uses the words "a universal source of light." But as a young man he was repelled by him. Into the influence of Rousseau, on the contrary, and into the general movement of feeling to which Rousseau belonged, Goethe in his youth was caught, almost inevitably; and he abandoned himself to it for a time, it might seem without restraint.

Yet Goethe differed from Rousseau as profoundly as he differed from Voltaire. The young creator of "Werther" may seem to have started on his career as a German Rousseau. In reality, "Werther" expressed only a fragment of Goethe's total self. A reserve force of will and an intellect growing daily in clearness and in energy would not permit him to end as Rousseau ended. In 'Götz von Berlichingen' there goes up a cry for freedom; it presents the more masculine side of that spirit of revolt from the bonds of the 18th century, that "return to nature," presented in its more feminine aspects by "Werther." But by degrees it became evident to Goethe that the only true ideal of freedom is a liberation not of the passions, not of the intellect, but of the whole man; that this involves a conciliation of all the powers and faculties within us; and that such a conciliation can be effected only by degrees, and by steadfast toil.

And so we find him willing during ten years at Weimar to undertake work which might appear to be fatal to the development of his genius. To reform army administration, make good roads, work the mines with energetic intelligence, restore the finances to order,— was this fit employment for one born to be a poet? Except a few lyrics and the prose 'Iphigenie,'

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these years produced no literary work of importance; yet Goethe himself speaks of them as his «zweite Schriftstellerepoche,»— his second epoch as a writer. They were needful to make him a master in the art of life, needful to put him into possession of all his powers. Men of genius are quick growers; but men of the highest genius, which includes the wisdom of human life, are not speedily ripe. At 26 he was a chief figure in German, even in European, literature; and from 26 to 37 he published, we may say, nothing. But he was well employed in widening the basis of his existence; in organizing his faculties; in conciliating passions, intellect, and will; in applying his mind to the real world; in endeavoring to comprehend it aright; in testing and training his powers by practical activity. A time came when he felt that his will and skill were mature; that he was no longer an apprentice in the art of living, but a master craftsman. Tasks that had grown irksome and were felt to be a distraction from higher duties, he now abandoned. Goethe fled for a time to Italy, there to receive his degree in the high-school of life, and to start upon a course of more advanced studies. Thenceforward until his closing days the record is one of almost uninterrupted labor in his proper fields of literature, art, and science. His task, regarded as a whole, was to do over again the work of the Renaissance. But whereas the Renaissance had been a large national or European movement, advancing toward its ends partly through popular passions and a new enthusiasm, the work which Goethe accomplished was more an affair of intelligence, criticism, conscious self-direction. It was less of a flood sweeping away old dikes and dams, and more of a dawn quietly and gradually drawing back the borders of darkness and widening the skirts of light. A completely developed human being, for the uses of the world,— this was the ideal in which Goethe's thoughts centred, and toward which his most important writings constantly tend. A completely developed State or commonwealth should follow, as an ideal arising out of the needs and demands of a complete individual. Goethe knew that growth comes not by self-observation and self-analysis, but by exercise. Therefore he turned himself and would turn his disciples to action, to the objective world; and in order that this action may be profitable, it must be definite and within a limited sphere. He preaches self-renunciation; the active self-abandonment of devotion to our appropriate work. Such is the teaching of ‹Wilhelm Meister›: it traces the progress of a youth far from extraordinary, yet having within him the capacity for growth, progress through a thousand errors and illusions, from splendid dreams to modest reality. Life is discovered by Wilhelm to be a difficult piece of scholarship. If we ask,— for this, after all, is the capital question of criticism,— What has Goethe done to make us better? the answer is: He has made each of us aspire and endeavor to be no fragment of manhood, but a man; he has taught us that to squander ourselves in vain desires is the road to spiritual poverty; that to discover our appropriate work, and embody our passion in such work, is the way to true wealth; that such passion and such toil must be not servile, but glad and free; that the use of our intelligence is not chiefly to destroy, but to guide our activity in construction; and that in doing our best work we incorporate ourselves in the best possible way in the life of our fellows. Such lessons may seem obvious; but they had not been taught by Goethe's great predecessors, Voltaire and Rousseau. Sanity for the imagination Goethe found in classical art. The young leader of the Romantic revival in Germany resigned his leadership; he seemed to his contemporaries to have lost the fire and impulse of his youth; his work was found cold and formal. A great change had indeed taken place within him; but his ardor had only grown steadier and stronger, extending now to every part of his complex nature. The change was a transition from what is merely inward and personal to what is outward and general. He did not go into bondage under the authority of the ancients; but he found their methods right, and he endeavored to work as they had worked. For a time the reaction carried him too far. But in the noble drama of ‹Iphigenie,› in the epic-idyll of ‹Hermann und Dorothea,› and in many of the ballads written during his period of close companionship with Schiller, we have examples of art at once modern in sentiment and classical in method. Goethe's faith in the methods of classical art never passed away, but his narrow exclusiveness yielded. He became, with certain guiding principles which served as a control, a great eclectic, appropriating to his own uses whatever he perceived to be excellent. As in ‹Hermann und Dorothea› he unites the influences of Greek art with true German feeling, so in his collection of short lyrics, the ‹West-Östlicher Divan› (West-Eastern Divan), he brings together the genius of the Orient and that of the Western world, and sheds over both the spiritual illumination of the wisdom of his elder years. Gradually his creative powers waned, but he was still interested in all — except perhaps politics — that can concern the mind; he was still the greatest of critics, entering with his intelligence into everything and understanding everything, as nearly universal in his sympathies as a human mind can be. The most invulnerable of Goethe's writings are his lyrical poems; against the best of these criticism can allege nothing. They need no interpreter. But the reader who studies them in chronological order will observe that as time went on, the lyric which is a spontaneous jet of feeling is replaced by the lyric in which there is constructive art and considerate evolution. In the poems of the ‹West-Östlicher Divan› Goethe returns to the lyric of spontaneity, but their inspiration is rather that of a gracious wisdom, at once serious and playful, than of passion. His period of romance and sentiment is best represented by ‹The Sorrows of Werther.› His adult wisdom of life is found most abundantly in ‹Wilhelm Meister's Apprenticeship.› The world has long since agreed that if Goethe is to be represented by a single work it shall be by ‹Faust.› And even those who perceive that ‹Faust› is best understood by being taken along with Goethe's other writings — his early ‹Prometheus,› his autobiography, his travels in Italy, his classical dramas, his scientific studies, his work as a critic, his vast correspondence, his conversations in old age — cannot quarrel with the judgment of the world.

'Faust,' if we include under that name the first and the second parts, is the work of Goethe's whole life. Begun and even far advanced in early manhood, it was taken up again in his midmost years, and completed with a faltering hand in the closing season of his old age. All his works, Goethe said, constituted a great confession. More than any other of his writings, 'Faust' is the confession of his life.

There are two ways in which the reader may deal with 'Faust.' He may choose for his own delight a fragment, detach it and disregard the rest; he may view this fragment, if he pleases, as a whole, as a rounded work of art. Such a reader will refuse to pass beyond the first part of the vast encyclopædic poem. To do this is legitimate. The earliest form in which we possess the drama, that of the transcript made by Fräulein von Göchhausen, is a tragedy which might be named 'The Tragedy of Margaret.' Possibilities of further development lay in the subject, were indeed required by it, and Goethe had probably already conceived certain of them; yet the stadium in the progress of Faust's history included in 'The Tragedy of Margaret' had a unity in itself. But a reader may approach 'Faust' otherwise; he may view it as expressing the complete mind of Goethe on some of the deepest problems of human life. Viewing it thus, he must accept the whole work as Goethe has given it; he must hold in abeyance, at least for a time, his own particular likings and dislikes. While keeping his mind open to all the poetry of 'Faust,' he will soon discover that here is something more than a poem; he finds in it the intellect, the character, the life of Goethe; it is a repository of the deepest thoughts and feelings concerning human existence of a wise seer.

The theme of 'Faust' as originally conceived was the turning of an idealist from his own private thoughts and dreams to the real world; from all that is unnatural,— systems, speculations, barren knowledge,— to nature and the founts of life; from the solitary cell to the company of men; to action, beauty, life, and love. If he can really succeed in achieving this wisely and well, Faust is saved. He is delivered from solitude, the inane of speculation, the vagueness of idealism, and made one with the band of his toiling fellows. But to accompany him there is the spirit of base worldliness, the realist, the cynic, who sees the meaner side of all that is actual, who if possible will seduce Faust into accepting the world apart from that elevating spirit which ennobles actual life, who will try to baffle and degrade Faust by degrading all that he now seeks,— action and beauty and life and love.

It is Goethe himself who is at odds with himself,— the realist Goethe set over against the idealist Goethe; and Mephistopheles is the base realist, the cynic whose endeavor is to mar the union of high poetry and high prose in human life, which union of high poetry with high prose Goethe always looked upon as the true condition of man's activity. Let Mephistopheles, the spirit of negation, try his worst, and at the last discover how an earnest striver's ways are justified by God. Faust may wander, err, fall, and grievously offend,—"as long as man lives, man errs"; but for him who ever strives upward, through all his errors, there is redemption in the end.

See Lives by Schäfer (1851), Lewes (1855), Goedeke (1877), Düntzer (1883), Heinemann (1899), Prem (1900), Witonsky (1900), Bielschowsky (1902 et seq.); Bernays, 'Der junge Goethe' (1875); Biedermann, 'Goethe Forschungen' (1879–99); Düntzer, 'Zur Goetheforschung' (1891); Zarncke, 'Goethe Schriften' (1897); Weissenfels, 'Der junge Goethe' (1899); Sell, 'Goethe's Stellung zu Religion und Christenthum' (1899); Vogel, 'Goethes Selbstzeugnisse über seine Stellung zur Religion' (1899); Menzel, 'Der Frankfurter Goethe' (1900); Fischer, 'Goethe und Napoleon' (1901); Funk, 'Goethe und Lavater' (1901); Bode, 'Goethes Aesthetik' (1901).

Goethite, gė'tīt, a hydrous sesquioxide of iron, contains when pure 62.9 per cent of iron. It differs from hematite in having a yellow streak and from limonite in containing more water and crystallizing in the orthorhombic system. The lower grade yellow or reddish iron ores of the Lake Superior region, particularly on the Mesabic range in Minnesota, contain considerable goethite and the mineral is thus an iron ore of some importance, though it is not distinguished commercially from limonite. See Iron.

Goetschius, gĕt'shĭ-ŭs, **Percy,** American musical scholar: b. Paterson, N. J., 30 Aug. 1853. He was graduated from the Stuttgart Conservatory, became an instructor there, and was appointed to a royal professorship by the king of Würtemberg. In 1890 he received appointment to the professorship of harmony, musical history and advanced pianoforte in the musical department of Syracuse University, and later was professor of composition in the New England Conservatory (Boston, Mass.), from which post he resigned in 1896. He became organist of the First Parish Church (Unitarian) of Brookline, Mass., in 1897. In addition to his compositions, including anthems, sacred songs, and instrumental works, he wrote: 'The Material Used in Musical Composition' (1882), 'The Theory and Practice of Tone Relations' (1892), 'The Homophonic Forms of Musical Composition' (1898).

Goetz, göts, **Theodor von,** German painter: b. Lieschen, Siberia, 1826; d. 1892. He began as a genre painter, but in 1848 entered the army and during the Schleswig-Holstein campaigns filled his portfolio with sketches of march and battle. He thenceforward devoted himself to painting military scenes, and became renowned as a battle painter. He took part in the Franco-Prussian war of 1870–1, and painted many striking incidents of the campaign. Noteworthy is his 'Episode in the Battle of Sedan' (1875), one among many remarkable canvases which render him the Horace of Germany.

Goffe, gŏf, **William,** English regicide: b. Sussex about 1605; d. Hadley, Mass., about 1679. He became a major-general in the parliamentary army, sat in the House of Commons and in Cromwell's "other house," and was one of the judges who signed Charles' death warrant. In 1660, with his father-in-law, Gen. Edward Whalley, he fled to America; and they lay in hiding round about New Haven from 1661 to

1664, when they went to Hadley, Massachusetts. There they lived for many years in seclusion; and it is there that, according to the well-known tradition, when the townsmen were called from the meeting-house to repel an Indian attack, and were standing irresolute, Goffe put himself at their head and drove off the foe, and then disappeared as suddenly as he had come. The genuineness of the story, however, has been questioned. His papers have been printed by the Massachusetts Historical Society. See Stiles, 'History of Three of the Judges of King Charles I.' (1794).

Gog and Magog, a king and his nation mentioned in Ezekiel, and the book of Revelations ("the prince of Rosh, Meshech and Tubal from the land of Tubal"). Gog, king of the Magog people, represented the northern hordes, who were to invade western Asia (Ezek. xxxviii. 39). Probably Gog was the Gyges of the Greeks, Gyges being a typical name for kings reigning northwest from the Assyrians. The event predicted was the irruption of the northern nations into Syria.

Gog and Magog are also the names given to two reputed giants of early British history, whose statues are erected in the Guildhall in London. The legend reported by Caxton with reference to these personages declares that they were the last two survivors of the sons of the 33 infamous daughters of the Emperor Diocletian, who, having murdered all their husbands, were sent to sea in a ship, and arriving in Britain and cohabiting there with demons, had a number of giants for their offspring. These giants, it is said, were conqnered and brought prisoners to London, where they were kept chained to the gates of a palace on the site of the Guildhall. When they died their place was taken by effigies of them. Effigies called Gog and Magog certainly existed in London at a very early period, and they were sometimes brought out and placed on a conspicuous place to welcome a sovereign entering the city, as was done to Henry V. in 1415; Philip and Mary in 1554; and Qneen Elizabeth in 1558. The old effigies were burned in the great fire in 1666. The present figures of Gog and Magog, which are 14 feet high, were erected in 1708.

Gog'gler, or **Goggle-eye,** names given colloquially to several fishes that have prominent eyes, as the rock-bass, the wall-eyed pike, and a tropical crevalle. American gunners call a duck, the surf scoter, "goggle-nose," in reference to spectacles-like spots on its bill.

Gogol, gō'gŏl, **Nik'olai Vassil'jevich,** Russian novelist and dramatist: b. in the government of Poltava 31 March 1809; d. Moscow 21 Feb. 1852. From an early period he manifested a great inclination for dramatic representation, and even endeavored to establish himself in the profession of an actor, but his first appearance was unsuccessful. After filling a situation in a government office, became successively professor of history in the Patriotic Institute, a private tutor, and, lastly, professor of history in the University of St. Petersburg. In none of these did he continue for any time, and presently took up his residence abroad, spending a long period in Italy. His works are extremely popular in Russia for their graphic and humorous delineation of everyday life and manners, and more especially Russian country life. Among them are: 'Evenings at the Farm' (1832); 'Mirgorod,' a collection of tales (1834); 'Dead Souls' (1842), a satirical novel, depicting the public abuses and barbarism of manners prevalent in the provinces; and 'The Reviser,' a satirical comedy of Russian officialdom.

Goitre, goi'tėr, an enlargement of the thyroid gland which may occur sporadically or be endemic. Isolated cases occur the world over. In the United States the disease is comparatively prevalent around Lake Ontario and in parts of Michigan. It is found endemically in the mountainous regions of Switzerland and Italy. The canse is unknown, although certain claims are made that the water is responsible. The symptoms of goitre consist of a more or less uniform enlargement of one or both lobes of the thyroid, causing a puffiness either on one side or both sides of the neck about the region of Adam's apple. When small, no inconvenience is caused thereby, but if the growth becomes extensive, pressure on the important structures of the neck may result in difficulty in breathing, and occasionally sudden death has resnlted. Tumors of the thyroid gland such as carcinoma and sarcoma, sometimes simulate goitre. One form of goitre, due to abnormal thyroid function, is known as Graves' disease (q.v.). See Exophthalmic Goitre.

Gokcha, gŏk-chä', **Goktscha,** or **Sevanga,** sā-vän'gä, a lake in Erivan, in Transcaucasia, Russia. It is 6,400 feet above the sea and has an area of about 540 square miles. A large number of small streams flow into it, but the outlet, the Sanga, which flows into the Aras, seems to convey only a small portion of the waters to the Caspian Sea.

Golcon'da, Ill., village, connty-seat of Pope County; on the Ohio River. It is the trade centre for a large farming country and for a mining district. Its manufactures are chiefly flour and lumber. Pop. 1,200.

Golcon'da, India, an extensive fortress of the Nizam, situated on a granite ridge, seven miles west of Hyderabad, India. In its immediate neighborhood are the ruins of an ancient city, once the metropolis of the powerful kingdom of Golconda, which reached its height at the close of the 16th century and endnred till 1687. The place itself is still strong; and about 600 yards distant are the solid mausoleums of its former sovereigns. The fort is held by a small garrison from Hyderabad, and serves as the Nizam's treasnry, and also as a state prison. Golconda is proverbially famous for its diamonds; but in truth, they were merely cnt and polished here.

Gold (chemical symbol, Au; atomic weight, 187), a metal distinguished from other common metallic elements by its beautiful characteristic yellow color which it preserves untarnished on exposure to the atmosphere under nearly all conditions. Many alloys of copper with zinc, tin, and aluminum have also a more or less golden-yellow color, and are used as substitutes for and imitations of gold, being sold under varions fanciful names, such as Dutch metal, Mannheim gold, Abyssinian gold, etc. Some of the bronzes have also a golden color. None of these resist atmospheric action like gold, but some are fairly permanent under ordinary conditions. Pure gold has a high metallic lustre, but is inferior in this respect to steel, platinum, and silver. The metal possesses a higher specific gravity than any common metal, but is exceeded in this respect by platinum. The specific gravity varies from 19.2 to 19.4, and the metal is thus $1\frac{1}{2}$ times heavier than lead and nearly twice as heavy as silver, bulk for bulk. Gold melts at 1045° C., being somewhat less fusible than silver and more fusible than copper. It does not melt in a common fire. At high temperatures the metal is sensibly volatile, and in the intense heat of the oxyhydrogen blowpipe or electric furnace may be vaporized. The vapor is purple.

The pure metal is somewhat harder than lead, but softer than copper, silver, platinum, zinc, or iron. It is consequently too soft, in the pure state, for the purposes to which it is generally applied. For practical application it is alloyed with copper or silver, and both these metals are often present. The former renders the gold redder and the latter paler than its true color. The proportion of gold contained in an alloy is expressed in degrees of fineness, or as "carats" and carat grains (4 grains = 1 carat). The fineness is expressed in parts per thousand, for example 916.6, or decimally, .9166. The carat value of the gold is expressed in parts of 24, pure gold being 24 carats fine. Thus 9-carat gold contains 9 parts of pure gold and 15 of a mixture of copper and silver, etc., commonly known as alloy. Sovereign gold consists of 11 parts gold and 1 copper; guinea gold, of 11 parts gold, $\frac{1}{2}$ part of copper, and $\frac{1}{2}$ part of silver. Standard and guinea gold are thus 22 carats fine (the legal standard for coins in the United Kingdom and colonies), and contain only 2 parts of alloy. The German, American, and Italian standard is 21.6 carat, and is composed of 1 part copper and 9 gold. The following table shows the relative amounts of gold and baser metal in alloys commonly employed:

Carats Fine	Pure Gold	Alloy	Fineness in Thousands
24	24		1000.00
22	22	2	916.66
21.6	21.6	2.4	900.00
18	18	6	750.00
15	15	9	625.00
12	12	12	500.00
9	9	15	375.00
4	4	20	166.6

The lowest recognized standard is 9 carat, but much gold of inferior quality is worked up into ornaments and commonly sold as real gold. Derby gold is also a common name for this poor material. In the United Kingdom articles of jewelry, plate, etc., are stamped with certain marks known as hall marks, or plate marks, as a guarantee that they have the quality they profess to have. Tampering with hall-marked articles is an indictable offense. Many specious imitations of hall marks are put upon sham jewelry, but always differ in some essential feature. Gold alloys of a red character are frequently colored. This consists in treating the article chemically in such a manner as to dissolve out the base metal constituting the alloy, leaving a covering of purer gold, paler than the original. For this purpose the articles are boiled with 1 part of salt, 1 of alum, 2 of saltpeter dissolved in 4 parts of water, for 20 minutes. Rolled gold is produced by applying thin sheets of gold to a plate of alloy and rolling down the compound sheet.

Pure gold has a tenacity of about 7 tons per square inch, and elongates about 30 per cent before breaking. A wire one tenth of an inch thick will support nearly 200 pounds. Its alloys with copper and silver are stronger. Standard gold has a tenacity of 18 tons (Austen), and extends 34 per cent before breaking. At very low temperatures this is greatly increased (Dewar). Gold is the most malleable of metals, and can be reduced to extremely thin leaves by hammering (see GOLD-BEATING). Such leaves sometimes do not exceed $\frac{1}{250000}$ of an inch in thickness, and transmit green light, though presenting an unbroken metallic surface. This is best seen by mounting on glass. The extreme thinness and high lustre of the metal have led to its use as an illustration of the extreme divisibility of matter. A particle of gold weighing only $\frac{1}{2500000}$ of a grain is readily visible to the naked eye. A grain of gold can be made to cover nearly 80 square inches of surface. The malleability of gold is seriously affected by the presence of minute quantities of arsenic, antimony, bismuth, lead, sulphur, selenium, and tellurium. Of the last 0.2 per cent, and of bismuth 0.5 is sufficient to render the metal crystalline and brittle. Traces of the above elements unfit the metal for gold-beating and coinage. These are removed by passing chlorine gas through the molten metal, or by treating the molten metal with mercuric chloride (corrosive sublimate). By continued hammering the metal is slightly hardened, and must be annealed. Gold surpasses all other metals in respect of ductility. The extreme ductility of the metal is shown by the fact that wires less than $\frac{1}{20000}$ of an inch thick were obtained by Wollaston by encasing a wire of gold in silver and drawing down the compound wire. The silver was dissolved off by treatment with nitric acid. A length of 500 feet of such wire weighs only 1 grain. Gold wire is used for making gold lace. Gold is also extremely flexible and tough. The pure metal breaks with a hackly fracture, but the appearance is greatly affected by impurities.

Chemical Properties.— Gold alloys readily with most metals. It is rapidly attacked by mercury, and dissolves in excess of that metal. If the liquid amalgam be squeezed through wash-leather a yellow pasty mass remains, which may be used in "wash" or "fire" gilding. This process, however, has been largely displaced by electro-gilding, in which the bath consists of the double cyanide of gold and potassium, and is used hot. The metal is unattacked by any of the simple acids, save selenic, but dissolves in any mixture in which chlorine, bromine, or iodine is liberated. The common solvent is aqua regia, a mixture of 1 part nitric acid and 3 or 4 of hydrochloric acid. The chlorine liberated from this mixture converts the gold into the trichloride, an exceedingly soluble body of high tinctorial power, yielding yellow solutions. In the finely-divided state gold is dissolved by chlorine water, bromine water, and iodine solution or tincture, the trichloride, tribromide, and triodide being produced. It also dissolves in potassium cyanide solutions (in the presence of air) and in cyanogen bromide. These solvents are employed in the extraction of gold from its ores. Oxides of gold can be prepared with some difficulty. The monoxide is thrown down when caustic potash is boiled with gold chloride solution to which a little acetate of soda has been added. A trioxide (Au_2O_3), a dioxide (Au_2O_2), and a tetroxide (Au_2O_4) are also known. What is known as fulminating gold, $Au_2O_3(NH_3)$, may be prepared by adding ammonia to a solution of gold chloride or by steeping the hydroxide in ammonia. It is a green or brownish powder, which detonates violently when gently heated or when struck. Two classes of gold salts exist. Of the aurous salts, the principal are sodium auro-sulphite, auro-thiosulphate, the cyanide and potassium auro-cyanide. Of the auric salts, the principal are the trichloride and the chloraurates. Gold trichloride crystallizes from solution in dark orange-red crystals, $AuCl_3 2H_2O$. It is extremely soluble in water, and volatilizes at 300° in a stream of chlorine gas, but is decomposed on heating to 200° in air with the formation of the monochloride and chlorine, and, at a higher temperature, of gold. It is soluble in ether, naphtha, and essential oils.

The chlor-aurates are combinations of gold chloride with sodium, potassium, and other alkaline chlorides. The best known are $KCl.AuCl_3.2H_2O$, and $NaCl.AuCl_3.2H_2O$, salts commonly sold as gold chloride for photographic purposes. Gold is precipitated from solution by most metals. Iron, copper, and zinc precipitate it readily, generally in a more or less pulverulent form devoid of metallic appearance. Oxalic acid, ferrous sulphate, sulphur dioxide, and sodium sulphite, carbon, grape-sugar, and many organic reducing agents, precipitate the gold from gold chloride. In some cases the metal is so finely divided that it imparts a ruby color to the liquid and does not settle for months. Purple of Cassius is the fine purple pigment produced by treating gold chloride solution with a mixture of tin chlorides, that is, stannous chloride containing a little stannic salt. It is used in glass staining, pottery, and enamel painting, and for coloring artificial gems, imparting a pink, rose, or red color. The addition of tin chloride to the solution obtained by treating an ore with aqua regia and boiling off the excess acid, is a delicate test for the presence of gold. Finely divided gold imparts to pottery and glass a color varying from pink to ruby. Gold resists chemical action to a greater extent than platinum or any other common metal, and in alloys protects base metals from the action of acids to a remarkable extent. Owing to the high specific gravity of gold (19.3) it is possible to roughly determine the richness of the alloy by taking the specific gravity of the article. This is impossible where platinum (specific gravity 21.4) is present in the alloy. The specific gravity of standard gold is 17.157, and of 18-carat gold 16.8.

Assay of Gold.— The touchstone is employed to determine approximately the quality of the gold. It is a hard, black, silicious or flinty slate known also as Lydian stone. Basalt and black Wedgewood ware are also employed. The metal to be examined is rubbed on the stone (any plating or coloring being first scraped off), and the streak compared with that made by needles of known composition differing from each other by one-half carat. The streak is also treated with nitric acid and a test acid, and the result of their action observed. Three or more sets of needles are employed, the chief being a gold-copper series, a gold-silver series, and a gold-silver-copper series. Sometimes five sets are employed, in which the proportions of silver and copper are varied. The series to which the article tested belongs is determined by comparison for color, hardness, and toughness, the latter being inferred from the dryness or greasiness of the streak. The streak is first treated with pure nitric acid (applied with a feather), which is afterward rubbed off. With brass and other spurious copper alloys the streak is completely and instantly dissolved, while poor gold leaves a very faint impression. Nitric acid does not affect any alloy above 15 carats fine. A test acid consisting of 98 parts nitric acid (specific gravity 1.34) and 2 of hydrochloric acid (specific gravity 1.173) is used if the streak has been unaffected by the nitric acid. Gold of 18 carats fine and over is not affected by this mixture in the cold. This method of testing is only used when a rough idea of the richness is all that is necessary for valuation purposes.

Accurate assays of gold alloys are made by wrapping a weighed quantity (either 5 grains or 0.5 gram) in sheet-lead, with sufficient silver to equal three times the weight of pure gold present. Lead to the amount of 34 times the weight of the sample is used for all alloys containing less than 50 per cent of gold, and less for richer alloys. The sample is dropped on to a bone-ash cup (cupel) previously heated to full redness in a muffle furnace. The copper and all base metals in the alloy are oxidized, and the oxides dissolved in the molten litharge formed by the oxidation of the lead added. The fused oxides are absorbed by the porous cupel, thus keeping the metallic surface clear, and at the end of the operation only silver and gold remain behind. After cooling, the button is rolled into a ribbon, annealed, coiled up, and boiled first in nitric acid of 1.16 specific gravity, and afterward in nitric acid of 1.26 specific gravity, to dissolve out the silver, and after washing the coherent cornet of gold is heated to dull redness in an annealing cup and weighed. The addition of silver in assaying is known as inquartation. It is necessary owing to the protective action exerted by gold on other metals.

World Production of Gold.— Gold is very widely distributed, smaller or larger quantities being found in nearly every country. The ancients obtained gold from the Spanish Peninsula, Greece, Asia Minor, and India. The Ophir of the Bible has been variously located. Possibly it was in East Africa. In more modern times Peru, Bolivia, Brazil, Chile, Mexico, and other countries of South and Central America furnished immense supplies of gold after the discovery of America until about 1850. By far the greatest discoveries of gold have been made during the 19th century. The discovery of the Californian placers in 1848, and of the Australian placers in 1851, produced a mad rush to the diggings. In 1858 gold was found in New Zealand, and in 1861 the Otago district became a large producer. Since then immense developments have taken place. Besides California, Montana, Arizona, Colorado, Nevada, Idaho, and others of the United States have furnished, and still furnish large supplies, and Alaska must also be added. British Columbia is an important source, both alluvial and quartz mining being followed. Canada has also entered the lists as a gold-producer, and the phenomenal discoveries of rich alluvial deposits in the Klondike region in the Yukon basin still furnish excitement. The rich finds in western Australia, in the Calgoorlie and Coolgardie districts, have recently placed that colony in the front rank as a gold-producer, while Victoria, South Australia, and New South Wales have long been large gold-producing countries. In Victoria much energy in the development, more especially of "deep lead" mining, is being put forth. The Witwatersrand district of the Transvaal has sprung into importance since 1886, and Johannesburg is now perhaps the largest gold-mining centre of the world. Russia is also an important producer, the gold being obtained beyond the Ural mountains. India also produces a considerable amount. Of the prospective gold fields the most likely are British Guiana, the hinterland of the Gold Coast, certain parts of China, and possibly East Africa. Gold has been found in several parts of the United Kingdom, principally around Dolgelly, in Merionethshire, in Sutherlandshire, in the Lead Hills, in the Wicklow Mountains, and other places in Ireland. The production of gold in recent years is shown in the tables given below. Such figures, however, are all more or less uncertain:

Country	1896 oz. fine gold	1897 oz. fine gold	1899 oz. fine gold
South Africa...	2,150,106	2,818,493	3,644,889
Australasia	2,185,872	2,690,278	3,777,559
Russia	1,041,794	1,121,511	3,164,603
United States..	2,568,132	2,774,935	3,506,679
Other countries	1,874,171	2,075,495	3,081,454
	9,820,075	11,483,712	15,175,184
Value	£41,713,715	£48,780,511	£64,309,450

The great increase in the Australian yield is due to the activity in western Australia; in the United States, to Colorado — which now excels California. Canada doubled her output in 1898 — the output being 701,459 ounces. This is due to the Klondike field. The crude bullion from the Transvaal in 1898 amounted to 4,545,014 ounces. In the decade 1831–40 the value of the average annual gold production of the world was £2,831,800; from 1841–50, £7,638,800, the California placers being by this time worked. In the period 1851–5 the average annual value was £29,195,400, in 1881–5 only £20,371,777. The phenomenal advance since 1885 is largely due to the development of the Transvaal, but since 1894 the United States, Australia (especially West Australia), and the Klondike region have greatly contributed to the increase; while the cyanide process for treating tailings has led to more perfect recovery of the metal from the ore treated. This phenomenal output of gold — considered along with the fact that much of the ore treated contains only a few pennyweights, and in some cases a few grains to the ton — will give some idea of the enormous amount of capital and energy employed in the search after the precious metal.

Production in the United States.— The following table shows the production of gold in the United States in the calendar year 1901:

Alabama	$ 3,900
Alaska	6,904,400
Arizona	4,193,400
California	15,730,700
Colorado	29,000,000
Georgia	144,900
Idaho	2,273,900
Maryland	200
Michigan	29,000
Missouri	700
Montana	5,023,300
Nevada	3,000,000
New Mexico	832,900
North Carolina	65,800
Oregon	1,777,800
South Carolina	120,900
South Dakota	6,601,800
Tennessee	200
Texas	1,100
Utah	3,824,300
Virginia	7,400
Washington	620,200
Wyoming	62,000
Total	$80,218,800
British Klondike	17,595,400

The total gold production of the world from the discovery of America by Columbus to the year 1900 is, according to the report of the United States mint, in round numbers, $9,811,000,000. Pure gold of this value would weigh about 16,272 tons, and occupy a space equal to 27,039 cubic feet. Graphically this amount could be represented by a solid circular tower of gold 20 feet in diameter, and 86 feet high. The total yearly world production of gold since 1900 would increase the height of such tower about 3 feet each year.

It has been calculated that the control by England of the African gold mines will result in a largely increased gold supply.

In 1898, the latest complete year before the Boer war, the Witwatersrand, or the "Rand," the Transvaal's principal mining district, produced $60,000,000 in gold. At the rate of increase for the previous few years, maintained through the part of 1899 before the war, the output would have been about $90,000,000 in that year if the conflict had been averted, and more than $100,000,000 in 1900. After mining has been fully resumed, the Rand's annual product, it is estimated by experts on the ground, will soon go up to $100,000,000, and by 1905 or 1906 it will be $125,000,000. It is estimated that that district will yield something like $3,000,000,000 in the next quarter of a century, or before the reef already being worked is exhausted.

There are to-day nearly 1,200 tons of gold in the vaults of the Treasury of the United States — the greatest hoard of the yellow metal ever gathered in the history of the world. Four hundred tons of this gold are piled, like bags of salt, within the four walls of the Sub-Treasury in Wall street, New York. Outside the Treasury hoard there is in circulation through the country a nearly equal amount of gold coin, making more than 2,500 tons of gold in the United States bearing the imprint of the eagle. The total value of this coin is more than $1,260,000,000.

Gold-beaters' Skin, a skin or membrane of great tenacity used in gold-beating (q.v.), and specially prepared from the outer coat of the cæcum of cattle. The intestines of 500 cattle are required to make a single packet or "mold" of gold-beaters' skin, the mold containing about 850 leaves, between which the gold to be hammered out is laid. See Gold-beating.

Gold-beating, the art of hammering gold into leaves of extreme thinness for the purposes of ornamental gilding. For this purpose pure gold is alloyed with small quantities of other metals according to the color required. Ten colors are recognized: red, pale-red, deep-red, orange, lemon, deep-pale, pale, pale-pale, deep-party, party, besides fine gold. In the deeper colors copper preponderates in the alloy, varying from ½ dwt. to ¾ dwt. per ounce, and no silver. The pale ones contain silver varying from a few grains to 1 dwt. per ounce. The middle ones contain from ¾ to a little over 1 dwt. of alloy, of which ⅔ is silver and ⅓ copper. Ordinary gold-leaf contains about 21 grains of alloy per ounce, and is thus nearly 23-carat fine. The operations are conducted as follows: The metal is melted and cast into ingots, which are rolled out into thin ribands between polished steel rolls. Each ounce of gold is rolled to a length of about 10 feet, the riband being 1½ inches wide and 0.0015 to .001 inch thick. This is cut up into pieces, each weighing about 6 grains, so that 2 ounces — that is, a "beating"— yields 160 to 170 such pieces. These are packed between intervening sheets of vellum, some 3 inches square, the surfaces of which have been rubbed over with fine plaster of Paris — brime — to prevent the gold from sticking. A number of blank pieces of vellum are placed at the top and bottom of the pile, and the packet is bound with straps of the same material. The cutch thus formed is beaten with a hammer weighing from 17 pounds upward, or by a power hammer, till the gold has been extended to the size of the parchment sheets. The packet is then unbound, the gold squares each divided into four by a steel knife, and the pieces packeted between sheets of gold-beaters' skin (q.v.) about 4½ inches square. A number of blank skins are placed at both top and bottom. The 600 to 700 pieces are all put into the same packet, and comprise what is called the shoder. The shoder is secured by slipping the pile into a parchment band, and again into a similar one at right angles, and is beaten with a round-faced hammer weighing from 9 to 12 pounds, until the gold has extended across the skins. When the gold has filled the shoder each leaf is divided into four pieces with a strip of bamboo sharpened on the long edge. The 2,500 to 2,800 pieces thus obtained are packed in three packets between fine gold-beaters' skin 5 inches square. Each of these packets constitutes a "mold." A large number of blank skins are placed at either side. The packet is secured as before, and each mold is beaten with the "finishing" or gold hammer, weighing from 7 to 10 pounds, till the metal extends to the edges of the skins, and in some places flows over. When the beating is finished the mold is opened. Each leaf is then lifted deftly by long wooden tweezers, placed, with a sudden downward movement, on a leather pad dusted with brime, and from the central part leaves 3⅜ inches square are cut by means of two sharpened bamboo strips fastened parallel to each other. The leaves are placed by the tweezers in books of soft paper rubbed over with red ochre, red bole, and brime to prevent the gold from sticking. If the leaf does not lie flat, a sudden puff of breath, well directed in the centre, lays it flat. Each book contains 25 leaves. Fine gold is more difficult to deal with than that containing a little alloy, owing to its liability to stick when the leaves touch. It, however, beats equally well. The leaf begins to transmit light when $\frac{1}{150000}$ of an inch thick. Ordinary gold-leaf varies from $\frac{1}{200000}$ to $\frac{1}{250000}$ of an inch thick.

Gold Coast Colony, a British crown colony on the coast of West Africa, bounded on the east by Togoland (German), and on the west by the Ivory Coast (French). Its coast line is about 350 miles; its area, inclusive of Adausi, Ashanti, and the Northern Territories, is about 75,000 square miles. Pop. 1,500,000, of whom 500 are Europeans. The native state of Ashanti lies inland, at the back of the central portion of the colony. The territories in the hinterland to the north of Ashanti, were erected into a separate district, the Northern Territories, in 1897 (area 38,000 square miles, pop. 317,964) and placed under the administration of a commissioner. The products are chiefly palm oil, gold, palm kernels, rubber, timber, etc. Chief town, Akkra, pop. 16,267. The government includes a governor, an executive council, and a legislative council of nine, none of whom are elected.

Trouble arose between the king of Kumassi, who had declared himself king of Ashanti in 1894, and the British authorities, and in 1895 an expedition was sent against him, under the command of Sir Francis Scott, which resulted in the submission of the king, who was afterward taken to the coast. The kings of Bekwai and Abodom also made their submission, and the country was placed under British protection, and a resident appointed at Kumassi. The Niger Convention drawn up by the Anglo-French Commission sitting at Paris, and signed 15 June 1898, and the agreement of Germany 1899, settled the boundaries of the hinterland to the west and the north. Bona and Dokta were given up to France, and the French had to concede Wa and other points to the east of the Volta, which had been occupied by them. The railroad from Sekondi to Tarquah was completed 1901, and in 1902 was prolonged 48 miles beyond the latter point. A line is also being laid to the gold mines of Princissu.

Gold-crest, or **Golden-crested Wren**. The British name for one of the Kinglets (q.v.).

Gold Cure, a specific discovered by Dr. Leslie E. Keeley, by the administration of which drunkenness, addiction to such drug habits as taking opium, or cocaine, as well as the tobacco habit are, it is claimed, cured by a renovation of the nerve cells. Dr. Keeley's theory is that all habits of the kind specified above are symptoms of physical disease and disorder, and may be treated like any other affection of the body. Keeley Institutes have been established all over the United States, and there is a Keeley Institute in London. The treatment consists in the administration of bichloride of gold, according to a prescription which has not been made public. According to the testimony of many reformed inebriates of both sexes the results of the Keeley Cure are genuine and lasting. According to the statistics recently issued by the Keeley Institute, the success of the cure extends to all classes. Out of 1,000 consecutive cases treated, 236 were housewives, 150 physicians and surgeons, 50 were without calling, 30 were attorneys, 29 were merchants, 23 were farmers, 20 were dentists; clergymen, authors and actors were also represented.

It takes four to six weeks to accomplish a complete cure, and testimonials are not wanting from many of the leading men and women in the country as to the efficacy of Dr. Keeley's specific, as they have seen it operating in the case of those who have been submitted to it. "The Keeley League" is an association of 30,000 men who have been cured by the specific and accompanying treatment. The total number which it is claimed have been released from the domination of the drink or drug habit is 300,000.

The discovery was made by Dr. Keeley in 1879, while he was practising physician in Dwight, Ill. In 1880 he opened his first institution at Dwight. The regular medical profession has not accepted with favor the claims of the Keeley Cure.

Gold Hill, Nevada, formerly a distinct village, but now a part of Virginia City. It is about 7,000 feet above the sea. It has rich silver mines, and several quartz mills. Here, on Mount Davidson, is the famous Comstock lode.

Gold Lace, a kind of lace made of gold wire, flattened between two polished steel rollers, into a ribbon which is twisted round a core of silk. The "gold wire" used in the manufacture of gold thread is nearly always composed of pure silver with a thin coating of gold in India. But in European countries it is only the very best qualities of this wire which are made of unalloyed silver. A good quality of English gold thread is made from wire consisting of 1 part of copper added to 25 of silver, which is afterward coated with gold. But alloys of copper and silver in many proportions are used, some wire containing only 1 part of silver to 60 of copper. The silver, or alloy of copper and silver, is made into a rod 1½ inches in diameter, and then annealed and polished to prepare it for its coating of gold. This is laid on in the form of leaves of pure gold, and subjected, for the best qualities of wire, to the fire-gilding process — that is, the gold-coated rod is heated to redness on burning charcoal, which causes the leaf to adhere firmly. Rods so treated are next smeared with wax, and drawn through the holes of a steel draw-plate. (See WIRE-DRAWING.) The wire is frequently annealed during the process of drawing, and this requires to be very skilfully done, or the golden tint of the surface is lost. Gold wire for thread is generally drawn down to a size measuring 1,100 to 1,400 yards to the ounce of metal. Finer sizes reach the length of 1,800 to 2,000 yards to the ounce, and to attain this fineness the wire is drawn through perforated gems, such as diamonds or rubies. The fine wire, after being annealed, is flattened between polished steel rollers. Finally the flat wire, or rather ribbon, is wound over yellow or orange colored silk, so as completely to envelop it, by a spinning engine. The gold thread is then finished. Some of the best qualities of the metal covering or "plate" of this thread have 12 pennyweights of gold to the pound of silver or of alloy. Inferior kinds have as little as 2 pennyweights to the pound, and still cheaper sorts of thread are covered with flattened copper wire which has received a thin coating of electro-deposited silver, and this afterward receives, on the outside of the thread only, a still thinner electro-deposited coating of gold — two grains of the precious metal covering 3,000 square inches of surface. For this very cheap kind of thread yellow cotton is used instead of silk.

The only difference between gold and silver thread is that the thin coating of gold is wanting on the latter. Gold thread is used in the manufacture of military lace. This, however, is a woven substance and not true lace; but some real lace is made both of gold and silver thread. Both kinds of thread are also used for facings of liveries, and for ecclesiastical robes, altar cloths, and banners. These and other fabrics are either embroidered or woven, but often only in part, with the thread. (See BROCADE; DAMASK; EMBROIDERY.) Much of the "gold thread" used for theatrical dresses and decorations has only a covering of Dutch metal and the "silver thread" in these is spun with a covering of a cheap white alloy, having a mere film of silver on the surface.

Gold Mining. Gold is usually found in nature in the metallic or native state, and may be distinguished from iron and copper pyrites and other yellow metallic minerals by its malleability and softness. Native gold is never pure. Its quality varies from about 800 to 950 fine, or about 20 to 23 carats (see GOLD). Electrum is a native alloy of silver and gold about 500 fine. A native amalgam with mercury also occurs. The metal sometimes occurs crystallized in octahedra and other cubic forms. It is also found in irregular masses which may be nodular, filiform, or arborescent, or it may form thin leaves merely gilding the surfaces of the rock. More commonly it exists in grains irregularly distributed through sand, gravel, or rock. These grains are sometimes so minute as to be invisible to the naked eye, and the presence of gold can only be detected by subjecting the rock to a careful assay, either by grinding with mercury, washing, or fire assay.

The metal occurs in (1) alluvial deposits, or "placers." These are deposits of gravel, sand, clay, or loam, consisting of the debris of weathered rocks, generally transported by running water from hillsides to valleys and plains. They mark and follow the courses of existing rivers or of rivers belonging to former ages. Gold is found in them in all degrees of coarseness, from minute specks or "colors" to masses weighing many ounces. One of these, designated the "Welcome Stranger," found at Dunolly in Victoria, weighed 2,195 ounces troy, and many others of large weight have been found.

These larger masses of gold have usually a more or less rugged and lumpy exterior, and are described as "nuggets." The largest usually occur near the source from which the gold in the alluvium has been derived. This source almost always consists of veins of quartz, or other material, occurring in one of the older rocks. Alluvial deposits vary in character from pipe clay to coarse gravel. The gravel is usually loose, but sometimes in working the deposits intervening layers are met with which are cemented together. These are known as "false bottoms." River sands also frequently contain gold. Alluvial deposits are often very rich, particularly in nuggets. This is largely due to the force of the water carrying forward the light earthy material, while the larger and heavier particles, owing to their greater resistance, accumulate nearer the source. (2) The formation which is known as "deep leads" consists of ancient river beds that have been covered by more recent deposits of drift, earth, or volcanic rocks, which have become hardened and consolidated. They are composed of sand, gravel, loam, and clay, the so-called "wash-dirt" or "pay dirt" varying from a few inches to several feet in thickness. Formerly these deep leads were the main drainage channels of the country, and in rain storms were heavily flooded, carrying the debris from the hillsides down the creeks and gullies. In Victoria the deep leads are often overlaid with a deposit of basalt known as "bluestone," showing volcanic action to have been instrumental in covering up the deposit. These deposits often extend out beyond the covered portion, and in mining operations trouble is occasioned by water which finds its way in through the exposed portion. Their direction is traced by boring. (3) In the primitive rocks gold occurs generally, though not invariably, in veins of quartz. The terms "lodes," "reefs," "ledges," are also used much in the same sense as veins. The metal is not uniformly desseminated through the rock, but occurs in most cases in rich streaks and pockets. Careful examination will often reveal its presence, but no general appearance of the quartz can be relied on. Highly mineralized quartz is generally most productive. The minerals usually present are silver, zinc, lead, copper, iron, nickel, bismuth, tellurium, and antimony-bearing minerals, the commonest being iron pyrites, mispickel, zinc blende, galena, copper pyrites, argentite and other silver ores, nagyagite and other tellurides, bismuthine, antimonite, limonite and hematite. Sometimes these — especially iron pyrites — are present in very large quantities. Near the surface this has been completely decomposed and partially converted into oxide of iron, conferring a reddish brown color on the more or less spongy rock. Such decomposed rocks containing much oxide of iron are described as "gossans." In the cavities small particles of free gold can often be observed. In the unaltered portions of the rock the accompanying minerals may be plainly distinguished. The veins may be compact and large, but the mineral streak often occupies only a portion of the lode, though many "leaders" may occur. Much of the lode is sometimes barren. In some quartz deposits the stone is uniformly rich; in others the gold is concentrated at certain points in what are known as pockets. According to a recent report from Cripple Creek, Colo., a mass weighing over a hundredweight with a slight admixture of quartz has been found there. A similar mass of less size was found some years ago in India, and another near Sydney, N. S. W., was 5 feet high, 1 foot wide, and 6 inches thick, full of threads, wires, lumps, and sheets of gold. It realized £15,000. The "banket" ore of South Africa resembles both alluvial deposits and reefs. It consists of a mass of quartz fragments mostly irregular, embedded in a cement of mineralized matter which carries the gold. This, near the surface, is completely "weathered," and an incrustation of oxide of iron remains surrounding the quartz. Strangely enough this deposit resembles a reef rather than an alluvium and extends to great depths. Several "deep" mines are now in operation. No satisfactory explanation can be given of this formation. Ores of other metals frequently contain gold. Iron and copper pyrites, antimonite, galena, and silver ores are often gold bearing. The precious metal is extracted in the smelting of the mineral. Gold occurs also in combination with tellurium and possibly with selenium, as well as in the free state. Most telluric ores are gold bearing, and the presence of this element is often looked on as an indication of gold.

Placer Mining.— When the alluvium is at the surface the exploration of the ground can proceed forthwith, and with pick and shovel the gravel is turned over and the nuggets taken out. The remainder is afterward washed to recover the finer particles of gold, in the pan, the dolly, or the cradle. When the "pay dirt" is covered with soil, etc., the "cover" is first removed to lay it bare, and the washing proceeded with. From the above references the presence of water is a most important item in the satisfactory exploiting of alluvium. The washing of sands and gravels is a simple matter. In washing in the pan —"panning out"— a quantity of the dirt free from the stones is put into a shallow iron or wooden dish some 15 inches in diameter, with a slight depression in the middle. It is then mixed with water, and the dish put with its edge just under water with one side a trifle lower than the other. Any lumps are broken up by hand. By a gentle whirling and jerking motion the sand and other light bodies are washed over the edge of the pan, and the heavy matters containing the gold remain at the bottom and accumulate in the central depression. Pebbles are thrown out, and the "colors" (specks of gold) are then sought after and picked out, or the whole heavy residue saved, dried, and blown, or treated with a little mercury to extract the gold.

The "dolly" or "tossing tub" is intended for washing fine stuff or coarsely crushed material passing through a sieve having 12 meshes to the linear inch. It consists of a circular tub in which the dirt is mixed with sufficient water, and is stirred around with a shovel or other implement three or four minutes. A little of the water is then removed, and the tub struck on its sides for some few minutes with a hammer to quicken the subsidence of the heavy matters. The water is then poured off with the lightest matters, and the upper portions of the remaining mud scraped off and thrown aside. Some fresh dirt is added and the operation repeated. By this means a gradual accumulation of gold takes places at the bottom of the tub — or kieve, as it is called — and is removed from time to time. Some tossing tubs are provided with rotary stirrers.

The "cradle" consists of a short box or trough six or seven feet long, mounted on a kind of rockers, and slightly inclined to allow the mud to run off. A box with a bottom of iron plate perforated with half-inch holes is placed over the higher end of the trough. Underneath this an inclined plate directs the stuff to the top of the trough, across the bottom of which strips of wood called riffles, about half an inch thick, are fixed transversely to arrest the heavy particles of gold. The "pay dirt" is thrown into the box at the top, and water is led into or poured on it. The finer portion is thus carried through the holes into the trough. Lumps are broken up and the cradle rocked from side to side with a jerking motion. The light matters are carried away by the water from the lower end of the trough, and the particles of gold and other heavy matters lodge behind the bars and are afterward collected.

Sluicing.— This is the method adopted where practicable for treating alluvial deposits. The "sluices" consist of troughs called "flumes," in sections about 12 feet long, mounted on trestles to give a sufficient inclination — from ¾ to 1½ inch to the foot. The lower ends of the troughs fit into the upper ends of the succeeding sections. The bottom of the sluice box is crossed transversely by bars of wood or iron. In long sluices these are about two inches thick and are supported by longitudinal bars, dividing the bottom of the sluice into rectangular spaces. The gravel is placed at the top and washed down by a stream of water, while the lumps in the hand sluices are broken up by raking them.

The smallest of the sluices, known as the "long tom," and worked by two or three men, consists of two such sections. Into the upper one the gravel is thrown, and the lower end is closed by an iron grid set at an angle, to keep back the pebbles and large stones, while the sand, etc., passes through to the lower trough. In this it deposits its gold and heavy matters behind the riffle bars which in these shorter sluices are not so thick. The longer sluices, for dealing with larger quantities of material at a time, are made 250 feet long, or longer in many cases, and if there are many stones in the stuff to be treated, the sluice is divided into two sections, placed at different levels. The lower end of the upper section is not blocked, but near it the bottom consists of an iron grating — the "grizzly." The stones are washed forward over the grating, and fall or are raked out at the end. Under the grating is the second section of the sluice, often arranged at right angles, or to run in an opposite direction and with a smaller inclination. On this the sand and fine particles carried by the water fall, so that the smaller particles of gold may be recovered. In sluicing, mercury is often fed in at the top of the sluice in order to amalgamate the gold, and the amalgam then lodges behind the riffles. In other cases the fine sand, after passing through the first section of the sluice, falls on inclined tables covered with blankets, rough cloth, or hides with the hairy side up, over which it flows in a thin stream. These "blanket strakes" serve to arrest and recover the fine gold. Amalgamated copper plates are employed for the same purpose in some cases, over which the fine sand flows before running to waste.

In dealing with the hard "cements" and "deep leads," the material is generally first treated in a "puddling" machine. In this the pay dirt is disintegrated by edge runners, or revolving rakes or harrows, or some other form of crushing or stirring apparatus, while a current of water carries the debris from the machine into the flumes and over the strakes. Much of the coarse gold remains in the puddling machine. Where the configuration of the ground admits, there is no difficulty in getting the necessary fall, but where the surface is level this has to be obtained artificially, by erecting very high poppetheads over the shafts from which the pay dirt is drawn. In some cases these are over 100 feet in height, the puddlers being placed on a platform at a suitable elevation, from which the flumes slant downward, being caried on trestles.

Hydraulic Mining.— In places where the ground is suitable, these deep leads and other alluvial deposits are worked by washing down the gravel by means of a powerful jet of water, a head of 200 to 250 feet being sometimes employed. The jet is delivered from a movable pivoted nozzle — the "monitor" or "giant"— against the bank of auriferous material, and the detached debris washed into sluices where the gold is deposited. These sluices are larger than those already mentioned, being sometimes 5 to 6 feet in width, 2 to 3 feet deep, and are often paved with stone and provided with iron riffle bars. Some of them are upward of a mile long. Mercury is always fed in at the top, and the amalgam recovered by raising the riffle bars after turning off the water and cleaning out the gravel. An immense water supply is required for this purpose, and the water is often brought for miles in "flumes" which cross gulches and valleys supported on trestles, and are carried in tunnels through hills. This is the cheapest mode of working. From two to four grains of gold per ton, and in some few cases less, is sufficient to pay expenses. If the material is exceptionally hard, blasting is resorted to in order to break it down, when the action of the jet is sufficient to disintegrate it. A "miner's inch" of water is the quantity that will flow through a hole an inch square in an inch board, under a head usually of 7 inches, but more or less according to the locality, the time of flow being specified. A 24-hour inch at 7 inches pressure is nearly 14,000 gallons. In other cases an inch reaches 17,000 gallons. The river gravels of Scotland, Ireland, and Wales, and many parts of Europe, have yielded gold, but the richest of such deposits are those of California, Klondike, and Australia. Magnetic iron sand, tin stone, ilmenite, sulphides, garnets, and diamonds are often associated with alluvial gold.

Quartz Mining.— In dealing with the material from veins or reefs of quartz and other hard substances containing free gold, the stuff is reduced to fine powder and then passed, suspended in water, over copper plates amalgamated with mercury, to which the gold adheres. The "tailings" are then treated either by "concentration" and the concentrates chlorinated, or the whole of the tailings is treated by the cyanide process. The ore to be crushed is first passed through a "stone breaker" or "ore crusher." In the Blake type the moving jaw permits the introduction of the larger lumps at the top, but only allows the crushed material to pass out at the bottom in pieces a little larger than walnuts. In the Gates type a gyrating cone revolves inside a fixed vertical cone. Both have ribbed surfaces, and they are of different angles, so that the large material introduced at the top is broken down before it can pass out at the bottom. The broken ore passes to the ore bins, thence to the feeders and on to the stamps, or some form of grinding mill. The lower part of the battery consists of a cast-iron box — "mortar box"— fitted on one or both sides with a fine screen of wire-cloth or perforated sheet metal. At the bottom of this box is a row of iron blocks called "dies," on which the stamps fall. The stamps are heavy cylindrical cast-iron blocks — heads — to which are attached loose steel facing pieces —"shoes"— fixed to the lower ends of the vertical iron rods — stems — moving up and down between guides carried by the framing. The stamps are raised by cams keyed on the revolving shaft. These engage with collars

— tappets — fixed on the stems. As the shaft revolves, the cam raises the stamp twice in each revolution and allows it to fall when the cam passes. The stamps are thus kept pounding away at the ore in the mortar box. The heads and their attachments weigh up to nearly half a ton, and make from 70 to 90 blows per minute. Five heads usually constitute a battery. Some mines have 200 stamps at work. Each head should crush about one and a half to two tons of ore per day. The motive power may be steam-engines or turbines. Some mills are driven electrically. In wet crushing mills a stream of water is admitted to the mortar box, and carries the crushed material through the screens. Mercury is fed into the mortar boxes in small quantities, and much of the gold is retained there on amalgamated copper plates. Slightly inclined amalgamated copper plates arranged in steps are placed in front of the battery, and over these the crushed ore pulp passes slowly as it leaves the mortar box, the gold being retained by the amalgamated surfaces. The plate nearest the battery is generally heavily silver plated. The "tailings" which may still contain some gold are treated as described below. The stamp battery is often replaced by roller crushing machines and grinding mills of various types, the objects of which are the same; and with certain ores these are even more effective. The best known of these are Krom rolls and the Huntingdon mill. Steam stamps are also employed, making up to 200 blows per minute.

Treatment of Amalgam.— The amalgam, both that which is retained on plates placed in the battery and that which accumulates on the plates outside, is collected from time to time. The plate just outside on which the splash from the battery falls, is made small so as to be readily removable for cleaning up. The other plates are not so often disturbed. The amalgam is ground with water in a small iron pan with a revolving muller —"clean-up pan"— to cleanse the amalgam from sand, etc. Afterward it is pressed in wash-leather, canvas, or other material to expel the excess of mercury, which is returned to the battery as required. The residue is "retorted," that is, it is heated in retorts to expel the mercury, which is condensed and recovered. The gold obtained is subsequently melted in crucibles and afterward refined. "Free-milling" ores yield nearly the whole of their gold by this treatment. Ores containing sulphides, arsenides, antimony, tellurium, etc., do not, and are described as "refractory ores." Free-milling ores are generally "weathered"; the minerals having been decomposed by the action of the atmosphere and water.

Treatment of Tailings.— Tailings always contain gold, either as "float" gold, "rusty" gold, or bound up in pyrites or other mineral occurring in the rock. Pulp (that is, the crushed rock) containing float gold is led through amalgamating pans, where it is ground with mercury before running to waste. In dealing with pyritical ores, when chlorination or grinding with mercury is resorted to, the pulp is passed to concentrating appliances, blankets, strakes and "vanners" being employed. Vanners are by far the most effective and generally employed. Each consists of a slightly sloping table, formed of an endless traveling belt of india-rubber which is stretched over rollers at the ends of a frame, and so mounted as to be capable of violent agitation while moving slowly in an upward direction. The vibrations number 200 a minute. The pulp is led on at the higher end, and the flow of the water carries the light matters down the slope, the separation being greatly assisted by the shaking movement. The residue is also sprayed with water, and the heavy matters only are carried forward by the belt over the higher end and pass into a box below, being then known as "concentrates." These may be ground for a prolonged period with mercury (old fashioned), or treated by chlorination. For cyanide treatment, concentration is unnecessary.

Chlorination Processes.— The concentrates are first calcined to remove the sulphur and arsenic, and to render the material more porous. The residue is treated in vats provided with false bottoms and with filter beds, or other suitable receptacles, having tightly fitting covers. The calcined ore, as free as possible from "slimes"— very fine material which becomes impervious when wet — is dampened with water and sifted into the vats, in order that it may lie lightly. The cover is put on and luted, but a plug in the top taken out. Chlorine gas is admitted slowly under the false bottom of the vat through a pipe for that purpose, and gradually lifts out the air. The plug is then inserted, and the chlorine allowed to act for some 30 to 40 hours, fresh supplies of the gas being added if found necessary. The vat is then ventilated, the cover removed, and the ore treated with water several times to dissolve the chloride of gold that has been formed. The solution drains through the filter bed, and passes out into the settling tank, where any sand, etc., is deposited. From the settlers it passes to the precipitating tanks, where a solution of sulphate of iron — ferrous sulphate — or other precipitant is added, and the whole thoroughly paddled or mixed by mechanical stirrers. The gold is thus precipitated as a brownish purple powder, which is allowed to settle, and the liquor is then siphoned off. Several batches of solution are thus treated, and the gold obtained is collected, washed with acids, dried, and melted in crucibles. Many modifications of the original process with special forms of plant have been introduced. In the Newberry-Vautin process air is pumped into the chlorinating vessel to increase the pressure; in the Pollok process hydraulic pressure and rotation are employed; and the Mears works under pressure of chlorine. In several of these modifications the chlorine is generated in the chlorinating vessel by means of bleaching powder, and either sulphuric acid or acid sulphate of soda. Various precipitants have also been employed. See Gold.

Pyritic Smelting.— This term is applied to a method of smelting pyritic gold ores in cupolas, with or without the addition of coke. If the ore contains above 40 per cent of sulphur no coke is necessary. On charging the ore into the cupola some of the sulphur is driven off by the heat, and part of the remainder when it reaches the twyers burns and furnishes sufficient heat to melt the regulus — a sulphide — and slag off the ferrous oxide resulting, and the quartz. A plentiful supply of air is required. The gold remains in the regulus, which also contains any copper present.

Gold Refining and Parting.— The crude bullion is dealt with according to its purity. Very base bullion is cupelled with lead, only the silver and gold remaining on the cupel. When less impure it is melted in crucibles and nitre and borax added to oxidize and flux the copper and other metals it contains. After this treatment the bullion still contains silver as well as small quantities of other metals, to separate which the gold is "parted." This is effected by boiling the alloy in acids to dissolve out the silver, but unless a sufficient quantity of silver is present the acid will not completely dissolve it. The gold is first alloyed with the necessary quantity of silver. For nitric acid parting the alloy contains two and a half or three times as much silver as gold. When sulphuric acid is employed it contains four times as much or more. The alloy is granulated by pouring the molten metal into water, and the granulated metal is then boiled with nitric acid in glass or platinum vessels, whereby the silver is converted into silver nitrate and dissolved, the gold remaining unattacked. After drawing off the solution the residue is washed, dried, and melted down. The silver in the solution is afterward recovered by precipitating it with hydrochloric acid as chloride, which is subsequently reduced to metal. At the same time the nitric acid is recovered. Sulphuric acid is often used in place of nitric, particularly in dealing with silver containing a little gold. The granulated metal is first boiled with sulphuric acid, in iron pans, suitably provided with covers to carry off the vapors for the recovery of the acid. This converts the silver into soluble sulphate of silver. After a second treatment the residue is washed, dried, and melted down. The silver is recovered from the sulphate by treatment with ferrous sulphate or other reducing agent, or by passing the solution over metallic copper, by which it is precipitated. The precipitated silver is afterward washed and melted down. When little silver is present it may be removed by melting the gold in a crucible and bubbling chlorine gas through the molten metal by means of a clay tube passing through a hole in the cover. The silver is converted into chloride, which melts and rises to the top of the metal. The gold is not chloridized, the temperature being sufficient to completely decompose its chloride. The scum contains some gold, and this is afterward recovered. Besides removing the silver, any traces of lead, antimony, bismuth, tellurium, or other base metals which would render the metal brittle are converted into chlorides and volatilized so that the metal is left tough and malleable. The process is often employed to toughen brittle gold. The employment of bichloride of mercury by gold-beaters to toughen the gold used for that purpose produces a similar effect, the chloride of mercury giving up half its chlorine for the purpose, and being volatilized as calomel. Platinum is separated from gold by alloying with so much silver as to reduce the platinum below 9 per cent. The alloy is then parted by nitric acid, when the platinum dissolves out with the silver. Osm-iridium, a hard alloy, which often occurs with alluvial gold, is removed from the metal before parting by allowing it to subside to the bottom of the pot after addition of silver. This it does owing to its being heavier than gold.

The Cyanide Process.— As defined in the letters patent, this process consists in separating precious metals from ore containing base metal by subjecting the powdered ore to the action of a cyanide solution containing cyanogen to one thousand parts of water. By treating the ore with this dilute cyanide solution, the gold or silver is obtained in the solution, while any base metals in the ore are left undissolved. From this latter solution the gold is precipitated by its disposition on filiform zinc. Chemically, the process is based on this reaction in which a double cyanide of gold and potassium is formed: $2Au + 4KCy + O + H_2O = 2KAuCy_2 + 2KHO$, or according to Feldtmann in his 'Notes on Gold Extraction': $2Au + 8HCy + 3O = 2AuHCy_4 + H_2O$. Two parts of gold plus four parts of cyanide of potassium, plus oxygen from the air, plus one part of water equals two parts of double cyanide of gold and two parts of potassium hydrate. The cyanide process is especially valuable in treating tailings heretofore left on the dumps, not being collectible on the amalgamated plates as is the coarser gold. For cyanide treatment, the free milling ore-tailings should be taken directly from the battery to the cyanide works as any decomposition products vitiates the action of the cyanide.

Stages in the Cyanide Treatment.— The first process consists in passing a dilute alkaline and cyanide wash through the powdered ore, saturating the latter. This first alkaline wash may be 3 parts cyanide of potassium (KCy) to 2,000 parts water and should contain 4 ounces of caustic soda per ton of the wash; after this, the saturated ore should leach for say three hours. The next process consists in passing a much stronger cyanide solution over the washed ore. This second solution should contain from one third to one half of 1 per cent cyanide of potassium (KCy), and 100 per cent water, according to the richness and nature of the tailings to be treated, and the diluted cyanide solution should not be less than one third the weight of the tailings in the vats. For this solution and its contact with the ore at least five hours should be allowed, after which the ore should remain nearly double this time in leaching and three or four for drying. It may now be assumed that much of the gold is in solution. The next process is to subject these tailings to another wash, the object being to wash out the dissolved gold. For this purpose, after the previous strong solution has been drained off, a wash of three fourths to four fifths of the weight of the ore and composed of 3 parts cyanide of potassium (KCy) to 2,000 parts water is used. The ore treated by this weak solution should remain for draining off six or eight hours: finally, a water wash should be applied, the quantity of water used being 7 per cent or more of the weight of this ore; this should be leached off for several hours.

The Precipitation.— The cyanide solutions containing gold, as they flow from the leaching vats, are passed through one or more precipitating boxes containing zinc shavings upon which the gold is precipitated. The quantity of gold cyanide solution flowing through each box containing the zinc shavings must be carefully regulated; which may be ascertained by assaying the solution at intervals. The zinc shavings having reconverted the gold into metallic forms, the next process is the collection of the metal. Care should be taken that no iron or metal other than zinc be exposed to the solutions in the boxes. The tray holding the zinc shavings is lifted out from the last compartment and moved up and down so that the fine particles of slime and zinc should fall through the sieve and settle in the bottom of the box.

The zinc shavings are next taken out of the tray and rubbed in the water to remove all the gold possible adhering to them. The tray is turned over and brushed down so as to remove any gold adhering to it. After this the solution of water in the zinc boxes is pumped into settling tanks, where it is allowed to stand for two weeks; thus giving the extremely fine particles of gold held in the suspension time to settle. Great care should be taken in pumping not to disturb the gold-zinc slimes at the bottom of the box. The gold-zinc slimes are now shoveled into enameled iron buckets and discharged through a 900-inch sieve, and washed and rubbed into the gold clean-up tank. The water having settled in the latter tank is siphoned off, and the precipitate (gold-shines) is drained off through plug holes and deposited upon a calico or linen filter, or into a filter press. When sufficiently dry, the gold-shines are on an iron plate or in iron pots and are ready for roasting and smelting, the object being to oxidize the greatest portion of the zinc which in the form of small chips and shavings, has fallen through the zinc box trays. Having placed the dried precipitate in a plumbago crucible and covered the same with usual fluxes — bi-carbonate of soda, borax, and sand in the proportion of 50 per cent bi-carb., 25 per cent borax and 16 per cent sand to 100 per cent by weight of precipitate — the entire mass is melted, poured into molds, and after settling and cooling may be turned out, and freed from the slag by hammering off the latter. Thus the pure gold bullion is obtained. In the treatment of ore-tailings by the cyanide process, the amount of cyanide necessary varies from three fourths of a pound to one and one fourth pounds per ton of tailings, and the cost of this amount is insignificant.

Estimates on the cost of cyanide plants can be only approximately stated. The following figures may, however, be considered within limits:

To treat 3,000 tons of ore per month........	$25,000
To treat 5,000 tons of ore per month........	37,500
To treat 7,000 tons of ore per month........	50,000
To treat 16,000 tons of ore per month........	90,000

Gold Mining, Dry Placer Method.— The latest invention of Thomas A. Edison has perfected a device for separating the gold from the placer gravel without the use of water. It has been impossible to work these fields because the water needed for the proper operation of the hydraulic system was not at hand.

Mr. Edison employs an air blast to separate the gold from the gravel and other impurities. Like most of his inventions this one is simple.

The old placer system, with the hydraulic stream, got out 75 per cent of the gold, but with Mr. Edison's system of dry washing, it is said, 98 per cent of the gold is saved. When water is obtainable the new system cannot compete with the hydraulic, because the stream washes out gold at the cost of 3 cents a ton while the new plan costs 8 cents.

After the gravel has been excavated by steam shovels it is conveyed to the mill, where it passes through, or over, a series of screens, thereby being separated into particles of uniform size. Each separator is so constructed as to handle gravel of a certain size, and the gravel is distributed automatically to a machine and thence passes to a hopper, situated on top of the separator. Here a roller regulates the feed of the gravel through a narrow slit in the top of the machine, and the gravel falls to the bottom.

Back of this slot and under it there is a rotary blower, which directs a powerful blast against the falling gravel, which falls down almost as a thin screen. The heaviest metal falls directly to the bottom of the separator, but the blast throws the lighter gravel, black sand and iron into a separate compartment, leaving the gold alone and so nearly undefiled that any impurities may be removed by simple processes.

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Gold of Pleasure, an annual cruciferous plant (*Camelina sativa*), with abundant yellow flowers, called «cameline» by the French and «dotter» in Germany. It is a weed in lint-fields, but is also cultivated in parts of Europe for the sake of the oil in its seeds. Its seeds and oil-cake are, however, inferior to those of flax, rape or colza. The stems are used for thatch, and made into brooms; and their fibres are sometimes woven into very coarse cloth and packing-paper. The seeds are used for emollient poultices. *C. dentata* is similar, but is not cultivated.

Gold Reserve (United States Treasury). All banking institutions must retain, to pay to depositors or note-holders who may wish to recall their money or claim the fulfilment of the promises on the notes, a stock of coin of a kind satisfactory to the claimants. The amount of this «reserve» needed in quiet times is ascertainable by experience, and is but a small part of the total deposits or issues, as only a small and calculable percentage of customers will wish their money at one time; in times of panic no estimate can be made. The United States formerly directed the Treasury Department to hold a reserve of $100,000,000 in gold, to protect its credit; but the silver panic of 1894 showed that no such arbitrary figure is of any value. When no fear of government solvency was entertained, scarcely any was needed; when the enormous silver purchases had come to threaten a breakdown of national credit by its coming on the market, the sudden rush for gold brought the reserve within three days of extinction, and only the sales of bonds and the knowledge that the policy would be pursued prevented suspension of specie payments. The abandonment of the silver policy has made another «run» less likely; but the government prefers to retain a larger reserve than the former limit. The nominal reserve (see article below) is now $150,000,000; and the recent good business years and excess of exports had brought the actual cash on hand 1 Nov. 1902 up to $350,421,878.30.

Gold Standard and Gold Production. The metal gold is the only substance of which the earth is composed that is freely accepted in return for all services and in exchange for all other kinds of property by every race in the world. In other words, it is the world's standard of value; the one commodity the market for which cannot be glutted; the one substance that is everywhere accepted not only without compulsion and without limit as to quantity, but that is also the particular object of universal desire. As a mineral it has a history that is probably almost as old as the human race that has fought for its possession with so much avidity. No less than 1,400 years before the dawn of the Christian era, the Greeks were using it as an object of ornamentation, and yet even they were not the originators of the practice. They had borrowed the custom of wearing gold to make the person more attractive from the Egyptians, a people that had decked its women in gold more than 1,000 years before the Greeks had dreamed of utilizing it in this manner. It was, of course, the use of gold as an ornament that first suggested its subsequent use as money, and that finally made it the standard upon which the coinage of the world is based.

Among the many things for which the 19th century will always be memorable not the least important will be the fact that it was during this period that the single gold standard was adopted by practically all the civilized nations of the earth. Beginning with a monetary system that, in a broad sense, may be described as the double standard of silver and gold, the nations of the ancient world maintained this method until sometime in the Middle Age. From about the beginning of the seventh century, however, and until sometime in the 13th century, the single silver standard of coinage prevailed, and, when the double standard was then reintroduced, it remained in vogue until the 19th century, when the progressive financiers began to appreciate the need of a better system.

England was the nation that led the way in the work of exchanging the double standard of silver and gold for the single gold standard, but, while this was done in 1816, other countries were slow to follow in her footsteps. It was not until 1854, therefore, that the double standard was superseded by the single standard in Portugal, but Germany followed in 1871; the United States, in 1873; the Scandinavian States, in 1874; Holland, in 1875; France and the Latin Union, in 1876; Austria-Hungary, in 1892; British India, in 1893; Japan, in 1898, and Russia, in 1899. The gold standard also prevails in Roumania, Servia, Turkey, and Egypt, but, while all the South and Central American countries, with the exception of Bolivia, Colombia, Guatemala, Honduras, Nicaragua, Salvador, and Paraguay have adopted it, most of them are almost hopelessly entangled in a mass of irredeemable paper. It may thus be seen that, among all the nations of importance, China and Mexico alone failed to adopt the single gold standard during the 19th century, while the latter is now (1905) taking the necessary steps to remedy her financial ills by the adoption of such a standard.

It was not alone for this reason that the 19th century was closely identified with the history of gold, however, for it is this period that will always be noted for having been the occasion of two great events in the world's record; the greatest discovery of gold and the greatest production of gold. According to the statistics prepared by the director of the mint, the world's production of gold during the first half of the 19th century was $787,463,000, while, for the second half, it was $6,909,040,000. At the beginning of the century the most important gold-producing countries were Mexico, Colombia, Peru, Brazil, and Buenos Ayres, in the western hemisphere, and Russia and Hungary in the eastern hemisphere. With the exception of small quantities that were obtained in Africa and from the East Indies there was practically no other places where the metal could be found. During the period from 1801 to 1810, the average annual yield of these countries was not in excess of $12,000,000, and fully two-thirds of this amount came from the American mines. Owing to the revolutionary disturbances that broke out in Mexico and throughout South and Central America during the period between 1810 and 1824, the output of gold, as well as that of silver, was greatly reduced. At this time the world's production of gold declined until it reached the comparatively low average of about $7,600,000 per annum, an amount which, in the opinion of William Jacob, one of the best authorities of that period, was insufficient to supply the quantity used in the arts and to make good the loss by accidents, such as by abrasion, shipwreck, etc. As the restoration of peace was quite generally effected about this time, however, disaster was avoided ,for the increase in the production of gold, which began at once, steadily continued. Even the average output of Russia commenced to show some remarkable gains, her production between 1837 and 1848, averaging more than $12,500,000 per annum, which was in excess of the production of the entire world at the beginning of the century. The following table gives the details of the world's production during the first half of the century as computed by the director of the mint:

Period.	Annual average	Total for period
1801-1810	$11,815,000	$118,152,000
1811-1820	7,606,000	76,063,000
1821-1830	9,448,000	94,479,000
1831-1840	13,484,000	134,841,000
1841-1850	36,393,000	363,928,000
Half-century	$15,749,200	$787,463,000

The era of gold discovery dates from 1848, when James Wilson Marshall, on 19 January, discovered a small lump of gold in the tail-race of Sutter's saw-mill, in El Dorado County, Cal. Naturally such a discovery led to a search, not only of the bed of the stream but in the adjoining ground, and, in both places, rich deposits of the precious metal were found. The story of the rush that followed this find of new gold fields is a familiar tale to readers of American history. The news spread like wildfire through California, down the Pacific coast to South America, and finally east to the Atlantic States, and so to Europe. In response to these tidings gold hunters flocked from every inhabitable portion of the globe, with the result that the gold production of California alone amounted to $36,000,000, or a sum equal to that which the annual average of the entire world had attained during the preceding decade. A year later it had reached the sum of $56,000,000, and it was in that year that a similar discovery of placer gold was made in New South Wales, which was followed shortly by a still more important find in the colony of Victoria. New mines were also discovered in Russia during this period, and as all these discoveries were attended by great public excitement and heavy immigration the new mines were so well worked that the production of Australia and New Zealand soon aggregated $65,000,000, while that of Russia alone was in excess of $25,000,000.

The finding of the Comstock lode in Nevada was the next great discovery of the precious metal. This fissure vein, which was fully four miles long, was in rock of the Tertiary Age, and was situated at the base of Mt. Davidson, in the Virginia range, an offshoot of the Sierra Nevada. In the central part of the fissure its width is about 3,000 feet, while the gangue, or veinstone, is quartz, not uniformly distributed in the fissure, but coagulated in large bodies commonly known as "bonanzas." Apparently the metal had been deposited in this place in solution, while some idea of the tremendous magnitude of the deposit may be obtained from the fact that, since 1861, the year when it was first scientifically worked, the Comstock lode has yielded more than $350,000,000 of bullion. At the value ratio of 1 to 16.40 per cent. of the bullion produced was gold, while 60 per cent. was silver. As the richest ore bodies of the lode had been exhausted during the seventies, the annual yield gradually declined until, in 1882, it was less than $1,500,000, but as attention was then turned to the working of such lower-grade ores as had previously been neglected, the annual production gradually increased until it had again attained a figure of several millions.

It was about this time (1884) that there was discovered in the Witwatersrand of the Transvaal a deposit of gold that was destined to surpass in magnitude, not the Comstock alone, but every other find of the precious metal that the world had ever seen. Here the country rock is a bed of sandstone, interlaminated with deposits of conglomerate, known to the Dutch as "banket." It is this conglomerate that carries the gold, the average being 10 pennyweights per ton of material. Borings to the depth of 3,500 feet, however, have found the proportion of gold in this reef undiminished, while the outcroppings of the reef have been traced for a distance of 40 miles. The working of these mines gave the Transvaal a gold production of $78,070,761, in 1898. Then came the interruptions due to the war with Great Britain, in 1899, and this, with other disturbances, made a full resumption of the work impossible prior to about 1904, although it is believed that the output of the Rand willl yet equal the sum of $100,000,000.

The most surprising discovery of modern times, however, was the finding of the gold placers of the Klondike, in 1894. As the ground underneath which this gold is found is perpetually frozen, it is quite evident that these deposits must have been laid down at some age when the climate of that region was much warmer than it is at present. To procure this gold to-day, however, it is necessary to sink a shaft through the frozen ground by the use of hot boulders, after which the drift is run by building a fire against the face of the ground, the gravel which is then thrown out being left until summer, when it will thaw sufficiently to permit of washing and panning. It has been estimated that all the gravel which two men are able to throw out during the eight months of winter, can be washed by the same men in two months of the summer. In spite of the difficulties of mining and the cost of transportation the output of the Klondike region steadily increased until 1900, when it was estimated at more than $20,000,000. Since that time there has been a slight falling off in the product, which, in 1904, was figured as somewhat more than $16,000,000. Similar placer mines have also been discovered in the Cape Nome region of Alaska, and, in 1904, their output amounted to more than $9,000,000.

At the present time, however, the most important gold-bearing district within the borders of the United States is that at Cripple Creek, Col. This ore is a telluride, known to mineralogists as calaverite. The country rock is altered andesite, granite, or phonolite, containing thinly disseminated iron pyrites and tellurium minerals. The tellurium,, at or near the surface, is oxidized, and the gold, when it is visible, exists as an ochre-like powder known as "mustard gold." The tellurium, through a process of roasting, is oxidized, and the gold thus set free in the metallic state is easily soluble by cyanide or chlorination. The estimated yield of the Cripple Creek district in 1904 was $24,000,000. The increase in the gold production of Australia during recent years has also been a remarkable factor in extending the world's output. During 1900, new workings were established in West Australia, and these, with the product of the older mines, produce an amount of gold, which, in 1904, was approximated at nearly $88,000,000.

The statistics showing the world's production of gold during the second half of the century, as compiled by the director of the mint, are as follows:

Period.	Annual average.	Total of period.
1851-1855	$132,513,000	$662,566,000
1856-1860	134,083,000	670,415,000
1861-1865	122,989,000	614,944,000
1866-1870	129,614,000	648,071,000
1871-1875	115,577,000	577,883,000
1876-1880	114,586,000	572,391,000
1881-1885	99,116,000	495,582,000
1886-1890	112,895,000	564,474,000
1891-1895	162,947,000	814,736,000
1896-1900	257,506,000	1,287,978,000
Half-century	$138,181,000	$6,909,040,000

The production of the world by single years from 1901 to 1904, inclusive, was:

Year.	Production.
1901	$263,374,800
1902	295,889,600
1903	325,527,200
1904	346,892,200
Total for 4 years	$1,231,683,800

The world's production of gold in 1904, according to the same authority, was divided as follows:

Counties.	Value.
Australia	$87,767,300
Africa	85,913,900
United States	80,464,700
Russia	24,803,200
Canada	16,400,000
Mexico	12,605,300
India	11,485,500
China	4,500,000
All others	22,942,300
Total	$346,892,200

The production of the United States and its territories during 1904 was divided as follows:

State, etc.	Value.
Colorado	$24,395,800
California	18,994,800
Alaska	9,160,500
South Dakota	7,024,600
Montana	5,097,800
Nevada	4,307,800
Utah	4,215,000
Arizona	3,343,000
Idaho	1,503,700
Oregon	1,309,900
All others	1,110,900
Total	$80,464,700

In concluding this review of the gold situation it may be interesting to note the manner in which new supplies of gold operate on prices. From a commercial point of view, gold stands for purchasing power, and yet people do not mark up the prices of their goods merely because some new gold mine has been discovered, but the fact that some men have $2 in their pocket where they had only $1 before creates a greater demand for goods, and it is to this increased demand that the advance in prices is due. It was in this way that the new supplies of gold acted when they brought about an increase in both prices and wages during the 20 years succeeding the discovery of the precious metal in California. This result was not brought about because the community was richer for the privilege of having two dollars instead of one with which to transact a given amount of business, but because, as Professor Cairnes shows, the distributions of the earnings of society was shifted by giving the advantage to wage-earners over rentiers and others having a fixed income. The former had more steady employment and better wages than before, while the latter were compelled to pay higher prices for the goods which they consumed without experiencing a corresponding increase in their income.

Gold Standard Bill, a short name for the act of 14 March 1900, "To define and Fix the Standard of Value, to Maintain the Parity of All Forms of Money Issued or Coined by the United States, to Refund the Public Debt, and for Other Purposes." It provides that the dollar of 25.8 grains of gold, .9 fine, shall be the standard unit of value, and all forms of money issued or coined by the United States shall be maintained at a parity of value with this standard, and it shall be the duty of the secretary of the treasury to maintain such parity. All United States notes and treasury notes issued under the act of 14 July 1890 shall be redeemed in gold coin as above, and to secure this the secretary of the treasury is directed to set aside a reserve of $150,000,000 in gold coin and bullion, to be used for such redemption purposes only. If this reserve falls below $100,000,000 despite certain assigned methods of replenishing it, the secretary shall pledge the credit of the United States by issuing bonds at not exceeding 3 per cent interest, payable quarterly, exempt from all taxation. This is not to interfere with the legal-tender quality of silver money already in circulation. As fast as silver dollars are coined under previous acts, an equivalent amount of treasury notes shall be retired, and silver certificates issued instead. The coinage of subsidiary silver coins, and the recoinage of such as are out of circulation, is provided for. This act is not to prevent international bimetallism if it is found possible to secure a stable relation between gold and silver.

Goldau, gŏl'dow, a valley in Switzerland, in the canton of Schwyz, between Mount Rigi and the Rossberg. On 2 Sept. 1806 a landslide from Mount Rossberg destroyed the village of Goldau and three other villages situated in the valley, killing about 450 persons. A little village built in the valley, near the mines, is called Goldau. It has a population of about 490.

Goldchain, or Golden Moss. See STONECROP.

Gol'den, Colo., city, county-seat of Jefferson County; on Clear Creek, and on the Union P., the Denver, L. & G., and the Denver & G. R.R.'s; about 15 miles west of Denver. In the vicinity are deposits of coal and brick clay. The chief industries are smelting, the manufacturing of brick and pottery, and flour milling. A State Industrial School and a School of Mines are located here. Pop. 2,203.

Golden Age, among the Greeks and Romans was the reign of Saturn, whose blessings are described by Virgil in his eclogue addressed to Pollio. The Latin poet was borrowing from the Greek Hesiod who depicted the Golden Age as the patriarchal era of Saturn or Cronos. This was followed by the Silver Age of voluptuousness under Jupiter. Then came the Brazen or warlike age under Neptune. To this succeeded the Heroic Age under Mars, the Iron or utilitarian Age under Pluto, god of riches. The Golden Age in England was the reign of Elizabeth (1558–1603); in France under Louis XIV. The Golden Age of German literature included the period between Klopstock and Goethe (1750–1850). The Golden Age of Italian art was the famous 'Cinque Cento' extending from the life of Leonardo da Vinci (d. 1520) to Michelangelo (d. 1576).

Golden Beetle, one of the richly gilded beetles of the family *Chrysomelidæ* (q.v.).

Golden Bible, the Book of Mormon, which Joseph Smith, Jr., professed to have found in 1823. He declared that an angel appeared to him, and led him to the discovery. He was not, however, allowed to take up the gold plates on which the book was written until four years later. Joseph Smith was at first unable to read the "reformed Egyptian" characters in which the revelation was written until, in the same box with the plates, he discovered an instrument called Urim and Thummin, by the aid of which he translated the Golden Bible into English and published it in 1830, with the certificate of 11 men testifying that they had seen the plates of gold.

Golden Bull, a name given to several state documents; the principal ones are as follows:

1. Of Hungary, 1222, wrung from King Andrew II. by his nobles, just as Magna Charta was extorted from John of England. Andrew II. of Hungary, surnamed "Hierosolymitanus," was a feeble, self-willed, worthless king, like John of England. Its terms were:

The nobles and the Church were to be exempt from taxes.

The daughter of a noble without male heir shall inherit one fourth of his property.

No noble shall be obliged to follow the king in any foreign war.

The palatine (that is, mayor of the palace), shall be the supreme judge.

No foreigner to hold office or dignity without consent of the council of the realm.

The king shall not grant counties or offices of any kind in perpetuity.

If the king violates any of the laws in this bull, it shall not be treason to levy war on him.

This bull was so called because the attached seal was enclosed in a golden case or box. It is rather remarkable that one of the very first countries in Europe to effect the liberty of subjects should have been one of the last-born nations, the Huns of Hungary.

2. 'Bulla Aurea of the Empire,' 1356, published by Kaiser Karl IV. at the Diet of Nuremberg, and held the Magna Charta of Germany. It prevented a repetition of the contests which had hitherto arisen whenever a vacancy in the throne occurred; and regulated the functions, number and privileges of the electors. Called "golden" because the seal attached to the parchment was of gold instead of lead, or else that it was enclosed in a golden case.

It limited the number of electors to seven (three prelates and four lay princes). The prelates were the three Archbishops of Maine, Cologne, and Treves; the lay princes were the King of Bohemia, the Duke of Saxony, the Margraf of Brandenburg, and the Pfaizgraf of the Rhine. Their persons were declared sacred. Every question was to be decided by majority and without appeal.

Golden Calf, an idolatrous image, doubtless of Egyptian suggestion and symbolism, cast by Aaron from the earrings of the people, while the Israelites were encamped at the foot of Sinai, and Moses was absent on the Mount.

Golden Circle, Knights of the. See Knights of the Golden Circle.

Golden Cross, United Order of the. See United Order of the Golden Cross.

Golden-crowned Sparrow, Thrush, etc., birds so named for some conspicuous yellow marking on the top of the head. The sparrow (*Zonatrichia coronata*) is a near relative of the white-crowned, or Peabody bird (q.v.), and is seen in the United States only in the spring and fall; it sings brilliantly in its Arctic and Alaskan breeding-home. The golden-crowned "thrush" is a warbler, bettter known as "ovenbird" (q.v.). The "wren" or "gold-crest" is a kinglet (q.v.).

Golden or War Eagle. See Eagle.

Golden Eagle, Oriole, Plover, Shiner, Warbler. See Eagle; Oriole; Plover; etc.

Golden-eye, or Whistle-wing, a duck (*Clangula clangula*) which breeds numerously in all northern regions, where its nest is made in holes in trees, or (in Lapland) in suitable boxes placed in trees. The American birds form a geographical race called *Americana*. During cold weather they appear in the United States and the middle districts of Europe, traveling about in small, watchful parties which escape swiftly on the least alarm, and arouse all other ducks within sound of the loud noise made by their wings. An European name is "garrot." The general color of the drake is white beneath, with head and sides of neck rich green, back and tail grayish-black, and the bill bluish-black; it has a round white spot before each eye, the iris of which is golden yellow, and two white bands on the wing; length about 19 inches. The female is ashy, with rufous head. In the Rocky Mountains and northward occurs a second somewhat larger species, Barrow's golden-eye (*C. islandica*), which differs prominently in the greater extent of the loral spot.

Golden-eyed Fly, a lace-winged fly (q.v.).

Golden Fleece. See Argonauts.

Golden Fleece, Capture of the ("Argonautica"), an epic poem in four cantos, by Apollonius of Rhodes (235 B.C.), a contemporary of Ptolemy Philadelphus. Apollonius found all the elements of his poem in the legendary traditions of the Greeks; the expedition of the Argonauts being, next to the siege of Troy, the most famous event of the heroic ages. The third canto describes the conquest of the Golden Fleece, and the beginning of Medea's love for Jason, the development of which forms the finest portion of the poem. The Argonauts go through the most surprising adventures, and encounter perils of every description, before they are able to reach the port from which they started. These various events have allowed the poet to introduce brilliant mythological pictures such as his account of the Garden of the Hesperides. The work has been frequently translated, and is admittedly the masterpiece of Alexandrian literature. The 'Argonautica' of Valerius Flaccus is an imitation of that of Apollonius, regarded by most modern scholars as without originality or invention.

Golden Fleece, Order of, a celebrated order of knighthood in Austria and Spain, founded by Philip the Good, duke of Burgundy and the Netherlands, at Bruges, 10 Jan. 1429, on the occasion of his marriage with Isabella, daughter of King John I. of Portugal. The order was instituted for the glory of the saints and the protection of the Church, and the fleece was probably assumed for its emblem as much from being the material of the staple manufacture of the Low Countries as from its connection with heroic times. The number of the knights was 31, and they themselves filled up vacancies by vote. This continued till 1559, when Philip II. of Spain held the last (the 23d) chapter of the order in the cathedral of Ghent; and subsequently Philip obtained from Gregory XIII. permission to nominate the knights himself. After the death of the last Hapsburg king of Spain in 1700, the Emperor Charles VI. laid claim to the sole headship of the order in virtue of his possession of the Netherlands, and, taking with him the archives of the order, celebrated its inauguration with great magnificence at Vienna in 1713. 'Philip V. of Spain contested the claim of Charles; and the dispute, several times renewed, was at last tacitly adjusted by the introduction of the order in both countries. The insignia are a golden fleece (a sheepskin with the head and feet attached) hanging from a gold and blue enameled flint-stone emitting flames, and borne in its turn by a ray of fire. On the enameled obverse is inscribed *Pretium laborum non vile*. The decoration was originally suspended from a chain of alternate flints and rays, for which Charles V. allowed a red ribbon to be substituted, and the chain is now worn only by the grand-master. The Spanish decoration differs slightly from the Austrian. The costume consists of a long robe of deep red velvet, lined with white taffetas, and a long mantle of purple velvet lined with white satin, and richly trimmed with embroidery containing fire-stones and steels emitting flames and sparks. On the hem, which is of white satin, is embroidered in gold, *Je l'ay empris* («I have captured it»). There is also a cap of purple velvet embroidered in gold, with a hood, and the shoes and stockings are red. See Reiffenberg, 'Histoire de l'Ordre de Toison d'Or' (1830); and Zoller, 'Der Orden vom Goldenen Vlies' (1879).

Golden Gate, a channel at the entrance to San Francisco Bay, between the peninsula upon which is located San Francisco and the one upon which Sausalito stands. The average width is two miles, and the depth is sufficient for ocean steamers. It is guarded by Forts Pointe and Mason, both on the south shore, and by a fort on Alcatraz Island. The name was given to this channel by Drake, about 1578.

Golden Hind, The, one of the two vessels in Sir Humphrey Gilbert's colonizing expedition of 1583. Gilbert's own vessel was the Squirrel, and he went down with it in a storm. The Golden Hind, Capt. Edward Hales, returned to England with the news.

Golden Horn, the harbor of Constantinople, an inlet of the Bosporus; so called from its shape and beauty. See CONSTANTINOPLE.

Golden House of Nero, a palace which Nero erected for himself at Rome after the disastrous fire of 64 A.D. This palace stretched from the Palatine across the level area on which the Flavian amphitheatre was afterward built to the foot of the Esquiline. According to Tacitus, whose virulence is often unjust, Italy and the provinces were plundered to gratify the emperor's love of magnificence in the erection of this structure. Gold and precious stones blazed on its walls; the grounds around it were variegated with meadows, lakes, and shady woods, and it was considered one of the wonders of the Roman empire.

Golden Mole, or **Cape Mole**, a South African insectivore with fur showing golden iridescence. It has the habits of a mole, no external ears or tail, and the eyes covered with skin; but a greater structural resemblance to the potamogales (q.v.). Five species constitute the family *Chrysochloridæ*, differing from moles (q.v.) most markedly in the fact that the fore-feet are adapted for digging by the development of the middle toe into a powerful tool, and by a hollowing inward of the chest. The best known species is *Chrysochloris trevelyani*, about six inches long.

Golden Oriole, commonly known as the Baltimore oriole, an American bird (*Icterus galbula*), closely allied to the *Ploceidæ*, weaving birds of Asia. Its nest is skilfully constructed so as to hang in the form of a long slender pouch from the extremity of a bough. Its plumage is brilliantly contrasted in color, and as black and yellow were the armorial colors of Lord Baltimore it was named in early colonial days after that nobleman. It is found in the hot months as far north as the coast of New Brunswick, and westward from the Saskatchewan River to Texas and northern Louisiana. In winter it migrates to Panama and the West Indian Islands. It is a powerful and delightful songster. Its eggs are from 4 to 6 in number and hatch in 14 days. The golden oriole is the farmer's friend and destroys many insect pests which are destructive to vegetation.

Golden-rod (*Solidago*), a genus of plants belonging to the *Compositæ*, containing about 85 species, most of them natives of North America, where their brilliant yellow flowers are very conspicuous in the autumnal months, especially in Canada and the northeastern United States. Two or three species are found in Europe, and a few in South America and Mexico. They are perennial, chiefly herbaceous, with simple undivided leaves, and bear numerous small flowers, disposed in spikes or panicles. Among the marked forms of inflorescence are the pyramidal panicle of numerous, one-sided, scorpioid racemes, well illustrated by the *S. canadensis* and *S. rugosa;* the almost level cyme of the *S. rigida;* and the dense thyrsus-like cluster of the *S. speciosa*. The florets of the ray are about five in number, and yellow, the *S. bicolor* excepted, which has whitish rays. The dried leaves of the sweet-scented or anise-scented golden-rod (*S. odora*) have been used as a substitute for tea. This plant yields an aromatic oil with tonic properties. In Europe the different species are cultivated in gardens for ornament; one, the Aaron's rod (*S. virgaurea*), is common in Great Britain. The Alpine golden-rod is found on the summits of mountains in Maine, New Hampshire, and northern New York, and also in Europe. The sea-side or salt-marsh golden-rod (*S. sempervirens*) is an especially showy species; and the «yellow-weed» (*S. canadensis*) sometimes attains a height of eight feet. Some species found in New Zealand and St. Helena attain to the dimensions of trees.

Golden Rose, a rose of gold, or gilded, blessed by the Pope on the fourth Sunday of Lent and sent to some sovereign or other person who is known for his or her loyalty to the Holy See. It is sometimes sent to noted churches or sanctuaries.

Golden Rule, the rule laid down by Jesus in the Sermon on the Mount, and stated by him to be the law and the prophets — that is, a summary of their teaching: «Therefore all things whatsoever ye would that men should do to you, do ye even so to them» (Matt. vii. 12). This rule had already been «examined and adopted as a standard of ethics by westerns like Socrates and easterns like Theng-tsen, the disciple and friend of Confucius, some centuries before the birth of Christ.»

Golden Seal, Orange-root, Yellow Puccoon, or Yellow Indian Paint, a ranunculaceous perennial plant (*Hydrastis canadensis*) of wooded regions throughout the eastern United States, which sends up in early spring a hairy stem about a foot high, with large, deeply lobed leaves and a single greenish-white flower, followed by a head of crimson berries which resemble a raspberry. The root-stock is gathered by country people, especially in the South, for the sake of its thick orange-yellow bark from which a drastic and tonic medicine is made.

Golden State, California, so named on account of its gold deposits.

Golden Spur, Order of the, a papal order of knighthood, whose foundation has a legendary origin in Constantine the Great, or Pope Sylvester. Its institution can be traced historically to Pope Paul IV., 1559. The title of the members is "Count Hospitalers of the Lateran." The right of bestowing the order is vested in other prelates and kings beside the Pope. When it languished, Gregory XVI. revived it in 1841. It is intended to be bestowed as a recognition of conspicuous merit in personal character, science and art, and for services done to humanity and the Holy See. The badge is a gold Maltese cross with white enameled surface, to which a pendant spur is attached. On one face of the cross is a bust of Sylvester, with the inscription, *Sanctus Silvester Pont. Max.* (St. Sylvester, Pope). On the reverse is engraved "MDCCCXLI. Gregorious XVI. restituit" (Gregory XVI. restored it in 1841). The order has three grades; the ribbon is red with black stripes.

Golden Wasp, or Gold Wasp, a cuckoo-fly (q.v.)

Golden Wedding. See DIAMOND WEDDING.

Golden-winged Woodpecker. See WOODPECKER.

Goldfinch. (1) The familiar North American black-winged "yellowbirds" or "wild canaries" of the genus *Spinus,* the best known of which is the eastern thistle-bird or lettuce-bird (*S. tristis*), whose wave-like flight across the fields, each male singing sweetly in its course, forms one of the most pleasing incidents of a rural stroll. These little finches are bright golden-yellow, with the cap, wings, and tail black in the adult male; while the female and immature young are gray-brown and yellowish; and in autumn the male discards his conspicuous dress and assumes the plain attire of his mate. At this season they collect in flocks and remain together during the winter, seeking the seeds of the meadow-grasses and roadside weeds, especially thistles, and often coming near the house and barn. Their summer food includes more soft material, and they gather many caterpillars for their young. The goldfinch is one of the latest birds to make its nest, delaying until midsummer to fabricate the soft cup of hempen and downy materials which is lodged usually in some crotch of a village shade-tree, and contains half a dozen spotless bluish eggs. Several other species dwell in the western United States and southward. (2) The small European finch (*Carduelis carduelis*) to which the name first belonged, and whose habits are much the same as those above described, but which is more varied in plumage. The bill is horn-color, the tip black and the base encircled with crimson; nape of neck white; top of head, shoulder of wing and a part of the quills, black; remainder of wing dull yellow; back and rump dusky brown; under surface dull white. Its nest is neatly built of moss, twigs, roots, etc., lined with wool, is situated in bushes, hedges, or apple-trees, and the eggs are spotted with purple and brown. This finch is one of the sweetest singers of Europe, a favorite cage-bird, and the one most often taught pretty tricks; it is the most useful decoy in bird-catching. Examples are to be found in bird-stores all over the world; and in the neighborhood of New York many have escaped and are living wild in the parks and environs.

Goldfish, a carp (*Carassius auratus*), highly cultivated long ago in China as a domestic fish for the sake of its rich red-gold color, developed out of an originally much duller hue. It was introduced into England in 1728, and has spread over all of Europe and is naturalized in many waters of the United States as well as everywhere kept in household aquaria. The young are dark-colored, assuming the golden hue later in life, and sometimes losing it in old age, when the fish becomes silvery. The "silver fish" is a mere variety, as are the so-called "telescope fish" with large protruding eyes and the Japanese "butterfly fish," in which anal and caudal fins become more or less markedly double. All of these varieties thrive well in confinement when furnished with favorable conditions in the aquarium (q.v.), but are liable to fungus diseases of the skin. Diseased fish will infect all in an aquarium, and the aquarium itself, so that in the case of an inexpensive glass globe it is better to throw the receptacle away; a large aquarium should be emptied and thoroughly treated with some fungicide (q.v.) before new and healthy fish are installed. These fish are bred for sale by some fish culturists in various parts of the United States, who must exercise care or their stock will revert toward the original unadorned type of the species.

Golding, Arthur, English writer and translator: b. probably at London about 1536; d. about 1605. He finished the translation of Philippe de Mornay's treatise 'Sur la Vérité du Christianisme' which was begun by Sir Philip Sidney and entrusted to his care, publishing it under the title 'A Woorke Concerning the Trewenesse of the Christian Religion, etc.' (1589). Beside making translations of the works of Calvin and Beza, he also translated the first four books of Ovid's 'Metamorphoses' (1567).

Goldmark, Karl, Austrian composer: b. Keszthely, Hungary, 18 May 1830. He studied at the Vienna Conservatory. His first composition of note was the overture, 'Sakuntala' (1858); his first opera the 'Queen of Sheba' given at Vienna in 1875. His other works include: 'Merlin,' an opera performed for the first time at the Metropolitan Opera House, New York, in 1887; the overtures 'Prometheus,' 'In Spring,' and 'Penthesilea'; and the symphony 'The Country Wedding.'

Goldoni, gŏl-dō'nē, **Carlo,** Italian writer of comedies: b. Venice 1707; d. Paris 8 Jan. 1793. He early showed a taste for theatrical representations, reading every dramatic production of which he could obtain possession, especially the works of the popular comic poet Cicognini, and, when scarcely eight sketched a comedy, which excited the wonder of his relatives. His father, a physician then practising at Chiozza, destined him for the medical profession, and took him occasionally to visit his patients. But Goldoni, dissatisfied with this study, obtained permission to study law in Venice. Soon after, however, a relative procured for him a place in the Papal College at the University of Pavia, from which he was expelled for writing an abusive satire. His father died in 1731, and from this time Goldoni lived an unsettled and wandering life, resorting to various means to make a livelihood, but usually living as the companion of strolling players in a continual scene of dissipation and intrigue until 1736, when he married and removed to Venice.

Goldoni's merits in reforming the Italian theatre cannot be mistaken. Many of his numerous pieces still retain possession of the stage in his native country, and, in translations, of the stages of foreign countries. Among the numerous editions of his works, that published at Venice in 1788 and 1794–5, in 44 volumes, is the most complete; and that published at Florence in 53 volumes in 1827 the most elegant. Translations and imitations of some of his works have been made in French, German, and English. Goldoni wrote memoirs of himself in French, in which he also composed two comedies, one of which, 'Le Bourru bienfaisant,' was produced at Fontainebleau and Paris in 1771 with great applause, and has maintained itself on the stage. See 'Memoirs of Carlo Goldoni,' translated by Black with essay by W. D. Howells (1877); Rabany, 'Le Théatre et la Vie en Italie au XVIIIème siècle' (1896).

Golds'boro, N. C., city, county-seat of Wayne County; on the Neuse River, the Atlantic & N. C., the Southern, and the Atlantic C. L. R.R.'s; about 80 miles north of Wilmington, and 50 southeast of Raleigh. It is the site of a State Normal School for colored teachers, the Eastern Insane Asylum, and the Odd Fellows' Orphanage. The chief manufactures are cotton, agricultural implements, cotton-seed oil, furniture, mattresses, and machinery. Pop. 5,880.

Goldsboro, Kinston, and Goldsboro Bridge, Engagements at. On 11 Dec. 1862, Gen. Foster, in command of the Department of North Carolina, set out from Newbern for the purpose of taking Goldsboro and breaking the railroad that connected Richmond with the railway system of the South and Southwest, and then forming a junction with the Union forces at Suffolk and Norfolk, Va. He had four brigades of infantry, a regiment of cavalry, and seven batteries and two sections of batteries, in all about 11,500 men and 40 guns. He reached Southwest Creek on the 13th, to find the bridge destroyed and his passage disputed by about 400 Confederates, with three guns. The 9th New Jersey and 85th Pennsylvania soon routed this force, capturing one gun, and Foster pushed on toward Kinston, skirmishing heavily on the way, and when within a mile of the place, 14 December, encountered a force of 2,000 men under Gen. Evans, posted between the Neuse River and a deep swamp. After a sharp fight Evans was driven across the river, firing the bridge behind him; but the fire was extinguished and 400 prisoners and six guns were taken. Evans retreated through Kinston, reformed his command two miles beyond, and withdrew toward Goldsboro. Foster followed, had a successful engagement on the 16th, at White Hall and, when nearing Goldsboro 17 December, was checked by a heavy force under Gen. G. W. Smith at Goldsboro Bridge. Foster succeeded, however, in destroying the bridge of the Weldon & Wilmington Railroad over the Neuse, also several other bridges, and about six miles of railway, and retreated somewhat rapidly to Newbern, having lost during his eight days' campaign 92 killed, 487 wounded, and 12 missing. The Confederate loss was 71 killed, 268 wounded, and 496 prisoners. The prisoners were paroled.

Union Occupation of Goldsboro.— After the capture of Wilmington by Gen. Schofield 22 Feb. 1865, his next objective point and final destination was Goldsboro, where it had been arranged that he should unite forces with Gen. Sherman, who was marching north from Savannah. Forces were assembled at Newbern, and the march began on 1 March. Kinston was occupied 14 March, after some days' sharp fighting. (See Kinston, Battle of.) The railway and bridges were repaired, and Schofield entered Goldsboro with little opposition on the 21st, and two days later Sherman joined him. Consult: 'Official Records,' Vol. XVIII.; Cox, 'The March to the Sea.'

E. A. Carman.

Golds'borough, Louis Malesherbes, American naval officer: b. Washington, D. C., 18 Feb. 1805; d. there 20 Feb. 1887. In 1827 he rescued the English brig Comet from a Greek pirate whose force was five times greater than his own. In 1861 he was put in command of the North Atlantic blockading squadron and the advice given by him at this time resulted in the Burnside expedition and the capture of Roanoke Island with various other positions of strategic importance in North Carolina. He became rear-admiral in 1862.

Goldschmidt, Hermann, hĕr'män gōld'-shmit, German painter and astronomer: b. Frankfort-on-the-Main 17 June 1802; d. Fontainebleau, France, 10 Sept. 1866. He became a pupil of Schnorr and Cornelius, and went in 1836 to settle at Paris, where he exhibited many pictures, among which may be mentioned: 'Une femme en costume algérien'; 'Le jeune Florentin'; 'La poésie'; 'La Sibylle de Cumes'; 'L'offrande à Venus'; 'Cléopatre'; 'Vue de Rome'; 'Mort de Roméo et Juliette'; etc. In 1847 he suddenly conceived the design of becoming himself an astronomer, and in this new profession he rapidly became known as one of the ablest observers of celestial phenomena. Between 1852 and 1861 he discovered 14 telescopic planets, namely, Lutetia, Pomona, Atalanta, Harmonia, Daphne, Pales, Doris, Eugenia, Europa, Alexandra, Nysa, Melete, Danaë, and Panope. In 1863 his sight began to fail, making it impossible for him to continue his observations.

Goldschmidt, Jenny Lind. See Lind, Jenny.

Goldschmidt, Meier Aaron, Danish novelist and publicist: b. Vordingborg 26 Oct. 1819;

d. Copenhagen 15 Aug. 1887. He entered journalism when quite young, edited the comic paper 'Corsaren' (1840–6), and in 1847 founded a monthly publication in which he discussed the political movement of the time, and showed himself a strong advocate of constitutional freedom. His first novel, 'A Jew,' appeared in 1845; other novels of his are: 'Homeless' (1853); 'The Heir' (1865); and 'The Raven' (1867); he also wrote a few dramas, and his autobiography (1877). His novels are most remarkable for the skill with which he pictures the life of the Jews.

Goldschmidt, Otto, English composer: b. Hamburg, Germany, 21 Aug. 1829. He was a pupil of Mendelssohn and Hauptmann at the Leipsic Conservatory, became a resident of England in 1858, was appointed a professor in the Royal Academy of Music in 1863 and its vice-principal in 1866. From 1876–85 he was first musical director of the Bach Choir. He several times conducted the famous Lower Rhine Festivals at Düsseldorf. His compositions include the oratorio 'Ruth' (1867), and he also edited with Sterndale Bennett 'The Chorale Book for England.' In 1852 he married Jenny Lind (q. v.).

Goldsmith, Oliver, Irish poet and miscellaneous writer: b. Ireland,* 10 Nov. 1728; d. at 2 Brick Court, Middle Temple, London, 4 April 1774. Goldsmith, like Richardson, "flowered late." The son of a poor clergyman of the Established Church, his childhood was spent at Lissoy, a hamlet in Westmeath, lying to the right of the road from Ballymahon to Athlone. From the first instruction of a female relative, he passed to the care of the village schoolmaster, a roving old soldier who had fought in Queen Anne's wars. Thence he went to schools at Elphin, at Athlone, at Edgeworthstown, earning nowhere any particular distinction. He was regarded as dull and heavy intellectually, although physically he was robust and athletic. Now and then he surprised his family by an unexpected gift of repartee, and he scribbled verse early. But nothing occurred in his boyhood to favor the supposition that a genius had been born into the world of letters.

In June, 1744, after anticipating, in his own person, the plot of his later comedy of 'She Stoops to Conquer,' by mistaking the house of a gentleman at Ardagh for an inn, his father, impoverished by the attempt to portion his eldest daughter, sent him to Trinity College, Dublin, as a poor scholar. His college career was not brilliant. His tutor was hard and unsympathetic, and devoted to the mathematics which Goldsmith (like Gray and Swift) detested, though he had some faculty for "turning an ode of Horace." He got a small exhibition in 1747, a success which he unwisely celebrated by a mixed party in the garret which passed for his "rooms." Into this rejoicing his incensed tutor burst abruptly, and by knocking down the host, dispersed the guests. Thereupon his humiliated pupil ran away, vaguely bound for America. Matters were, however, patched up by his elder brother, and he returned to college, where, in February, 1749, he took a low degree.

He left no memories behind him but his name scratched upon a window-pane, a battered lexicon scored with "promises to pay," and the tradition that, after writing songs at five shillings a head for the Dublin ballad singers, he used to steal out in the twilight to hear them sung. When he returned to his widowed mother (his father had died during his college days), he had no more pressing vocation than to fish in the river Inny, blow the German flute, and take the chair at the village "free and easy." When he was old enough, he presented himself for ordination, but was rejected for incompetence, aggravated by red breeches. He next tried tutoring; made a little money, bought a good horse, and started again for America. In brief space he returned on a miserable hack, and without a penny. Law was then essayed. Being equipped with £50 for study in London, he lost it on the road to a sharper. Finally he did reach Edinburgh, to study physic. Upon the same pretext he went from Edinburgh to Leyden. Then, being again without means, he started — like Holberg — to make a kind of Grand Tour on foot through Europe. He visited France, Germany, Switzerland, and Italy, flute-playing and disputing at convents for a subsistence. In February, 1756, being then seven and twenty, he landed at Dover with a few half-pence in his pocket. He had, however, sent home to his brother from Switzerland a fragment of the poem which afterwards became 'The Traveller.'

For the moment literature seems to have been the last thing in his thoughts. He is suspected to have tried strolling; he is known to have been an apothecary's assistant, a poor physician (with a dubious foreign diploma), a reader and corrector of the press to Richardson the novelist, and an usher in a Peckham "academy." Here, at last, he drifted into authorship, being engaged by Griffiths of the 'Monthly Review' to supply "copy" of all work for that serial. With Griffiths he speedily fell out; and eventually found his way back to Peckham, where his old employer promised get him a foreign medical appointment. Meanwhile he published (1758), under a pseudonym, a translation of the 'Memoirs' of Jean Marteilhe of Bergerac, a Protestant condemned to the galleys for his religion. Failing, for unknown reasons, to take up the post at Coromandel which had been found for him, he tried to pass as a hospital mate. He was rejected at Surgeons' Hall in December, 1758, as "not qualified."

We next hear of him as living in a tiny court off the Old Bailey, writing a high-titled 'Enquiry into the State of Polite Learning in Europe.' This, superficial of necessity, but bright and epigrammatic, attracted some notice. He began a miscellany called 'The Bee,' and was employed on various periodicals. Then Smollett enlisted him for the 'British Magazine;' and for Newbery's 'Public Ledger' he wrote the delightful essays afterwards collected in 1762 as the 'Citizen of the World.' By this time the skies were opening. He had moved into better rooms at 6 Wine Office Court, Fleet street, made the acquaintance of Johnson, and

* The exact place of Goldsmith's birth is doubtful. It is usually said to be Pallas in Longford, but others make it Elphin, Roscommon.

was certain of employment. Besides dispersed papers, he wrote 'Memoirs of Voltaire,' a 'History of Mecklenburgh,' a 'Life of Richard Nash' (of Bath). What is more, he was writing the 'Vicar of Wakefield,' for in October, 1762, he sold a third share in that book to Benjamin Collins, a Salisbury printer, for £21. How this is to be reconciled with Boswell's story that Johnson sold the entire novel to a bookseller for £60 has not yet been explained; but internal evidence shows clearly that parts of the book were written in 1762.

His further career must be rapidly abridged. After much compiling for Newbery, which included an excellent 'History of England' in letters, he published, in December, 1764, his first long poem, 'The Traveller; or, a Prospect of Society.' Its sweetness of versification, its simple language and the beauty of its descriptions at once distinguished it as the best poem since the death of Pope. Its popularity drew attention to its writer's other work, and a volume of his collected essays followed in 1765. Upon these came 'The Vicar of Wakefield,' 1766. Its success, strange to say, was only gradual, but it continues to this day; and its inimitable types, its happy mingling of Christianity and character, its wholesome benevolence and practical wisdom are not likely to be forgotten. The Primrose family are citizens of the world.

Goldsmith's next triumph was on the stage. In January, 1768, he managed, after many vexations, to get a play produced at Covent Garden. This was 'The Good Natur'd Man,' in which he attempted to combat the insipid "genteel" comedy made popular by French models and the novels of Richardson. His efforts were only partially successful, though his profits were sufficient to enable him to move into fresh chambers in the Temple, whence, in a maze of miscellaneous "book-building," he sent forth, in May, 1770, another and a still more beautiful descriptive poem, 'The Deserted Village.' It was received with enthusiasm, and speedily ran through three editions. Three years later, though always hampered with task-work, he crowned his achievements with the comedy of 'She Stoops to Conquer.' In the interval which had elapsed since 'The Good Natur'd Man,' "genteel" comedy had passed into the "sentimental" stage. But Goldsmith's bustling piece, skilful in construction and brimming with humor and character, gave a knock-down blow to the lachrymose drama, which was eventually dispatched by Sheridan. A few months later, in April, 1774, Goldsmith died, and was buried in the Temple burying-ground. The Literary Club, to which he had belonged, erected a tablet to him in Westminster Abbey, with a well-known epitaph by Johnson. 'Retaliation' and the 'Haunch of Venison,' two of the happiest of his lighter poetical efforts, were published posthumously.

Goldsmith had many weaknesses. He had few physical advantages; and he was both sensitive and self-conscious. But he had the best heart in the world. "Let not his frailties be remembered," said his rugged old Mentor, Johnson; "he was a very great man." He was also a very great writer. To have died at 46, after 30 years of purposeless "eddying round and round," the author of two admirable didactic poems, an unique novel, and a comedy which still holds the boards, to say nothing of his essays and familiar verse, which are models in their way, is certainly to deserve a high position in the work of his century,— a position which he retains to-day in virtue of his simplicity, his kindliness, his humor, and the indefinable gift of genius.

Bibliography.— Goldsmith's life has been written by Prior (1837); Forster (1848–71); Washington Irving (1844–9); William Black, 'English Men of Letters' (1878); and Austin Dobson, 'Great Writers' (1888, revised American edition, 1899). His "miscellaneous works" were first published in four volumes (1801), with the so-called 'Percy Memoir.' Then, in 1820, came a "trade edition," followed by Prior (1837), and Cunningham (1854–5). The fullest modern edition is that of Gibbs 'Bohn's Standard Library' (5 vols., 1885–6). There are editions of the poems by Mitford 'Aldine series' (1831–95); Bolton Corney (1845), and in the 'Temple Library' (1889). A reprint of Marteilhe's 'Memoirs' was published in 1895, and a fac-simile reprint of the first edition of the 'Vicar of Wakefield' with a bibliography in 1885. Consult also Boswell's 'Johnson;' Macaulay, 'Encyclopædia Britannica;' Thackeray's 'English Humorists,' and 'Edinburgh Review,' 1846, by Lord Lytton.

Austin Dobson,
Author of 'Life of Goldsmith,' etc.

Goldsmith Beetle, an attractive northern dung-beetle (family *Scarabaeidæ*) measuring nearly an inch in length and shining like burnished gold. It is most abundant during May and June, flying principally at night; and, although it feeds on the foliage of various shade and fruit trees, seldom does much harm. The name is extended by entomologists to all scarabs of the sub family *Rutelinæ*.

Goldthread, a low smooth ranunculaceous herb (*Coptis trifolia*), closely related to hellebore, whose evergreen leaves are all basal, long-petioled, and divided into three serrate broadly obovate parts; and the flowers small and white on scapes. The root consists of long, bright, yellow, bitter threads. This plant contains a white alkaloid called coptine, and a tea made of it is tonic. It grows in boggy woods throughout all northern regions. See also Coptis.

Goldtit. See Verdin.

Goletta, gō-lĕt'tä, Africa, the port of the city of Tunis, from which it is 11 miles north. In the new quarter are the bey's palace, a large dock, and an arsenal defended by a battery. Pop. about 3,000.

Golf, anciently known as Goff, Gouff, or Gowff, a game of Dutch origin, but generally identified with Scotland, where as early as 1457 the local Parliament inveighed against its abuse, and whence it has become popularized throughout the English-speaking world. The word, derived from the German *Kolbe*, in Dutch *Kolf*, signifies a club. *Kolf*, resembling golf, is a very ancient pastime in Holland and Belgium, where it is usually played on the ice.

The modern game of golf is played with clubs and balls on specially prepared courses called *links*, generally laid out on open suitable grounds. The simplicity of the game is attractive to beginners, but with a little experience the beginner learns how necessary are practice, skill, and judgment to make one play well enough to be classed as a good golf player. The prime necessity is plenty of room. The ground best suited for the purpose is a reach of undulating country with a sandy soil, short, crisp turf, and plenty of holes or ruts, the latter forming the *hazards* — natural obstacles — or *bunkers* — artificial obstacles — necessary to prevent the game from being too easy. The *links* should not be less than three miles round nor more than five. Throughout it are distributed 18 artificial holes at any distance from 100 to 500 yards apart. The holes are 4½ inches in diameter, and each is surrounded with a *putting green*, a space 60 feet square and made as smooth as possible to enable the player to aim with accuracy. The other requisites are two small balls about two inches in diameter and made of gutta-percha, and a number of *clubs* adapted to the various contingencies likely to arise.

There are two styles of clubs, the wood and the iron; these consist of a long wooden handle, preferably of hickory, securely attached to a head of beech wood, or of steel as the case may be. Altogether there are 19 shapes of clubs, but six are usually sufficient for a player's needs. The different clubs are used under different circumstances; for example, the chief wooden-headed clubs are the *driver* and the *brassy*, the first being used for driving the ball a long distance, and the latter, which is shod with brass, being employed in special situations, as when the ball is in a hollow. The club called the *putter*, used when the ball is near the hole, has the head either of wood or of iron. The iron-headed clubs are the *cleek*, the *iron*, the *mashie*, and the *niblick*, all adapted for special purposes. The clubs are used for driving the balls into the holes, and the object of the player is to get his ball into all the holes successively with the fewest possible strokes. When played by two persons the game is called *singles;* when played by four persons in pairs, it is called *foursomes.* There are two chief methods of playing the game, known as *match play* and *medal play*. In the former, two players are usually pitted against each other. Attended by their *caddies*, boys carrying the bags containing the clubs, the players start from the *teeing* ground where one of them begins the match by placing his ball on a small heap of sand, or on an artificial rubber cone, known as a *tee*, and driving it as near as possible to the first hole. A good driving stroke from a tee would be 200 yards. The record, made at St. Andrews, Scotland, is 280 yards. The other player does the same with his ball, after which the player whose ball is farthest from the hole plays again. They continue thus until both balls have been holed. The player who takes the fewest strokes to do this is said to win the hole and counts one, and if both have taken the same number of strokes the hole is *halved* and neither counts. Having *holed* his ball the player takes it out, *tees* it again, and starts out for the next hole. Much of the interest of the game depends on the skilful play required to avoid the *hazards* and *bunkers* scattered over the course, or to get one's ball out when it lands in a difficult spot. In *medal play* the winner is the player who goes the round of the course in the fewest possible strokes irrespective of whether he had a majority of holes or not. Various modifications of these two modes of scoring are in use. A hole match may be won before the round is completed, as, for instance, when one competitor is four holes ahead with only three still to be played. When one player has a lead equal to the number of holes still unplayed, he is said to be *dormy* that number of holes; thus, a player when *dormy three* has a lead of three after playing the fourth last hole, in which case, though he may not win, he cannot lose. The central authority on the game in America regulating the various championships, etc., is the United States Golf Association organized 22 Dec. 1894, with which is now affiliated over 200 clubs throughout the country. Consult: Clark, 'Golf: A Royal and Ancient Game' (1899); Travis, 'Practical Golf' (1901); Richards, 'Royal Game of Golf' (1902).

Go'liad, Texas, city, county-seat of Goliad County; on the San Antonio River, and the Southern Pacific R.R., about 45 miles from the Gulf and 168 miles southwest of Galveston. Goliad gets its name from Hidalgo (q.v.), the patriot priest of Dolores, who in 1810 led the revolution in Mexico against Spain. When Goliad was founded the people did not dare to name it Hidalgo, so dropping the silent H and transposing the letters, they made the word Goliad. This place was the last site of the ancient mission of La Bahia del Espiritu Santo (1749). This mission was first founded at the place where La Salle built Fort Saint Louis in 1685. Goliad was the scene of a bloody contest (1812) between the so-called "Republican Army of the North," under Magee and Gutierrez, and the Mexicans. Here Magee died, evidently assassinated. In the Texas revolution (1835) Goliad was a point of strategical importance to the Texans. It was captured by Ben Milan and Collingsworth and became the base of military operations. The independence of Texas was declared here 20 Dec. 1835. Ira Ingram and Philip Dimmit were the leaders in formulating this declaration, and at the meeting there were 92 soldiers and all the citizens of the town. The official declaration of independence was made at Old Washington 2 March 1836. In Goliad, on Palm Sunday, 27 March 1836, the Mexican commander, Urrea, caused to be slaughtered 300 unarmed men who had surrendered, Fannin (q.v.) and his command. These defenseless men had been promised life and liberty before being marched out in squads and shot down like dogs. Urrea claimed he acted under orders from Santa Anna (q.v.). Afterward a rallying cry of the Texas troops under Sam Houston was "Remember Goliad." In 1902 Goliad was visited by a disastrous cyclone which swept away almost the whole town. Pop. 2,000.

Goliardery, gō'lĭ-är-dėr-ĭ, the name given to the *Carmina Burana*, a series of satirical Latin poems of the 13th century. They were the productions of the self-styled Goliardi, mediæval wandering students, disciples of the mythical Golias. While attacking the abuses and vices of the period, especially those existing in the Church, they glorified also the love of nature, women, and wine. This naturally antagonized the ecclesiastical mind which was prone to exaggerate into grave sins what ordinary men would consider as mere peccadilloes. From a classical standpoint the majority of the songs are generally below criticism; from a moral point of view, many of them are vigorous and healthful, and are popular among German students of the present day. Consult: Schmeller, 'Carmina Burana' (1894); Symonds, 'Wine, Women, and Song' (1884).

Goli'ath Beetle, one of the huge scarabe beetles of the cetonian genus *Goliathus*, distinguished by their large size, the horny processes on the head of the male, and the teeth-bearing lower-jaws. The name specifically belongs to *G. giganteus* of the Gold Coast, which is four inches long, and is chalky-white broadly and variously marked with black. It feeds almost entirely on the sap of trees. Compare HERCULES BEETLE.

Golomyn'ka, or **Oil-fish**, a goby-like fish (*Comephorus baikalensis*) found only in Lake Baikal, about a foot long, destitute of scales, and very soft, its whole substance abounding in oil, which is obtained from it by pressure. It is never eaten.

Golosh'es (Fr. *galoche*, "a patten, clog, or wooden shoe") (1) a kind of wooden clog, with a joint at the instep and upper leathers like those of very low shoes, worn in the Middle Ages. (2) India-rubber overshoes first manufactured in the United States and introduced into Great Britain about 1847. The term is now restricted to the latter meaning, and is used mostly in England, very rarely in the United States. See INDIA-RUBBER; RUBBER MANUFACTURES.

Go'marists, the ultra Calvinistic party in the Dutch National Church, so called from their leader, Francis Gomar (q.v.).

Gomez, gō'mēs, **Antonio Carlos**, Brazilian composer: b. Campinas 11 July 1839; d. Pará September 1896. He was a pupil at the Milan Conservatory, and had his first opera, 'A noite do castello,' presented at Rio de Janeiro in 1861. His 'Se sa minga' gained notable success at La Scala, Milan, in 1867, and was followed by a series of varying merit, including: 'Guarany' (1870); 'Salvator Rosa' (1874); and 'Lo Schiavo' (1889). He wrote the hymn 'Il saluto del Brasile' for the Centennial Exhibition at Philadelphia (1876), and a cantata, 'Colombo,' for the Columbian Exposition (1893). He was director of the Conservatory of Music at Pará, Brazil, 1895–6.

Gomez, Estevan, ēs'tā-vän, Portuguese navigator: b. about 1474; d. about 1530. He became an expert pilot in the Portuguese East Indian fleet, sailed in 1519 on Magellan's voyage as pilot of the Trinidad and was later transferred to the San Antonio, on board which he contrived a successful mutiny and then sailed for Spain. There he was imprisoned, but in a short time set free. It appears that in 1524–5 he was sent by Charles V. to explore the eastern coast of what is now the United States and discover a northern route to the Orient. A map executed in 1529 by Diego Ribeira, a cosmographer, marks the territory included between the present States of Rhode Island and New Jersey, Tierra de Gomez.

Gomez y Baez, ē bä'ēs, **Maximo**, Cuban soldier: b. Bani, Santo Domingo, 1831; d. Havana, Cuba, 17 June 1905. When Santo Domingo revolted against Spain he served as lieutenant of cavalry in the Spanish army; and when the freedom of the island was declared he went with the Spanish army to Cuba, but left the army because Gen. Villar maltreated some Cuban refugees. In 1868 he joined the Cuban insurrection, and through his ability and daring soon rose to a position of prominence, being in several successful engagements; though deprived of his command at one time, he was soon recalled, and rose to be major-general. On the failure of the rebellion, he left Cuba and settled on his farm in Santo Domingo. Returning to Cuba, he was influential in bringing about the insurrection of 1895–8, and was made commander-in-chief of the Cuban army. His policy was to avoid open engagements and to drive the Spaniards out by devastating the island and constant harrassing of their troops. When the American landed in Cuba (1898) he willingly co-operated with them. On 24 Feb. 1899 he marched into Havana at the head of his soldiers and was received by the United States authorities. In March of the same year he was deposed from his command by the Cuban Assembly on account of his accepting $3,000,000 for his army from the United States. He assisted the American governor-general in his work in the island, and was at one time suggested as a candidate for the presidency of the Cuban republic.

Gomez-Ferias, fā-rē'äs, **Valentin**, Mexican statesman: b. Guadalajara 14 Feb. 1781; d. Mexico City July 1858. He studied in the University of Guadalajara, was appointed a professor there in 1810, was a liberal member of the first constituent congress, was elected vice-president with Santa Anna, and in consequence of the latter's absence, assumed executive powers 1 April 1833. His administration was strongly opposed by the Clerical party; in 1835 a constitutional congress refused to acknowledge his authority, and he was exiled. He returned in 1838; in 1840 led an unsuccessful revolt, and again was banished. Having returned in 1845, he was elected vice-president in 1846; later a deputy to Congress, and was appointed postmaster-general under Alvarez.

Gompers, Samuel, American labor leader: b. London, England, 27 Jan. 1850. A cigar-maker by trade, he has been known as a zealous worker in the cause of the rights of labor, since his boyhood. He has been active in efforts to organize the working people, and was one of the founders of the American Federation of Labor, of which he is president. He has exerted much influence and has put forth various pamphlets on the labor question and the labor movement in general.

Gomuto, gō-moo'tō, a name in the East Indies for the stiff, strong fibre obtained from the leaves of the sugar-palm or areng (*Arenga saccharifera*) and hence often applied to the tree itself. This fibre, also called "ejow," is extensively used for ropes on account of its extraordinary strength and durability. At the base of the older leaves grows a woolly material called "baru," useful as stuffing for cushions, calking seams, and similar purposes. See PALM; SAGO.

Gonaives, gō-nä-ēv', Hayti, town on the west coast on the bay of the same name, 65 miles north-northwest of Port au Prince. It has an excellent harbor, a naval and military hospital, and a mineral spring. The exports are cotton, coffee, salt, and mahogany. Pop. 18,000.

Gonas. See HOTTENTOTS.

Goncourt, de, dė gôṅ-koor, EDMOND LOUIS ANTOINE HUOT: b. Nancy 26 May 1822; d. 16 July 1896; and JULES ALFRED HUOT DE: b. Paris 17 Dec. 1830; d. Auteuil 20 June 1870; French novelists. The Goncourt brothers were not men of letters but artists primarily, and in 1849 they set out, knapsack on back, to traverse France for drawings and water-colors. Their note-books made them writers as well as artists, and already in 1852 they had commenced that literary partnership which continued nearly 20 years. Their earliest serious works were a group of historical studies upon the second half of the 18th century, intended to be an effective resurrection of its habits of life, manners, and costume, which, though elaborate in detail lacked calm and impartial historical sense, breadth of view, and creative grasp of character. These books were: 'Histoire de la Société Française pendant la Révolution' (1854), 'La Société Française pendant le Directoire' (1855); 'Portraits intimes du XVIII. Siècle' (1856–8); 'Histoire de Marie Antoinette' (1858); 'Les Maitresses de Louis XV.' (1860), 'La Femme au XVIII. Siècle' (1862), and 'L'Amour au XVIII. Siècle' (1875); 'Gavarni' (1873), and 'L'Art au XVIII. Siècle' (1874). The more important work of the De Goncourt brothers was their novel writing; their conception of the novel was that it should be an imaginative attempt to grasp and summarize the results of close observation; their aim was to paint manners by taking the traits in which one man resembles a class; hence they select as generic types only persons of moderate faculties. Their novels include: 'Les Hommes de Lettres' (1860), republished in 1869 under the title 'Charles Demailly'; 'Sœur Philomène' (1861); 'Renée Mauperin' (1864); 'Germinie Lacerteux' (1865); 'Manette Salomon' (1867); and 'Madame Gervaisais.' After the death of his brother, Edmond wrote the 'La fille Elisa' (1878), a novel; 'L'Œuvre de Watteau' (1876); 'L'Œuvre de Prudhon' (1877); and 'La Maison d'un Artiste' (1881). Consult: Bellock and Shedlock, 'Edmond and Jules de Goncourt.'

Gon'dola, a long narrow boat used on the canals of Venice. The middle-sized gondolas are upward of 30 feet long and 4 to 5 feet broad; they always terminate at each end in a sharp point, which is raised perpendicularly to the ordinary height of a man. They have a well-furnished cabin amidship. They are propelled by rowing; the oarsman or gondolier stands in the stern facing forward; sometimes there are two gondoliers, the second one standing in the bow. They are usually painted black in accordance with an old law of the Venetian republic, which prescribed that all gondolas should be black, except those of the doge and the foreign ambassadors. The gondolas were until recently the only means of getting about the city; now steam-launches, acting as omnibuses, are also used.

Gonds, an aboriginal race of British India, a remnant of the Dravidians who were driven out of the plains by an early Aryan invasion. They took refuge in Gondawana, a territory pretty well identical with what are now called the Central Provinces. Here their seat was the Satpura plateau, between the rivers Pain Ganga, Pranhita and Godavari on the west and the Indravati on the east, while they were bordered on the north by the river Nerbudda. They still retain their dominion in the mountain forests of Orissa. Since 1781 they have become subjects of England, and their speech and religion have more and more conformed to those of the Hindu. Their language, known as Gondi, is a Dravidic branch of the Dekhan language. The contact with British civilization has not influenced them much in their highland lurking places. Their religion consists in a worship of many spirits, and they are enslaved to their priests. They have distinct physical characteristics which differentiate them from the Hindus. They are swarthy, almost black in complexion; their hair is long and black, though sometimes it is of a ruddy tinge. In countenance they have a broad forehead, and small, deep-set eyes. They wear little clothing. One of their clans, the Moria, tattoo their faces, and shave their heads. They do not like agriculture, but are much in demand as builders and roadmakers. According to the census of 1891 the total number of Gondi-speaking people in British India is 1,380,000, the majority of whom are found in the Central Provinces, the remainder being scattered through Bera and Hyderabad. Consult: Forsyth, 'Highlands of Central India' (1889); Dalton, 'Descriptive Ethnology of Bengal' (1872); Risley, 'Tribes and Castes of Bengal' (1892); Williamson, 'Gondi Grammar and Vocabulary.'

Gon'falon, an ensign or standard which used to be borne by the chief magistrates of many Italian cities, as Florence and Lucca. These magistrates were hence called gonfaloniers. The title of gonfalonier was also sometimes bestowed by the Roman Catholic Church on persons of distinction, who were called gonfaloniers of the Church.

Gong, an instrument of Chinese origin, made of a mixture of metals and shaped into a basin-like form, flat and large, with a rim a few inches deep. The sound of the gong is produced by striking it, while hung by the rim, with a mallet, which puts the metal into a state of vibration, and produces a loud piercing sound. The modern gong or gong-bell is sounded by striking it with a hammer operated by machinery.

Góngora, Luis de Góngora y Argote, loo-ēs' dā gōn'gō-rä ē är-gō'tā gōn'gō-rä, Spanish lyric poet: b. Cordova, 11 July 1561; d. there 23 May 1627. About 1614 he entered the Church, and became a prebendary of the cathedral at Cordova, and eventually chaplain to Philip III. Góngora's earlier writings — sonnets on a great variety of subjects, lyrical poems, odes, ballads, and songs for the guitar — are inspired with much true poetic feeling. His later works, consisting for the most part of longer poems, such as 'Solidades' (or Solitary Musings), 'Polifemo,' 'Pyramo y Thisbe,' are executed in an entirely different and novel style, characterized especially in respect of diction, by some of the same distinctive features as are found in Euphuism in England and Chiabrerism in Italy. This later style of Góngora, which his followers and imitators designated the *stilo culto,* is florid, pedantic, full of Latin inversions and mythological allusions, pompous, and mannered, and in many places very obscure. His works were never published during his lifetime. The first edition was printed by his friend, Vicuña, in 1627. See Churton, 'Góngora' (1862).

Goniatites, go"nĭ-a-tī'tēz, a group of ammonites (q.v.), including the earliest forms characterized by the structure of the septa, which are lobed, but without lateral denticulations, as in the higher ammonites; they consequently exhibit, in a section, a continuous undulating line. Some forms with slightly waved septa approach very near to the Nautilus. The siphonal portion is shorter than the sides, forming a sinus at the back, as in the Nautilus. The last chamber, the one tenanted by the animal, occupies a whole whorl, and has besides a considerable lateral expansion. The shells are small, seldom exceeding six inches in diameter. This genus is confined to the Palæozoic strata.

Goniom'eter, a device for measuring the angles of crystals. The application goniometer may be likened to a protractor with a rotary radius. It is a semicircle hinged at 90°, to which are attached two arms of steel which are directly applied to the crystal whose angles are to be measured. Far more accurate is the reflecting goniometer, consisting of a graduated circle mounted either vertically or horizontally upon a stand with an apparatus for adjusting the crystal, and one or two telescopes; it determines through what angular space the crystal must be turned that two rays of light reflected in turn from two surfaces shall have the same direction.

ननioph'olis, a primitive crocodile of the Jurassic Period. It is distinguished from modern crocodiles by several features, especially by the bi-concave vertebræ and the arrangement of the bony plates on the back. It once inhabited the Jurassic swamps and river-deltas in Europe and America, along with dinosaurs, turtles, etc. A complete skeleton is now exhibited in the Brussels Museum.

Gonorrhœa is perhaps the most universal and widespread of all diseases that affect the human race. Competent authorities have computed that fully three fourths of the adult male population and from one sixth to one third of the adult female population have contracted this disorder. The great majority of women who have gonorrhœa are reputable married women who have been infected by their husbands. Material as well as moral and sanitary conditions modify venereal morbidity. It is much greater in large centres of population than in suburban and rural communities.

Definition.— Gonorrhœa may be defined as a specific inflammation peculiar to certain mucous membranes, attended with the production of a purulent discharge. This discharge has the property of exciting a similar inflammation when brought in contact with other mucous surfaces susceptible to its action. The urethral mucous membrane in the male and the mucous membrane of the urethra, vagina, and cervix in the female are ordinarily the seat of gonorrhœal inflammation. Almost all mucous surfaces of the body, particularly the conjunctival mucous membrane, are susceptible to the irritant action of gonorrhœal pus.

Cause.— The cause of gonorrhœa is a specific micro-organism termed the gonococcus, which was discovered by Neisser in 1879. Inflammation of the urethra may result from a multiplicity of causes, chemical, irritant, and others, but true gonorrhœal inflammation has as its unique etiological factor the gonococcus.

The Gonococcus.— This micro-organism is a diplococcus; in shape each individual of a pair resembles a coffee bean — flat or slightly concave on one side and rounded on the other, with their flat surfaces opposed. The two hemispheres are separated by such a narrow interval that it is only recognizable under a lens of high power. The diplococci are grouped in pairs, fours, and other multiples of two. Their growth occurs by fissure, at right angles to the central interspace. The gonococci are always grouped in irregularly shaped columns, and are never met with in chains or pairs, as certain other micro-organisms. The differential characteristic of the gonococci is, that they quickly take a stain of aniline dyes and are more rapidly bleached than other micro-organisms. They may occur both within and without the pus and epithelial cells. In acute cases they are very numerous, but have a tendency to grow fewer with the decline of the inflammatory process. They are characterized by a marked longevity, are susceptible of existing in a latent state for an indefinite period, and are capable of being revived and exalted in virulence by local irritation which causes congestion of the parts, or when transferred to virgin tissues in which they find conditions favorable for their germination and growth. Numerous cases are on record where the gonococcus has been found still conserving all its virulence, and susceptible of being provoked into new activity by a variety of irritant causes years after infection.

Within the past two or three decades, our knowledge of gonorrhœa has undergone most marked and revolutionary changes. The old conception of gonorrhœa was that of a purely local disease, confined to the mucous tract in which it had its habitual origin, trivial in character, of limited duration, and entailing no serious consequences to the individual, except from neglected complications. The occasional occurrence of rheumatism, or of ophthalmia, which was recognized by the older observers, was thought to be due to the development of a latent rheumatic diathesis, to sympathetic inflammation, or simple metastasis. The idiosyncrasy of the patient was thought to play an important role in their production.

Since the discovery of the gonococcus, new facts have been developed, showing that instead of being limited to the genito-urinary tract, the range of its morbid action is much more extensive, and not infrequently is radiated to important internal organs. As a result of modern investigations, it may be positively affirmed that the gonococcus is susceptible of being taken up by the blood-vessels and lymphatics, and that it may affect almost every organ of the body. Staining and culture experiments have demonstrated its presence not only in the ovaries, tubes, and peritoneal cavity, which it reaches through invasion of the intermediate mucous membrane, but also in the lining membrane of the brain and cord, of the heart, of the pleura, liver, spleen, kidneys, as well as the joints and tendinous sheaths.

The number, variety, and gravity of these systemic manifestations has led to the serious consideration of the question whether gonorrhœa is not to be classed as a constitutional affection. The cause or relation between these systemic affections and the gonococcus has been proven by the identification of the gonococcus in the lesions it has produced. These general effects have been also ascribed not simply to the pathogenetic action of the gonococci, but to their toxins and the presence of certain pyogenic microbes associated with the gonococcus.

Complications.— The more common complications of gonorrhœa are acute and chronic inflammation of the prostate and bladder and seminal ducts and vesicles, the cord and testes.

Gonorrhœal Arthritis.— One of the most important complications of gonorrhœa is seen in certain joint-affections, which are usually described under the term of gonorrhœal rheumatism. This complication usually occurs from the second to the third week of the disease, but may develop as early as the fifth or sixth day. Gonorrhœal arthritis manifests a remarkable affinity for the large articulations, as the knee and ankle joints, the hip and elbow. Only one joint may be involved, constituting what is termed mono-articular arthritis, or a number of joints may be involved, constituting poly-articular arthritis. In the latter case, different joints are more likely to be involved in succession, rather than simultaneously. As a result of the inflammation of the synovial membrane, which is particularly involved, there often occur serous, fibrinous, or purulent effusions. It is essentially a hydrarthrosis, and in most instances the disease is confined to the synovial membrane of the joint during the whole course of the affection. Gonorrhœal arthritis is usually chronic in duration, often lasting from two to three or for many months. In some cases it is chronic and practically indefinite. Anchylosis or immobility of the joint from rapid formation of adhesions is a not infrequent termination. Very often the tendinous sheaths, the bursæ and fascia may be involved.

Unfortunately the treatment of gonorrhœal rheumatism is extremely unsatisfactory. It does not seem to be susceptible to the curative action of remedies which are valuable in attacks of ordinary rheumatism. In quite a large proportion of cases there is more or less deformity or permanent disability.

Gonorrhœal Ophthalmia.— There is usually recognized a distinction between an ophthalmia which is due to a septic absorption, like gonorrhœal rheumatism, and that form of purulent conjunctivitis which is caused by direct transference of pus containing gonococci to the eye. The former never results from the direct inoculation of the contagious matter. Its symptoms are milder, and there are rarely changes which occasion adhesions or permanent injury to the sight. On the contrary, purulent conjunctivitis is due to the inoculation of the mucous membrane of the conjunctiva. The inflammatory process is characterized by greater intensity and rapidity of action, and not infrequently results in partial or complete loss of vision. Unless prompt and efficient treatment be at once instituted the cornea may rapidly ulcerate and slough, and prolapse of the contents of the globe of the eye may occur through the perforation. These changes are sometimes almost incredibly rapid, taking place in three or four days, exceptionally in 24 hours, and leading to complete destruction of vision. In the ophthalmia of the new-born, the eyes of the child are liable to be soiled with the uterine and vaginal liquids containing gonococci — one of the most frequent causes of blindness. It is estimated that from 10 to 20 per cent of all blindness is caused by gonococcic infection.

Gonorrhœa in Women.— Our knowledge of gonorrhœa in women is essentially a modern acquisition. Until within recent years it had never been the subject of serious and careful study. In the female the local and general effects of gonorrhœa are apt to be much more serious and permanent, owing to the extent and character of the structures exposed to infection. The greater extent of the genital tract permits a larger field for infection by direct continuity of tissue. The periodic vascular changes incident to the menstrual period, and the more pronounced modifications caused by pregnancy, exert a marked influence in accentuating the gravity of gonorrhœa in women. As a result of these changes gonococci, invading the uterine cavity and ascending along the tubes and ovaries to the peritoneal covering, produce peritonitis. Not only do these inflammatory changes imperil the life and health of the woman (which danger, in many instances, can only be averted by an operation involving the sacrifice of her reproductive organs), but they may absolutely extinguish her hope of children. Gonorrhœa is one of the most prolific causes of sterility. The inflammatory changes result in the blocking up of the channels of communication between the ovaries and the uterine receptacle of the ovum, thus preventing contact with the germinative spermatozoids. This mechanical obstacle to the passage of the ovum is, as a rule, permanent and irrelievable. It thus happens that the aptitude of the gonorrhœic woman for conception is often extinguished by the first pregnancy, the first child representing the sum total of her productive energy. In this connection, it may be said that one of the complications of gonorrhœa affecting the male (epididymitis) is a very frequent cause of sterility in men. Neisser believes that gonorrhœa in the male is responsible for 45 per cent of sterile marriages. The proportion of sterility due to the husband is variously estimated from 17 to 25 per cent, and almost the entire proportion of sterility in women is due to gonorrhœa communicated to her by her husband. The low birth-rate of married women is not, as is generally supposed, always voluntary, but it often proceeds from physical causes relating to the health or productive capacity of the married parties; it is not from choice, but from incapacity.

Gonorrhœa as a Social Danger.—Owing to its great frequency, the persistent vitality and virulence of its germs, even after apparent cure, and especially to the grave nature of the infection in women, and the serious menace to the health and even the life of the victim — to say nothing of its destructive effects upon the procreative functions — gonorrhœa is now regarded by the medical profession as one of the most formidable social plagues of our age. Every year in this country thousands of young, innocent women are infected by their husbands, who in most cases are not aware that they carry with them the germs of a disease destined to wreck the health or lives of their partners. Many such women drag out a miserable existence of semi-invalidism, subject to painful or difficult menstruation, no longer able to walk freely, condemned to pass their days of suffering in a reclining position; and after years, it may be, of this suffering, worn out and desperate, they apply to the surgeon, who, at the price of the sacrifice of their generative organs, renders their existence possible in making them castrated women.

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Gonsalvo de Cordova, gōn-säl'vō dė kŏr'-dō-vä (Sp. gōn-thä'lō dā kŏr'dō-bä), in full GONSALVO HERNANDEZ DE CORDOVA Y AGUILAR, Spanish warrior: b. Montilla, near Cordova, 1453; d. Granada, 2 Dec. 1515. At the court of Ferdinand and Isabella, Gonsalvo attracted much attention by his personal beauty, his knightly skill, and the magnificence of his apparel and style of living. In the war with Granada, 1481–92, he took many places by storm, and vanquished the boldest Moors who dared to meet him in single combat. He was selected to carry on the difficult and dangerous negotiations with the Moorish king Abu Abdallah (or Boabdil), which resulted in the capitulation of Granada and the termination of Moorish rule in Spain. He helped Ferdinand II., king of Naples, to drive the French over the Neapolitan frontiers, and in 1500 delivered Zante and Cephalonia from the Turks and restored them to Venice. In the war between France and Spain, for the sovereignty of Naples, Gonsalvo gained successive victories, until by the fall of Gaëta, the French were forced to yield their claim upon Naples. Ferdinand now bestowed upon him the duchy of Sessa, and appointed him viceroy of Naples, with unlimited powers, which post he held until 1507, when the jealousy of the king caused his removal.

Gontcharoff, gōn-chä-rōf, **Ivan Alevander,** Russian novelist: b. Semborsk 18 June 1813; d. St. Petersburg 27 Sept. 1891. He studied at the University of Moscow, obtained a post in the finance ministry in 1835; published his first book, 'A Common Story' in 1837; subsequently was appointed an official in the censor's department, and then, until his retirement in 1873, was editor of the *Northern Post,* a government newspaper. His 'Oblomov' (1858), "a personification of that generic apathy which was, and still is, the common product of the material and moral conditions of Russian life," is his best work. He wrote also 'The Precipice' (1868) and some sketches.

Gon'ville and Caius (kēz) **College,** a college of Cambridge University, England, was founded in 1348 by Edmund Gonville of Terrington, Norfolk, and endowed for a master and three fellows. The original site was between Free School Lane and the churchyard of St. Botolph's. In 1353 William Bateman, bishop of Norwich, Gonville's executor, established the college where the Gonville Court at present stands, and altered the name to the Hall of the Annunciation of Blessed Mary the Virgin. In 1558 Dr. Caius obtained the royal charter by which all the former foundations were confirmed and his own foundation was established. By this charter the college was thenceforth to be called Gonville and Caius College. New statutes were given by which the college is henceforth to consist of a master, 30 fellows, and 36 scholars. The fellowships are all open, and are not vacated by marriage, but terminate generally at the end of 10 years from the full standing of M.A. The scholarships are also open. There are also connected with this college four studentships in medicine, founded by Charles Tancred, and two Harrow scholarships.

Gonzaga, gōn-zä'gä, **Thomaz Antonio Costa de,** Brazilian poet; called the Portuguese Anacreon: b. Oporto, August 1744; d. Mozambique 1809. After studying in the university of Coimbra, Portugal, he returned in 1768 to Brazil to enter on an official career. In 1788 he was about to marry a young lady of distinguished beauty when he became involved in a political conspiracy. The court condemned him to perpetual exile in an island on the coast of eastern Africa, which by special favor was commuted to 10 years' banishment to Mozambique. He left Brazil in 1793, and was attacked by fever soon after reaching Africa, from which he recovered only to fall into madness from the effect of the climate. The most interesting of his poems were composed during his captivity, and celebrate in mournful and tender verse the object of his love under the name of Marilia. They are popular alike in Brazil and Portugal, and have been often reprinted. In grace, tenderness, purity of style, and harmony of verse, Gonzaga ranks among the first Portuguese poets.

Gonzaga Family, a noted Italian family which held the supremacy in Mantua 1328–1707. On 14 Aug. 1328 LUDOVICO (or LUIGI GONZAGA) assumed the sovereignty after his sons had driven out the Bonacorsi family and taken possession of Mantua. He died 1360, aged 93. Among his descendants, GIAN FRANCESCO GONZAGA, in 1432, obtained possession of the city, with its territory, under the title of a marquisate, as a fief from the Emperor Sigismund. With VINCENZO II., the reigning line became extinct in 1627. The next heir would have been the Duke of Nevers, but the Duke of Guastalla, Ferdinand II., one degree more remote, laid claim to the whole inheritance, and Charles Emmanuel, Duke of Savoy, claimed Montferrat. It was evident that the house of Nevers had a legal right, and France, Venice, and the Pope supported him. Spain and Austria, on the other hand, supported the groundless claims of the Duke of Savoy, whence arose a war concerning the Mantuan succession, which ended with the triumph of Charles, Duke of Nevers. His grandson, CHARLES III., succeeded him in 1637, and during his reign the principality obtained full independence. He died in 1665. Many persons of this family have obtained military renown. Others have been conspicuous for their love of the arts and sciences. CÆSAR, in 1565, erected the academy Degl'invaghiti; and others of the family founded galleries of paintings and antiquities. Giulio Romano, under their patronage, established an extensive school for painting, and many celebrated artists received from them support and honor.

Gonzalez, gōn-sä'lĕs, **Manuel**, Mexican soldier and statesman: b. near Matamoros 18 June 1833; d. Mexico City 8 May 1893. He entered the army in 1839 and fought under Juarez in 1861. In the war against the French he joined Escobedo in 1865 and was made a brigadier-general. Later he joined the party of Diaz and was secretary of war under him 1877–80, and followed him as president of the Mexican republic 1880–4. After his retirement he was governor of Guanajuato.

Goober, or **Gouber**. See PEANUT.

Gooch, SIR **Daniel**, English engineer: b. Bedlington, England, 24 Aug. 1816; d. Clewer Park, England, 15 Oct. 1889. Besides inventing various improvements in the building of locomotives, he was active in furthering the laying of the first transatlantic cable. He sat in Parliament 1865–85, and was connected with the Great Western Railway as a superintendent 1837–64.

Gooch, Frank Austin, American chemist: b. Watertown, Mass., 2 May 1852. He was educated at Harvard and was assistant in the chemical laboratory there, 1872–5. He was subsequently chemist on the Northern Transcontinental Survey and United States Geological Survey, 1878–86, and has been professor of chemistry at Yale from 1886.

Gooch, SIR **William Bart**, English colonial administrator: b. Yarmouth 21 Oct. 1681; d. London 17 Dec. 1751. He was a soldier of Marlborough in the Netherlands, and was governor of Virginia from 1727 to 1747. In 1740 he accompanied Vernon's expedition against Cartagena, and in 1749, after a generally excellent and successful administration, returned to England. During his term of office he opposed religious toleration to religious organizations other than the Establishment.

Good, James Isaac, American (German) Reformed clergyman: b. York, Pa., 31 Dec. 1850. He was graduated from Lafayette College, Easton, Pa., in 1872; entered the Reformed ministry and has been successively pastor of Heidelberg Reformed Church, York, Pa., 1875–7; Heidelberg Reformed Church, Philadelphia, 1877–90; and Calvary Reformed Church, Reading, Pa., 1890–3. Since the last named year he has been professor of dogmatics at Ursinus College. He has published: 'Origin of the Reformed Church of Germany' (1887); 'Rambles Round Reformed Lands' (1889); 'History of the Reformed Church in the United States.'

Good, John Mason, English physician and author: b. Epping, Essex, 25 May 1764; d. Shepperton, Middlesex, 2 Jan. 1827. In 1793 he removed to London, where he carried on business for several years as a surgeon and apothecary, and after 1820 practised as a physician. His principal works are: 'Memoirs of the Life and Writings of Dr. Alexander Geddes' (1803); Translations of Solomon's Song and the Book of Job; a translation of Lucretius 'On the Nature of Things' (1805); 'Medical Technology' (1810); 'A Physiological System of Nosology' (1817); 'The Study of Medicine' (1822); and 'The Book of Nature' (1826).

Good Friday, the name applied by the Church of England to the Friday before Easter, sacred as commemorating the crucifixion of our Lord; the Great and Holy Parasceve is the Greek title of it, and it is called in the Roman Missal the Parasceve. This day was kept as a day of mourning, of rigid fast, and of special prayer from a very early period. Eusebius (260 A.D.) says that the day had been observed long before his time. Constantine ordered a cessation from all labor on that day. It was one of the two paschal days celebrated by the Christian Church, and in memory of the crucifixion was called by the Greeks Pascha Staurosimon or the "Pasch of the Cross." In the Roman Catholic Church the service of this day consists of what is called the Mass of the Presanctified, the sacred host not being consecrated on Good Friday, but reserved from the preceding day. Communion is forbidden on Good Friday, except in the case of the celebrant and of sick persons.

The most striking part of the ceremonial is the so-called "adoration of the cross," or, as it was called in the Old English popular vocabulary, "creeping to the cross." The black covering is removed from a large crucifix which is placed before the altar, and the entire congregation, commencing with the celebrant priest and his ministers, approach, and on their knees reverently kiss the figure of our crucified Lord. The very striking office of *Tenebræ* (darkness) is held on Good Friday, as well as on the preceding two days: it consists of the matins and lauds of the following day, and has this peculiarity, that by the close all the lights in the church have been gradually extinguished except one, which for a time (as a symbol of our Lord's death and burial) is hidden at the Epistle corner of the altar.

In the Church of England, and in the Protestant Episcopal Church of the United States, as well as in the Roman Catholic Church, Good Friday is celebrated with special solemnity: proper psalms are appointed, and one of the three special collects is a prayer for "all Jews, Turks, infidels, and heretics." In some churches of the English Church, and of the Protestant Episcopal Church, the *improperia*, or reproaches, adopted from the Roman service, are sung; and Bach's passion music is frequently heard. In England and Ireland Good Friday is by law a *dies non*, and all business is suspended; but this is not the case in Scotland or the United States. In Scotland the day till recently met with no peculiar attention, except from members of the Episcopal and Roman Catholic communions; but of late years there have been services in some Presbyterian churches in the larger towns.

A German savant, Prof. Hans Achelis of Königsberg, has decided on the basis of exact calculations made by the Royal Astronomical Society of Berlin that the date of the Crucifixion was 6 April 30 A.D.

Good Hope, Cape of. See CAPE OF GOOD HOPE.

Good Templars, a temperance society which combines the principles of teetotalism with certain mystic rites, imitated less or more from freemasonry, having secret signs, pass-words, and insignia peculiar to itself. It originated in Utica, N. Y., where it was organized by Daniel Cady and others, in 1851, and extended to England in 1868. There is no restriction placed on membership on account of color, age, or sex. The organization consists of local "subordinate" lodges, county "district" lodges, national "grand" lodges, and an international "right worthy" grand lodge. A "juvenile order" is also attached, and the Templars have founded an orphanage at Sunbury, near London, at a cost of $50,000. It has no beneficiary system. Its platform consists of total abstinence from all intoxicating liquors as a beverage, no license, but prohibition of manufacture and sale, and the election of men who will enforce the liquor laws. The motto of the order is "Faith, Hope, and Charity." It is an outgrowth of the Sons of Temperance.

Good-will, the benefit derived from a business beyond the mere value of the capital, stock, funds, or property employed in it, in consequence of the general public patronage and encouragement which it receives from constant and habitual customers. It is legally considered a subject of sale along with the stock, premises, fixtures, trade debts, etc. It is usual for the seller to enter into an express covenant not to carry on a business of the same kind at some specified moderate distance from the place where the purchaser resides, and if he breaks the covenant he is liable to an action for damages. In most of the States of the Union the purchaser of good-will can only cut the seller off from soliciting old customers of the business surrendered and from otherwise attempting to supplant the new tenant in popular favor, by securing a written contract.

Good'ale, Dora Read, American poet: b. Mount Washington, Berkshire County, Mass., 29 Oct. 1866. With her older sister, Elaine Goodale (q.v.), she began to write verse in early childhood. Her poems, and those of her sister, appeared in magazines at that time and attracted much favorable notice. With her sister she published: 'Apple Blossoms' (1878); 'In Berkshire with the Wild Flowers' (1879); 'All Round the Year' (1880). She has also published 'Heralds of Easter' (1887).

Goodale, Elaine (Mrs. Eastman), American poet: b. Mount Washington, Mass., 9 Oct. 1863. In June 1891, she was married to Charles A. Eastman, M.D., an educated Sioux Indian. At an early age she began to write verse and with her sister Dora (q.v.) published: 'Apple Blossoms: Verses of Two Children' (1878); 'In Berkshire with the Wild Flowers' (1879); 'Verses From Sky Farm' (1880). She was sole author of 'Journal of a Farmer's Daughter' (1881). She taught for some time in the Hampton Institute in Virginia, and edited the 'Southern Workman' (1883). In 1885 she visited the Great Sioux reservation, and subsequently taught school at White River Camp, Lower Brulé Agency, Dakota.

Goodale, George Lincoln, American botanist: b. Saco, Me., 3 Aug. 1839. He was graduated from Amherst College in 1860 and has been instructor and professor of botany at Harvard from 1872. He has published: 'Concerning a Few Common Plants' (1879); 'Physiological Botany' (1885); 'Wild Flowers of America' (1886); 'Useful Plants of the Future.'

Good'all, Edward, English line-engraver: b. Leeds 17 Sept. 1795; d. London 11 April 1870. He was self-taught, and early in his career attracted the notice of Turner, a number of whose pictures he engraved. He also engraved many plates for the annuals.

Goodall, Frederick, English painter: son of Edward Goodall (q.v.): b. London 17 Sept. 1822; d. London 29 July 1904. At 17 years of age he began to exhibit, and he has produced some pictures of high excellence. He was elected to the Royal Academy in 1863. Among important works of his are: 'Raising the Maypole in the Olden Time' (1851); 'Cranmer at the Traitors' Gate' (1856); 'The Subsiding of the Nile' (1873); 'Andromeda' (1887); 'The Thames from Windsor Castle' (1890); 'Isles of Loch Lomond' (1891); 'The Palm Grove' (1894).

Goode, George Brown, American naturalist: b. New Albany, Ind., 13 Feb. 1851; d. Washington, D. C., 6 Sept. 1896. He was graduated from Wesleyan University in 1870, and from 1887 was assistant secretary of the Smithsonian Institution. Among his publications are: 'Museums of the Future' (1890); 'American Fishes'; 'Nature and Economic History of the American Menhaden.'

Goode, Richard Urquhart, American geographer: b. Bedford, Va., 8 Dec. 1858; d. 1903. He studied at the Univ. of Virginia, was topographer to the United States Geological Survey in 1879–82, engineer and topographer of the Northern Transcontinental Survey in 1882–4, and in 1889 was appointed geographer of the United States Geological Survey. His writings include reports and articles in periodicals.

Goode, William Athelstane Murray, American newspaper correspondent: b. Newfoundland 10 June 1875. After service in the British merchant marine and the United States cavalry, he became assistant night city editor of the New York *Recorder*, later city editor of the *Mercury*, and finally correspondent of the Associated Press, of which he was representative on board the flagship New York during the Spanish-American war. He contributed to magazines and published 'With Sampson Through the War' (1899).

Goodell', Henry Hill, American educator: b. Constantinople, Turkey, 20 May 1839; d. at sea 23 April 1905. He was graduated from Amherst College in 1862; was in the Union army in 1862–3; professor in the Massachusetts Agricultural State College in 1867–86, and in 1886 became its president. For several years he was chairman of the Executive Committee of the Association of American Agricultural Colleges and experiment stations, and in that capacity did much to further the interests of agricultural education.

Goodell, William, American missionary: b. Templeton, Mass., 14 Feb. 1792; d. Philadelphia 18 Feb. 1867. He was graduated from Dartmouth College in 1817, and from the Andover Theological Seminary in 1820; was ordained to the Congregational ministry in 1822, and in the same year went to Syria as a missionary. In 1823 he assisted in the establishment of the mission-station at Beirut, in 1823–8 was active there, in 1828–31 at Malta, in 1831–65 at Constantinople. Among his most important works was the preparation of a translation of the Bible into Armeno-Turkish.

Goodell, William, American abolitionist: b. Coventry, N. Y., 1792; d. 1878. He was in business at different times in Providence, Alexandria, Va., and New York; in 1827 began at Providence the publication of the *Investigator,* and later was editor of a series of abolition periodicals, including the 'Friend of Man,' official mouthpiece of the New York Anti-slavery Society; the 'Radical Abolitionist,' and the 'Principia.' His published volumes include: 'The Democracy of Christianity' (1851); 'Slavery and Anti-slavery' (1852); 'The American Slave Code' (1853).

Goodknight, James Lincoln, American educator: b. Allen County, Ky., 24 Aug. 1846. He was graduated from Cumberland University (Lebanon, Tenn.) in 1871, from the Union Theological Seminary in 1879, studied also at Edinburgh and Jena, and was president of West Virginia University (Morgantown). From 1900 to 1904 he was president of Lincoln (Ill.) University. His articles have appeared in various periodicals.

Good'land, Kansas, county-seat of Sherman County; on the Chicago, R. I. & P. R.R. The manufactures are flour and machinery. The city contains railroad repair-shops and grain elevators, and is the centre of trade for a large agricultural region in which there are a number of cattle ranches. Pop. (1900) 1,059.

Good'man, Edward John, English journalist and novelist: b. London 19 Dec. 1836. He entered journalism in 1857 and has served on the editorial staffs of several prominent English journals, including the London *Daily Telegraph.* Besides 'The Best Tour in Norway' (1891); 'Wilson's Handbook to Norway' (1894); and 'New Ground in Norway' (1896), he is the author of the novels 'Too Curious' (1887); 'Paid in His Own Coin' (1888); 'His Other Self' (1889); 'The Only Witness' (1891); 'The Fate of Herbert Wayne' (1892); 'The Night of the Fog' (1895).

Good'now, Frank Johnson, American legal scholar: b. Brooklyn, N. Y., 18 Jan. 1859. He was graduated from Amherst College in 1879, from the Columbia Law School in 1882, studied also at the Paris Ecole Libre des Sciences Politiques and Berlin University, and was appointed to the chair of administrative law at Columbia in 1883. A recognized authority on municipal, administrative, and constitutional law, he published: 'Municipal Home Rule' (1890); 'Comparative Administrative Law' (1893), 'Municipal Problems' (1897); 'Politics and Administration' (1900).

Good'rich, Alfred John, American writer on musical subjects: b. Chilo, Ohio, 1847. Largely self-taught, he was professor of musical theory in several institutions, and from 1899 directed his attention wholly to writing and private instruction. 'Music as a Language' (1880); 'Complete Musical Analysis' (1889); and 'Analytical Harmony' (1894) are among his books.

Goodrich, Charles Augustus, American Congregational clergyman: b. Ridgefield, Conn., 1790; d. Hartford, Conn., 4 Jan. 1862. He was graduated at Yale in 1812 and held pastorates of Congregational churches in Worcester, Mass., 1816–20, Berlin, Conn., 1820–48, and Hartford, Conn., from 1848. He published: 'Lives of the Singers' (1829); 'History of the United States' (1852–55); 'Universal Traveler,' etc. He was a brother of S. G. Goodrich (q.v.).

Goodrich, Chauncey Allen, American clergyman and lexicographer: b. New Haven, Conn., 23 Oct. 1790; d. there 25 Feb. 1860. He was graduated at Yale College in 1810, and was tutor there 1812–14. After a course of theological study he entered the ministry and was pastor of a Congregational church in Middletown, Conn., 1816–17; was elected professor of rhetoric and oratory in Yale 1817–39, and became professor of pastoral theology in the theological department of the college in 1839. While tutor he published in 1814 a Greek grammar, translated chiefly from the grammar of Hachenberg. This he subsequently revised and enlarged, and published under his own name. It was often reprinted, and for many years was extensively used. About 1832 he published 'Latin Lessons' and 'Greek Lessons,' in which the precepts of grammar are throughout accompanied by practical exercises — a method subsequently applied by Ollendorff to modern languages. In 1828 Noah Webster (his father-in-law) entrusted to him the superintendence of the octavo abridgment of his large dictionary, by J. E. Worcester, with discretionary power to conform the orthography more nearly to the common standard. After several years of labor, he published in 1847 greatly enlarged and improved editions of the 4to and 8vo dictionaries of Dr. Webster. In 1856 he published in 8vo the university edition of Webster's dictionary, and in 1859 a new issue of the unabridged 4to dictionary.

Goodrich, Frank Boot («Dick Tinto»), American writer: b. Boston, Mass., 14 Dec. 1826; d. Morristown, N. J., 1894. He first became known by his Paris letters to the New York *Times.* He was the author of: 'Court of Napoleon: or, Society Under the First Empire' (1857); 'Women of Beauty and Heroism' (1859); 'World-Famous Women, from Semiramis to Eugénie' (1870); etc.

Goodrich, Samuel Griswold («Peter Parley»), American writer: b. Ridgefield, Conn., 19 Aug. 1793; d. New York, 9 May 1860. He began as a publisher in Hartford, and established himself in 1824 as a publisher in Boston. He edited there, from 1828 to 1842, 'The Token,' an annual to which he contributed several tales and poems, and in which also appeared some of Hawthorne's 'Twice-Told Tales.' His famous Peter Parley series of popular and juvenile books was begun soon after his removal to Boston, and gradually extended to more than 116 volumes, comprising geographies, histories, travels, stories, and various illustrations of the arts and sciences. The geniality of these, and the admirable manner in which the author enlisted the sympathies of children, procured for them an immense success, which led to the issue in England of some spurious books under the name of «Peter Parley.» In 1837 he published a collection entitled 'The Outcast, and

Other Poems'; and in 1838 an ethical and educational work entitled 'Fireside Education.' In 1841 appeared a selection from his various contributions to annuals and magazines under the name of 'Sketches from a Student's Window'; and in 1857 'Recollections of a Lifetime,' a most entertaining account of his own history and that of his contemporaries. 'Merry's Museum' and 'Parley's Magazine' were conducted by him from 1841 to 1854. Under Fillmore's presidency he acted as American consul at Paris, and published there in French a treatise on 'American Geography and History.' The last work from his pen was the 'Illustrated Natural History of the Animal Kingdom' (1859).

Good'sell, Daniel Ayres, American Methodist bishop: b. Newburg, N. Y., 5 Nov. 1840. Graduated from New York University (then the University of the City of New York) in 1859; he entered the Methodist ministry in the same year; in 1880–8 was literary editor of the 'Christian Advocate' of New York, and in 1888 was elected bishop and became secretary of the Methodist board of education. He wrote 'Nature and Character at Granite Bay' (1901).

Goodwin, J. Cheever, American dramatist: b. Boston 14 July 1850. He was graduated from Harvard in 1873, was a reporter on the Boston *Traveller* in 1873–4, and secretary to the comptroller of New York in 1886–91. His writings include verse in periodicals and many plays, among them some popular successes, such as 'Evangeline,' 'The Panjandrum,' 'Wang,' 'The Lion Tamer,' 'Lost, Strayed, or Stolen,' and 'The Monks of Malabar.'

Goodwin, Maud Wilder, American historiical novelist: b. 1856. She has published: 'The Colonial Cavalier'; 'The Head of a Hundred'; 'White Aprons: An Historical Romance'; 'Dolly Madison,' a biography; 'Historic New York' (1898); 'Sir Christopher'; 'Flint'; etc.

Goodwin, Nathaniel Carl, American actor: b. Boston 1857. His first appearance was made in 'Law in New York,' at the Howard Athenæum, Boston, and subsequently he became known in burlesque and light comedy. Among the dramas which he has since presented are: 'A Gilded Fool'; 'In Mizzoura'; 'An American Citizen'; his chief success, 'Nathan Hale'; and 'The Altar of Friendship.' He also essayed "Shylock" in Shakespeare's 'Merchant of Venice.'

Goodwin, William Watson, American Greek scholar: b. Concord, Mass., 9 May 1831. He was graduated at Harvard College in 1851; and was Eliot professor of Greek there 1860–1901. He published: 'Syntax of the Moods and Tenses of the Greek Verb'; 'Greek Grammar'; and a revised translation of 'Plutarch's Morals' (1871).

Good'y, a local name in the Southern States for a small bay fish (*Leiostomus xanthurus*), much liked as a pan-fish, and known also as "lafayette" and about New York as "spot." It is one of the family *Sciænidæ* (see DRUM-FISH), has a deep, compressed body, bluish above and silvery below, with "about 15 narrow, dark, wavy bands extending from the dorsal downward and forward to below lateral line; a round black humeral spot rather smaller than the eye." It abounds from Cape Cod to Texas.

Good'year, Charles, American inventor: b. New Haven, Conn., 29 Dec. 1800; d. New York 1 July 1860. After coming of age, he joined his father in the hardware business at Philadelphia. Among the improved implements introduced by them was the steel pitchfork, a substitute for the heavy iron fork previously used. The firm being overwhelmed by the commercial disasters of 1830, Goodyear selected as a new occupation the improvement of the manufacture of India rubber. The first important improvement made by him was at New York in 1836, being a method of treating the surface of native India rubber by dipping it into a preparation of nitric acid. This discovery enabled the manufacturer to expose an India rubber surface in his goods, which on account of adhesiveness was before impracticable. The nitric acid gas process, as it was called, was introduced into public use, and met with great favor, especially in the manufacture of shoes, which continued to be made by that process in great numbers at Providence, R. I., until it was superseded by the invention of vulcanized rubber, for which he obtained a patent in 1844. From this period he employed himself in ascertaining new methods of employing rubber till the patents granted him were 60 in number. He received medals from the Exhibitions at London (1851) and Paris (1855), but his rights were continually infringed, and he remained poor while others were enriched by his inventions.

Goodyear, William Henry, American writer on art: b. New Haven, Conn., 21 April 1846. He was appointed curator of the New York Metropolitan Museum of Art in 1881. He has published: 'Ancient and Modern History' (1883); 'History of Art' (1887); 'The Grammar of the Lotus' (1890); 'Roman and Mediæval Art' (1893); 'Renaissance and Modern Art' (1894); etc.

Goo'kin, Daniel, American author and official: b. Kent, England, about 1612; d. Cambridge, Mass., 19 March 1687. He came with his father to Virginia in 1621, whence he removed in 1644 to Massachusetts, in consequence of his sympathy with the doctrines of the Puritans. He settled in Cambridge, was soon after appointed a captain of militia, and in 1656 became superintendent of all the Indians who had submitted to the government of Massachusetts, an office which he held till his death. He protected the fugitive regicides in 1661, was appointed one of the two licensers of the Cambridge printing press in the following year, became unpopular during King Philip's war by the protection which, as a magistrate, he extended to the Indians, and in 1681 was made major-general of the colony. His 'Historical Collections of the Indians of Massachusetts' bears the date of 1674, and was first published by the Massachusetts Historical Society in 1792. He is said to have written also a history of New England, of which no manuscript has been found.

Goorkhas, goor'kaz. See GHURKAS.

Goosan'der. See MERGANSER.

Goose. See GEESE.

Goose-barnacle. See BARNACLE; BERNACLE-GOOSE.

Goose-fish, or Angler, a marine fish (*Lophius piscatorius*) of the order *Pediculati,* with an enormous head and mouth, no scales, and brightly colored fringes about the jaws, which serve as lures to attract within reach the small fishes on which it preys; the first three rays of the dorsal fin are separated from the others, and spring barbel-like from the top of the head, nodding in the water and attracting other small fishes,— hence the name "angler." Like all fishes of its order, the carpal bones are elongated to strengthen and widen the reach of the pectoral fins, by means of which the fish leaps after its prey. The angler is popularly supposed to catch geese and other swimming birds, whence its name. It reaches a length of four feet, but is useless, and the bane of fishermen. It is remarkable for its pinkish ribbon-like masses of eggs, a foot wide, 40 feet in length, which are not uncommon in summer floating at the surface of the ocean. The goose-fish occurs on both coasts of the North Atlantic and has other names, as "fishing-frog," and "all-mouth." Near relatives are the batfish and the frog-fishes.

Goose-grass, or Gosling-weed, two of the many names applied to a widely distributed troublesome weed (*Gallium aparine*). See BEDSTRAW; CLEAVERS.

Gooseberry, goos'- or gooz'bĕr-ĭ, various spiny shrubs of the genus *Ribes,* natural order *Saxifragaceæ* or *Grossulariaceæ,* mostly natives of the northern hemisphere, especially of North America; some species valued for their fruit (berries), others for their flowers. Of the half dozen species cultivated, the European gooseberry (*R. grossularia*), which appeared in gardens during the 16th century, has developed the largest number of varieties and attracted the widest interest. Its progeny furnish practically all the varieties exhibited at the annual gooseberry shows of England. The fruits of some of these varieties weigh more than an ounce, having been developed by selection and crossing from an original weight of about one quarter of an ounce. The varieties may be divided, like apples or pears, into culinary and dessert sorts. They have not proved generally successful in America, the climate being considered too dry for them. Of the American species, several of which bear finer fruits than the natural European species, *R. oxyacanthoides* is the only one that has produced widely cultivated varieties. It has also entered into many hybrids with the European species. These American varieties are all of the culinary class, or are used while too unripe to be palatable as dessert. The first one, Houghton, was introduced about 1835, and with its seedling, Bowning, still commands the market. In America attention has not been attracted to the gooseberry because the American people have not cultivated a taste for dessert gooseberries. Of the ornamental species, *R. speciosum* is cultivated for its nearly evergreen shining foliage and its fuchsia-like showy flowers. It is not hardy in the northern United States.

The gooseberry is one of the easiest fruits to propagate. Cuttings of mature wood are most frequently used, but layers and suckers are also employed. The plants thrive best upon rather heavy, moist soil, and generally fail upon light soils, especially if dry. They like partial shade and northern exposures. In the South they fail. The plants may be transplanted in spring or fall, about 5 feet apart each way, cultivated frequently until mid-summer, trained and pruned like the currant (q.v.), but somewhat more openly, kept free from fungous troubles by the use of a fungicide (q.v.) and of insects by the use of an insecticide (q.v.). The fungi most frequently found upon the plants are mildew (*Sphærotheca mors-uvæ*) and leaf spot (*Septoria ribis*). The former, which is a surface feeder, appears upon the green parts as a frost-like gray growth, which later becomes brown. Free circulation of air, good drainage and open training of the bushes helps to prevent attacks. Leaf spot produces brown spots upon the foliage, which may fall prematurely. Spraying early in the season is believed to be the only preventive. With few exceptions, the insects that attack the gooseberry also visit the currant (q.v.) and may be combated by the same remedies. Consult: Card, 'Bush Fruits' (New York 1898); Thory, 'Monographie ou Histoire Naturelle du Genre Grosseillier'; Bailey, 'Cyclopædia of American Horticulture' (1900–2).

Gooseberry Insects. See CURRANT-INSECTS.

Goosefoot, a family (*Chenopodiaceæ*) of annual or perennial herbs, rarely shrubs, with 75 to 80 genera and 550 to 600 species, of wide distribution. The typical genus (*Chenopodium*) contains about 60 species, 15 or 20 of which are native to North America, or have been naturalized, some of them almost ubiquitous weeds, such as the pigweed (*C. album*); the city goosefoot (*C. urbicum*), thriving in suburban lots and roadways; the sowbane (*C. murale*); the turnpike or feather-geranium or Jerusalem oak (*C. botrys*); the now world-wide Mexican tea (*C. ambrosiodes*); and the wormseed (*C. anthelminticum*), from which is brewed a homemade vermifuge. Other genera contain allied weeds, as the strawberry blite (*Blitum capitatum*); the large genus (*Atriplex*) of sea-side and salt-land weeds called oraches; the western white sage (*Eurotia lanata*), a gray-green, pubescent fodder plant of the western plains; the sea-blites (*Dondia*) and odd brittle glassworts of salt marshes; and the spiny greasewood and Russian thistle (qq.v.). See CHENOPODIUM.

Go'pher, a name given by the early French settlers in the United States to various animals which honeycomb (Fr. *gaufre*) the ground by burrowing in it. In the Central States the name refers to the too common "striped" gopher, or ground-squirrel (*Spermophilus tridecemlineatus*), a troublesome little animal about 10 inches long, a third of which is tail, which is dark-reddish brown, with 6 to 8 light stripes, alternating with lines of dots — about 13 in all; it is yellowish below, with a broad black stripe on each side. It is a familiar object on prairies and grassy fields throughout the upper half of the Mississippi valley, hurrying to and from its hole, or standing upright, but inconspicuous, curiously watching your movements, but ready to drop out of sight at the least alarm. The burrows are numerous everywhere, and are injurious not only by the space they occupy, and as traps for the feet of horses and cattle, but because they offer run-ways for water and so promote washing away of soil. Some of the holes are short, and are merely shelters; others are long, have a nest at the inner extremity, and side-chambers in which in the autumn large winter stores of seeds are laid away. Where these spermophiles are very numerous, as they have become in the grain-growing districts, of Iowa, Minnesota and the Dakotas, the amount of grain stolen or shaken down is a serious tax on agriculture. Another spermophile, more common northward, is Franklin's or the "gray" gopher (*S. franklini*), which is much larger and has a harsh coat of yellowish-grizzled hair. Several other species inhabit the more western plains. All are truly ground-squirrels of the family *Sciuridæ*, and closely related to the chipmunk (q.v.).

In the farther Northwest, however, the word "gopher" ordinarily means one of the large gray rodents of the family *Geomyidæ*, distinguished prominently by having in the cheeks capacious pouches, lined with fur; hence they are called pocket-gophers and pouched rats. The most familiar species is *Geomys bursarius*, which is about nine inches long and has short legs, close ears and a short hairy tail; the fore feet are very strong, with the three middle toe-nails long and well-adapted to digging, and its burrows are made with surprising rapidity. Its food includes all sorts of vegetable matters, and it often injures orchards by gnawing the roots. As fall approaches it gathers a store of seeds, tuberous roots, nuts, etc., and stows it in its deep residence-burrow, where the winter is passed in a partial torpidity varying with the climate. These provisions are carried in the cheek-pouches, which also serve to take out the loose soil from the burrows. On the Pacific coast occur several other species, some with large, pendent cheek-pouches. In the Southern States is found a species (*G. tuza*), locally called "Salamander," of large size and common in the sandy parts of Florida and the country north of it. The Northwest has a second and smaller kind of gopher (*Thomomys talpoides*), dusky bluish-gray in color, with the lower parts whitish, which is mole-like in its habits, and is known in Idaho as "camass-rat," on account of its fondness for the tubers of the liliaceous plant called camass (*Camassia esculenta*) by the Indians.

All of these animals are a pest to agriculture, and are increasing rather than diminishing in settled regions, owing partly to the increased food afforded them by crops, and partly to the destruction of their natural enemies, the birds of prey, snakes, weasels, foxes, badgers, wolves, etc., which formerly held them in check. Efforts are therefore made to exterminate them in various ways, of which the most effective is by suffocating them with bisulphide of carbon, placed in their holes by saturating some porous object and rolling it into the burrow. Several pamphlets issued by the United States Department of Agriculture describe the animals and their habits, and give directions for their suppression.

Gopher Snake, or Indigo Snake, a variety of a tropical colubrine snake (*Compsosoma corais*) common in the southwestern United States and eastward to Georgia, which reaches a length of 10 feet, and is brownish black with reddish markings about the mouth and throat. It burrows beneath loose soil, is harmless to man, and is believed to prey upon rattlesnakes at every opportunity.

Gopher State, a name sometimes given to Minnesota.

Gopher Tortoise or **Turtle,** a burrowing turtle (*Xerobates polyphemus*) of the southern United States, brownish in color with black head; yellowish below. It is herbivorous and gregarious, and is most frequently found in the pine barrens, where it is frequently eaten by the negroes, who are also fond of its eggs.

Go'ral, a goat-like antelope (*Nemorrhœdus goral*) from the Himalaya Mountains. It resembles somewhat the chamois, and remains in small bands on the highest parts of the mountains. Other species or varieties inhabit the high plateaus of Tibet and Mongolia.

Goramy, gō'ra-mĭ, or **Gourami,** goo'ra-mĭ, the Javanese name of a fish of the genus *Osphromenus* (*O. olfax*), family *Anabasidæ* or climbing perches, a native of China and the Eastern Archipelago, but introduced into the Mauritius, West India Islands, and Cayenne on account of the excellence of its flesh, where it has multiplied rapidly. It is deep in proportion to its length, and the dorsal and anal fins have numerous short spines, while the first ray of the ventral is protracted into a filament of extraordinary length. It is one of the few fishes which build nests, which it does by interweaving the stems and leaves of aquatic plants.

Gordiacea, gôr-dĭ-ā'sē-a, an order of *Nematohelminthes*, the hair-worms (q.v.).

Gordian Knot, a knot tied by Gordius in the rope which bound the yoke of his chariot to the axle-tree in such an artful manner that the ends of the cord could not be perceived. The Phrygians had learned by an oracle that a king would come to them riding in a car, and Gordius appearing thus at an opportune time, received the kingdom. He dedicated his car and yoke of oxen to Zeus, with the knot still untied. So intricate was it that the report went abroad that the empire of Asia was promised by the oracle to him who could untie it. Alexander the Great, wishing to inspire his soldiers with courage and his enemies with the belief that he was born to conquer Asia, cut the knot with his sword, and so claimed to have fulfilled the oracle. Hence to "cut the Gordian knot" is equivalent to removing or solving a difficulty by bold or unusual measures.

Gordia'nus, Marcus Antonius, the name of three Roman emperors, father, son, and grandson. The first, b. 158 A.D., had governed Africa for many years, when he was proclaimed emperor at the age of 80. He associated his son with him in the empire, but six weeks later the son was killed in fighting against the rival emperor Maximinus, and the father, in an agony of grief, died by his own hand. The grandson was proclaimed emperor by the soldiers in Rome 238 A.D., although not more than 15. He reigned six years, when he was assassinated by his soldiers at the instigation of Philip, prefect of the Prætorian guard.

Gordon, Archibald D., American dramatist: b. Ceylon 11 Oct. 1848; d. Port Richmond, Staten Island, N. Y., 9 Jan. 1895. He was dramatic critic for several New York and Chicago journals, and published: 'Trixie'; 'The Ugly Duckling'; 'Is Marriage a Failure?'; 'That Girl from Mexico.'

Gordon, Charles George ("CHINESE GORDON" or "GORDON PASHA"), English soldier: b. Woolwich 28 Jan. 1833; d. Khartum, Africa, 27 Jan. 1885. He entered the Royal Engineers as second lieutenant in 1852, and served in the Crimean war and during the Taiping rebellion, with the permission of the English military authorities, assumed the command of a special corps of Chinese, trained and led by European and American officers. With these materials he performed marvelous feats of skilful soldiership and succeeded in completely crushing the rebellion. The Chinese government was eager to express its gratitude, but he refused all offers of substantial reward. On his return to England with the rank of colonel, he was appointed chief engineer officer at Gravesend for the construction of the Thames defenses. Here, while his engineering work afforded ample scope for his military talents, the philanthropy of his nature had full scope. During the six years he lived at Gravesend his house was school, and hospital, and almshouse in turn. Many a waif he rescued from the gutter, establishing evening classes for their benefit, and keeping sight of the more deserving till they were provided with a career in life; all this being done on his pay as an English colonel, without any private resources whatever. In 1873, on the resignation by Sir Samuel Baker of his command, Gordon was appointed in his place, under the khedive of Egypt, and from 1874 until 1879 governed the vast region of the Sudan with credit to himself and with satisfaction to the Cairo administration. In 1881 Mohammed Ahmed, a Mussulman enthusiast, gave himself out to be the Mahdi — the long-expected Redeemer of Islam — and gathered a number of followers around him who threatened the safety of the Egyptian garrisons in the Sudan. It having been decided that the Sudan be evacuated, the presence of an English officer of high authority at Khartum was asked, with full power to withdraw all the garrisons in the Sudan, and make the best arrangements possible for the future government of the country. Gordon, at the request of the British government, proceeded to the Sudan in the hope that his great personal influence and knowledge of the country would help to set matters right. These hopes were not fulfilled; Gordon was shut up in Khartum by the troops of the Mahdi, and for a whole year he held that town against the Arabs who surrounded him. An English force under Wolseley was despatched for his relief, an advance corps of which sighted Khartum on 28 Jan. 1885, to find that the town had been treacherously betrayed into the hands of the Mahdi two days before, and that its heroic defender had been killed. Gordon had all the qualities which are found in a successful military leader, modified, however, by the strong religious feeling which tinged his mind from an early period, and which latterly became so intensified as to give him somewhat the character of a religious enthusiast and fatalist. He left a most interesting journal, kept during the latter period of his siege in Khartum. Consult: Hill, 'Gordon in Central Africa' (1881); Lives by Forbes (1884); Henry Gordon (1886); Boulger (1896).

Gordon, Charles William ("RALPH CONNOR"), Canadian author: b. Indian Lands, Glengarry, Ont., Canada, 1860. He was graduated at Toronto University in 1883 and at Knox College in 1887; was ordained to the Presbyterian ministry and was a missionary in the mining and lumbering regions of the Rocky Mountains 1890–4. He became pastor of St. Stephen's Church of Winnipeg in 1894, and wrote: 'Beyond the Marshes'; 'Black Rock'; 'Gwen's Canon'; 'The Sky Pilot'; 'Ould Michael'; 'The Man from Glengarry'; 'Glengarry School Days'; and 'The Prospector' (1904), works characterized by vivid descriptions of life and scenery in the Canadian West.

Gordon, LORD George, English agitator: b. London 26 Dec. 1751; d. there 1 Nov. 1793. He was a son of the Duke of Gordon, and entered Parliament in 1774. In 1778, a bill having been passed through Parliament for the relief of Roman Catholics from certain penalties and disabilities, a society called the Protestant Association of London was formed for the purpose of procuring its repeal. In the following year Lord George was elected its president, and in June 1780 headed an excited mob of about 100,000 persons, who went in procession to the House of Commons to present a petition against the measure. The dreadful riot which ensued, and which was not suppressed till after the destruction of many Catholic chapels and dwellings, the prison of Newgate, and the house of the chief justice, Lord Mansfield, led to the arrest of Lord George Gordon, and his trial on the charge of high treason; but no evidence being adduced of treasonable design, he was acquitted. He died, after having become a zealous professor of the Jewish faith.

Gordon, George Henry, American soldier: b. Charlestown, Mass., 19 July 1824; d. Framingham, Mass., 30 Aug. 1886. Graduated from West Point in 1846, he was employed on various duty, later resigned from the army, and practised law 1857–61. In 1861 he organized the Second Massachusetts Volunteers, and became colonel of the regiment. He commanded the United States troops in Florida in 1864, the eastern district of Virginia in 1865, and was mustered out in the latter year with rank of brigadier-general and brevet major-general of volunteers. He wrote a 'History of the Second Massachusetts Regiment' (1876), and other works on the war.

Gordon, John Brown, American soldier: b. Upson County, Ga., 6 July 1832; d. near Miami, Fla., 9 Jan. 1904. He was of Scotch ancestry, his grandfather being one of seven brothers who all fought for American independence in the War of the Revolution. He was graduated at the State University in 1852 and was, a few months later, admitted to the practice of law; but at the outbreak of the Civil War was engaged in mining operations near Raccoon Mountain, Alabama. Here was organized a company, called the "Raccoon Roughs," of which he was elected captain. This company was assigned to the 6th Alabama infantry, in which he rapidly rose through successive grades to that of colonel (28 April 1862). At Seven Pines, through the wounding of General Rodes, the command of the brigade fell upon him; and at Malvern Hill he led it in the grand charge of D. H. Hill's division against the Federal position. At Sharpsburg he was five times wounded. On 1 Nov. 1862 he was commissioned brigadier-general with command of a Georgia brigade of six regiments, which he led with great distinction at Chancellorsville and Gettysburg. On the march into Pennsylvania, just before the battle of Gettysburg, he reached Wrightsville on the Susquehanna, making the most extended advance achieved in the East by Confederates during the war. On the first day at Gettysburg he struck the extreme right of the Union army in Ewell's grand turning movement, by which the victory so desperately striven for by A. P. Hill was secured, and the Federals were driven through the town of Gettysburg to the heights beyond. On 6 May 1864, in the Wilderness leading two brigades, he fell at sunset upon Sedgwick's corps, driving the Federals from a large part of their works and capturing 600 prisoners, including Generals Seymour and Shaler.

On 12 May at Spottsylvania Court House, commanding Early's division, immediately after Hancock had overwhelmed Edward Johnson, Gordon by an impetuous charge first checked the Federals and then drove them back to the base of the salient, where the fight continued with great fury to the close of the day. Two days later Gordon was commissioned major-general and placed in command of Evans' Georgia brigade, Hays' and Stafford's Louisiana brigades, and Terry's Virginia brigade — the latter being made up of the remnants of the "Stonewall" brigade and other Virginia troops. With this command he participated, under Early, in the defeat of Hunter's expedition, the invasion of Maryland, the victory at the Monocacy, the march into the suburbs of Washington, and the battles against Sheridan in the Shenandoah Valley, being especially distinguished in the surprise and rout of Sheridan's army in the early morning at Cedar Creek. Having been assigned to the command of the Second corps of the Army of Northern Virginia, he held his lines with great tenacity, and in March 1865 made the brilliant dash by which he captured Fort Steadman and parts of the line to the right and left of it. Owing to the failure of the supporting column to arrive in time, he was obliged to retire to his original position. On the retreat from Petersburg he protected the rear, and at Appomattox commanded half of Lee's army, making a last brilliant charge of that heroic but now fearfully depleted host. After the surrender he called his men about him and made them a speech remarkable for its strong declarations of faith in God and earnest exhortations to endure defeat with patience, obey the laws, and rebuild their ruined homes and fortunes. He became the trusted leader of his people, was twice elected governor of Georgia, and for two terms represented his State in the Senate of the United States, on all occasions using his influence for peace and fraternity between the late warring sections. As commander-in-chief of the United Confederate Veterans' Association he possessed the enthusiastic love and devotion of his comrades, who would never entertain the idea of his retirement from the office to which they every year elected him, declaring repeatedly that death alone could remove him from that post of honor. His very successful lecture on 'The Last Days of the Confederacy' was well known in both North and South. His war-time reminiscences began to appear in 'Scribner's Magazine' in 1903 and were later published in book form.

Joseph T. Derry,
Author of 'The Story of the Confederate States.'

Gordon, Joseph Claybaugh, American educator: b. Piqua, Ohio, 9 March 1842; d. 1903. He was the earliest American advocate of oral education for the deaf and in 1869 organized the oral department of the Indiana Institution for the Deaf. He was professor of mathematics and chemistry in Gallaudet College, Washington, 1873–97, becoming superintendent of the Illinois Institution for the Education of the Deaf in 1897. He published: 'Education of Deaf Children'; 'Notes and Observations on the Education of the Deaf'; etc.

Gordon, Julien. See Cruger.

Gordon, William W., American soldier: b. Savannah, Ga., 14 Oct. 1834. Graduated from Yale in 1854, he served in the Confederate army during the Civil War, distinguishing himself at the battle of Frederick City, Md., and subsequently was in the cotton trade at Savannah. He was for six years a member of the State legislature of Georgia, was brigadier-general of volunteers in the Spanish-American war (mustered out 1899), and was appointed to the evacuation commission for Porto Rico.

Gordon-Cumming, Constance Frederica. See Cumming, Constance.

Gore, Christopher, American statesman: b. Boston 21 Sept. 1758; d. Waltham 1 March 1827. He was graduated at Harvard College in 1776, and studying law, was soon engaged in good practice. In 1789 he was appointed the first United States district attorney for Massachusetts; in 1796 was chosen one of the commissioners to settle the claims of the United States upon Great Britain for spoliations, and remained in London, successfully engaged in the duties of this office, about eight years. In 1803 he acted as *chargé d'affaires* during the absence of the American minister; in 1809 was chosen governor of Massachusetts; and in 1814 was elected to the United States Senate. He left about $100,000 to Harvard College. Gore Hall, the library building at Harvard, is named in his honor.

Gorgeana, gôr-jē-ăn'a, Me., now York, the first incorporated city in the United States. On 2 Dec. 1631 a grant was made to Sir Ferdinando Gorges and others of 24,000 acres on both sides of the Accomenticus (Agamenticus, now York) River. Settlements were founded here, and on 10 April 1641 were formed into a borough named Accomenticus or Agamenticus which on 1 March 1642 was given a city charter as Gorgeana, with a full apparatus of mayor, aldermen, courts, etc. It had an extent of three miles on the coast and seven up the river, a small tidal stream. In 1652 Maine submitted to Massachusetts; and to avoid the city charter and Gorges' rights, Gorgeana was reincorporated as the town of York.

Gorges, gôr'jĕz, Sir **Ferdinando,** colonial proprietor of Maine: b. Ashton, Somersetshire,

GENERAL JOHN BROWN GORDON.

about 1565; d. 1647. He was a partner in the conspiracy of the Earl of Essex, against whom he testified on his trial in 1601. When Waymouth returned in 1605 from his voyage to North America, and brought with him five Indian captives, Gorges took three of them into his house, caused them to be instructed in the English language, obtained information from them of the «stately islands and safe harbors» of their native country, and determined to become a proprietor of domains beyond the Atlantic. He persuaded Sir John Popham, lord chief justice of England, to share his intentions, and in 1606 the king incorporated two companies, the London colony, and the Plymouth colony, between which was divided the territory extending 50 miles inland from the 34th to the 45th parallel north latitude. The Plymouth colony had the northern portion, which was styled North Virginia. Three ships with 100 settlers sailed from Plymouth 31 May 1607, and reached the mouth of the Kennebec in Maine, where they began a settlement, abandoned the next spring. In 1616 Gorges sent out Richard Vines with a party, which encamped on the river Saco through the winter. In 1620 Gorges and his associates obtained a new incorporation for «the governing of New England in America,» which was empowered to hold territory extending westward from sea to sea between the 40th and 48th parallels north latitude. Gorges himself united with John Mason in taking grants of the district called Laconia, bounded by the Merrimack, the Kennebec, the ocean, and «the river of Canada,» and under his auspices several settlements were attempted. His son, Robert Gorges, was appointed in 1623 by the council for New England «general governor of the country.» This council resigned its charter to the king in 1635, and the elder Gorges now determined to establish a miniature sovereignty on his own domain. To this end he obtained from the king a charter constituting him lord proprietary of the province of Maine, with extraordinary governmental powers, to be transmissible with the property to his heirs and assigns. He sent his son Thomas to be deputy governor, and the officers took an oath of allegiance to the lord proprietary. The province was divided into two counties, of which Agamenticus (now York) and Saco were respectively the principal settlements; the former received a city charter, as Gorgeana, in 1642. But the fatal want was a deficiency of subjects; probably two thirds of the adult males were in places of authority; yet the little monarchy continued for nearly 10 years. When the four New England colonies formed a confederacy in 1643, the settlements of Gorges were excluded from it. On Gorges' death his colonists at length formed themselves into a body politic for the purposes of self-government, and submitted to the jurisdiction of Massachusetts. «The nature of Gorges,» says Bancroft, «was generous, and his piety sincere. He sought pleasure in doing good, fame by advancing Christianity among the heathen, a durable monument by erecting houses, villages, and towns.»

Gorgias, gôr'jĭ-as, Greek orator and sophist: b. Leontini, in Sicily. He flourished in the 5th century B.C., and was one of the earliest writers on rhetoric. He was one of the first who introduced cadence into prose. He also treated of common-places, and showed the use of them for the invention of arguments. This induced Plato to give the name of 'Gorgias' to his elegant dialogue on this subject. Gorgias is said to have reached the extraordinary age of 107 or 108 years. Two works attributed to him are extant, 'The Apology of Palamedes,' and the 'Encomium on Helena,' but their genuineness has been questioned by several critics. See Jebb, 'Attic Orators.'

Gorgo, gôr'gō, or **Gorgon**, according to Homer, one of the frightful phantoms of Hades; but Hesiod mentions three Gorgons, Stheno, Euryale, and Medusa. They were all immortal, except Medusa. Their hair was entwined with serpents, their hands were of brass, their body covered with impenetrable scales, their brazen teeth as long as the tusks of a wild boar, and they turned to stones all those who looked upon them. According to some authors, Perseus, when he went to the conquest of the Gorgons, was armed with an instrument like a scythe, by Hermes, and provided with a looking-glass by Athena, besides winged shoes and a helmet of Pluto, which rendered all objects clearly visible and open to the view, while the person who wore it remained totally invisible. With weapons like these Perseus obtained an easy victory. The head of Medusa remained in his hands, and he gave it to Athena, who placed it on her Ægis, with which she turned into stones all such as fixed their eyes upon it. The residence of the Gorgons was beyond the ocean toward the west, according to Hesiod.

Gorgo'nia, the type-genus of the *Gorgonidæ*, a family of alcyonarian coral-polyps, the «sea-fans» or «sea-whips,» which have a calcareous or horny axis, the colony often greatly branched, and the branches anastomosing. In the common gorgonia (*Rhipigorgia flabellum*) of the West Indies and Florida Keys the branches form a flat net-work. In this and other sea-fans the short calicles of the single retractile polyps stand perpendicularly to the axis, communicating by longitudinal vessels and branching canals. While by far the greater majority of the species are inhabitants of tropical waters, in the Arctic seas, and in the deeper, cold waters of the Newfoundland banks, and on St. George's Bank, two large species occur: *Primnoa reseda* and *Paragorgia arborea;* the latter is of great size, the stem being as thick through as a man's wrist, and the entire coral-stock over five feet in height.

Goril'la. This term is derived from the 'Periplus' of the Carthaginian navigator, Hanno, who described, 500 years before Christ, an island on the west coast of Africa as full of wild men, which his interpreter called Gorilloi. When, therefore, Dr. Thomas Savage brought the first specimen of this animal to the attention of science, in 1847, the name «gorilla» was naturally applied to it. It now appears probable that the «Gorilloi» of Hanno were probably baboons. The gorilla of science, of which but one species is known (*Gorilla gorilla*), is the largest of the apes and is of great interest, since with the chimpanzee and the orang-outang, it is the nearest living relative of man. Structurally it is very closely allied to the chimpanzee. It does not exceed 5½ feet in height, but in bulk considerably exceeds man. Its skin is black, the hair being blackish and turning gray in old individuals. The skull has the supraorbital ridges greatly developed and the crest in the sagittal line is large. The arms are long, the hand reaching to about the middle of the shank, while the hands are webbed to the end of the first joint of the fingers. In the foot the heel is more apparent than in other anthropoid apes, correlated with its more terrestrial life. They usually walk upon all fours, a gait rendered possible by the very long arms.

These apes are limited in their distribution to the forested region of the Gaboon, and go about in families led by an old male. They are mainly diurnal in their habits, seeking their food, which is largely vegetable, during the day. At night the female and young are said to ascend a tree while the male sleeps at its foot. The stories told of its ferocity are possibly exaggerated, yet it is without doubt an extremely dangerous animal when brought to bay. When making an attack the male stands erect and is said to knock his adversaries down with his hand and then to use his powerful teeth, the canines of which are greatly developed. Consult: Keith, 'Proceedings Zoological Society of London' (1899); for accounts of its habits: Huxley, 'Man's Place in Nature'; H. O. Forbes, 'Monkeys' (1894); and Hartmann, 'Anthropoid Apes' (1885).

J. S. Kingsley,
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Gor'ky, Maxim, pen name of Alexei Maximovitch Pyeshkoff, Russian author: b. Nijni Novgorod 1868. He traveled over a large part of his native country as a tramp after serving in many employments from that of a ship's cook to that of a lawyer's clerk. The varied scenes and persons he saw in his vagabond life among the lowest of the population furnished him with rich material for his subsequent literary work, in which he takes upon himself to interpret *la misère* as it is in western and southwestern Europe. His style is like a flash-light revealing features of debased or tragic character with vivid realism, but his view of his subject is tinged with melancholy pessimism. Among his most admired works are: 'Foma Gordyeeff' (1902); 'Makar Chudra' (1892).

Gor'man, Arthur Pue, American legislator: b. Howard County, Md., 11 March 1839; d. Washington, D. C., 4 June 1906. Up to his 27th year he was a page in the United States Senate. He was then appointed Collector of Internal Revenue in the Fifth District of Maryland. In 1869 he was made general superintendent of the Chesapeake and Ohio Canal Company, and from 1872 was president of that corporation. His influence as a Democrat extended from the affairs of Maryland to national affairs and from the House of Delegates in his native State he was elected in 1893 to serve as Senator of the United States: to which office, after three years of private life, he was re-elected in 1902. He was prominent in opposing the Force Bill of 1889 and took part in the reframing of the Wilson Tariff Bill in 1894.

Gorringe, gôr'rĭnj, **Henry Honeychurch,** American naval officer: b. Barbadoes, W. I., 11 Aug. 1841; d. New York 6 July 1885. He came to the United States in youth, entered the Union navy in 1862, and served under Admiral Porter. He was promoted lieutenant-commander in 1865. He accomplished the removal of the Egyptian obelisk (Cleopatra's Needle), which the khedive had presented to the United States, from Egypt to New York city in 1880. He published a 'History of Egyptian Obelisks' (1885).

Gorse, or **Whin.** See Furze.

Gortchakoff, gŏr-chä-kof', **Alexander Mikhail'ovitch,** Russian diplomatist; cousin of the general of the same name: b. St. Petersburg 16 July 1798; d. Baden-Baden 1 March 1883. He entered the diplomatic service in 1824 as secretary to the Russian embassy in London. His experience in diplomacy was extended in Vienna, Florence, Stuttgart, and elsewhere, and he showed great skill in securing the neutrality of Austria during the Crimean war. In 1856 he became minister of foreign affairs, and in 1862 chancellor of the empire, having by that time made himself one of the foremost diplomatists of Europe. He was a prominent member of the Berlin Congress 1878, but his influence was then on the decline, and in 1882 he was superseded by M. de Giers.

Gortchakoff, Prince **Mikhail,** Russian general: b. 1795; d. Warsaw 30 May 1861. He took part as an artillery officer in the battle of Borodino in 1812, and served in the subsequent campaigns of the allies against the French. He acquired also a brilliant reputation in the Polish war of 1831; and in 1846 he was made governor of Warsaw. In 1855 he was appointed commander-in-chief in the Crimea, where he conducted the defense of Sebastopol. In 1856 he returned to Poland as governor of the country. By his express desire his body was carried to Sebastopol, and buried in the place he had so long and so bravely defended.

Gor'ton, Samuel, New England enthusiast, and first settler of Warwick, R. I.: b. Gorton, England, about 1600; d. Rhode Island November or December 1677. He did business in London as a clothier until 1636, when he embarked for New England, and settled at Boston. Religious disputes induced him to remove to Plymouth, where we first hear of him as a preacher. He soon exhibited such peculiar views that he was banished from the colony on a charge of heresy. With a few followers he then went to Aquetneck or Rhode Island, which had recently been settled by exiles from Massachusetts Bay; but falling again into trouble, was publicly whipped for calling the magistrates "just asses" and for other contemptuous acts, and was forced to seek an asylum with Roger Williams in Providence, about 1641. Here he became involved in the disputes of the colonists on certain questions of boundary. Gorton was then summoned to Boston, but refused to recognize the jurisdiction thus assumed, and about the same time removed to Shawomet, on the west side of Narragansett Bay, where he purchased land from the Sachem Miantonomo. But in June 1643 two inferior sachems contested his claims to the land, and applied to the general court at Boston for assistance. A body of 40 soldiers was consequently marched to Shawomet, and Gorton and 10 of his disciples were carried to Boston and condemned to hard labor, a sentence commuted to banishment in 1644. Gorton then went to

England, where he obtained from the Earl of Warwick an order for the land he claimed. Returning to Rhode Island in 1648 he founded the town of Warwick, thenceforth his home, and where he occasionally preached. He wrote several controversial works, the best known of which is 'Simplicitie's Defense Against Seven-Headed Policy' (1646). See Janes, 'Samuel Gorton' (1896).

Goschen, George Joachim, VISCOUNT, English financier: b. London 10 Aug. 1831; d. Hawkhurst, Kent, 7 Feb. 1907. He was educated at Oxford and entered Parliament as a Liberal for the city of London in 1863, which he represented till 1880. He was First Lord of the Admiralty, 1871–4. With M. Joubert he went to Egypt in 1876 on behalf of the bond-holders to reorganize the finances of that country, and two years afterward represented Great Britain at the international monetary conference held in Paris. In 1887 he became chancellor of the exchequer under Lord Salisbury, and in 1895 again took office under the same leader as First Lord of the Admiralty. From this office he retired toward the end of 1900, and was soon after raised to the peerage as Viscount Goschen. He represented Ripon in Parliament 1880–5, when he was returned for Edinburgh, and was member for St. George's, Hanover Square, 1887–1900. He wrote several financial and political pamphlets, and a work on the 'Theory of Foreign Exchanges' (1864).

Gos'hawk, a falcon of the genus *Astur*. The goshawk proper, or "gentle falcon" (*A. palumbarius*), was a favorite bird in falconry (q.v.), and is still used for large game, as rabbits, pheasants, and the geese from which it took its name. It is 21 inches in length, the crown, black, bordered on each side by a line of white, finely speckled with black; upper parts, slate, tinged with brown; legs, feathered half-way down, and, with the feet, yellow; tail-feathers with pale bands. It is to be found throughout Europe and central Asia; and it is a question whether the American goshawk (*A. atricapillus*) is really specifically different. The latter is a noble bird whose home is in the North, so that it is rarely seen south of the Canadian line except in winter, and uncommonly then. In its boldness, its marvelous power and control of flight, and its prey, it resembles our more familiar little falcons, the sharpshin and Cooper's hawk. Several other species inhabit the Orient, an Australian one being remarkable for its pure white color, with red irides.

It should be noted that the bird called "goshawk" in Scotland is the peregrine.

Goshen, Ind., city, county-seat of Elkhart County; on the Elkhart River, and on the Cleveland, C., C. & St. L., and the Lake Shore & M. S. R.R.'s; about 25 miles southeast of South Bend and 95 miles southeast of Chicago. It is situated in a fertile agricultural section of the State. Its principal industrial establishments are flour-mills, bicycle and machine shops, woolen-mills, sash and door factories, veneering and furniture shops; rubber goods, underclothing, mittens, and shirts are manufactured here. The city has large lumber, coal, and brick yards. Hay, grain, and live stock are the chief farm products shipped from Goshen to larger markets. The public library building and the high-school are the principal public buildings. The mayor holds office for two years. The city owns and operates the electric light plant and the waterworks. Pop. (1900) 7,810.

Goshen, N. Y., a village, railroad junction, and one of the county-seats of Orange County; on the New York, L. E. & W. and the Lehigh & N. E. R.R.'s; 59 miles northwest of New York. Goshen was founded in 1714, and incorporated in 1809; it has municipal waterworks. The manufactures include bricks, tiles, glass, cider, and foundry products, but the chief commercial interests are connected with the dairying industry, there being a considerable trade in milk, butter, and cheese, which are widely celebrated for their excellence. Pop. (1900) 2,826.

Gosling-grass. See BEDSTRAW.

Gosnold, gŏs'nōld, **Bartholomew,** English voyager to America: d. Jamestown, Va., 22 Aug. 1607. He joined Raleigh in his attempt to colonize Virginia, and after the failure of that enterprise was placed in command of an expedition fitted out at the cost of the Earl of Southampton and others for planting a settlement in New England. He sailed from Falmouth 26 March 1602, with one small vessel and a company of 32 persons, 20 of whom were colonists. Steering directly across the Atlantic, in seven weeks he reached Massachusetts Bay, first seeing land probably not far north of Nahant. Thence he turned south and landed on Cape Cod, to which he gave the name it still bears. Sailing around the promontory, and stopping at the island now known as No Man's Land, but which he called Martha's Vineyard, Gosnold anchored at the mouth of Buzzard's Bay, and resolved to plant his colony on an island which he called Elizabeth, and which now bears the Indian name of Cuttyhunk. The adventurers here built and fortified a house, but the hostility of the Indians, scarcity of provisions, and disputes about a division of the profits, disheartened them, and the whole party returned to England, taking a valuable cargo of sassafras root, then highly esteemed as a medicine, cedar, furs, and other commodities. Gosnold next turned his attention toward Virginia, and after long effort succeeded in organizing a company for colonization in that region, the heads of which were Edward Wingfield, Robert Hunt, and the famous Capt. John Smith. A charter was granted them by James I., 10 April 1606, the first instrument of that nature under which the English were planted in America; and on 19 Dec. 1606 Gosnold set sail with three small vessels and an ill-assorted band of 105 adventurers, only 12 of whom were laborers, and very few mechanics. After a tedious voyage, a storm having driven them into Chesapeake Bay (26 April 1607), they sailed up James River, which they named after the king, disembarked about 50 miles above its mouth, and founded the settlement of Jamestown. Sickness and various disasters destroyed 50 of their number before autumn, among whom was the projector of the colony. The Massachusetts township of Gosnold, comprising the Elizabeth Islands, was named in his honor.

Gospels. Our four gospels cannot perhaps be better described than by calling them "Memoirs of Jesus." Though they contain ample historical and biographical materials, they are neither histories nor biographies, in our modern sense of these terms. Moreover, each one has been written with the distinct purpose of edification. They do not relate facts simply as facts, but always with the object of awakening or strengthening faith. Each Evangelist has selected and arranged his materials in accordance with his conception of the best way to realize this aim. Altogether they give us but a small part of the life and activity of the Master, and yet they contain enough to make clear His character and mission. The recognition of these general characteristics is indispensable in the consideration of the critical questions which are connected with the study of the origin and interrelation of the four Gospels. In distinction from that of St. John, the first three gospels, since the days of Griesbach (latter part of 18th century) have been called "the Synoptics," for the reason that their accounts which are often parallel, give us a general view of the sayings and doings of Jesus. They differ from that of St. John in four particulars: (1) In the scene of Jesus' ministry, St. John confines himself almost entirely to Judea, while they are busy with the ministry in Galilee and the Perea. (2) In the number of Passovers noted. The Synoptics mention only one; St. John, at least three (ii. 13, vi. 4, xii. 1). Hence, so far forth, there seems to be a difference in the duration of the ministry. (3) In the events narrated. Apart from the events of the last or Passion week, St. John gives only three incidents in common with the other Gospels — the feeding of the multitude, vi. 1–13, the walking on the water, vi. 16–21, the anointing of Jesus by Mary of Bethany, xi. 55, xii. 11. (4) In the general teaching of Jesus. St. John's Gospel, as far as its teachings are concerned, deals quite exclusively with the person of Jesus, while the others make known to us the nature of the kingdom which he came to establish. These differences have made the fourth Gospel the subject of much study and speculation, and cause it still to be one of the difficult problems of New Testament criticism.

The Synoptic Problem.— For over 100 years students of the Gospels have been engaged upon the question of the origin and relationship of the Synoptic evangelists. No one can read these gospels attentively without being struck with the general resemblances in the narratives. These resemblances pertain to the place of our Lord's ministry — Galilee, to the time — only one Passover being given, and to the general order of events. More than one half of the incidents are the same in all three, and what is noteworthy regarding these is the close similarity in the language in which the incidents are given. Such facts point to a common relationship of some kind. Together with these resemblances, however, there are just as marked differences. The character as well as number of these differences is striking. What origin can account for both resemblances and differences? This is the Synoptic problem. In the course of the long period of work upon it, three typical solutions have been offered: (1) The solution of inter-dependence. This supposes that the Evangelists copied from one another and there have been as many variations in the form of the theory as there are possible orders of the Gospels. No one of them has proved satisfactory. Out of the discussions that were begotten, however, one important question early became prominent, and that was regarding the Gospel of St. Mark. Did St. Mark make his Gospel by compiling his account from the other two, or was his shorter narrative the basis of St. Matthew's and St. Luke's narrative? Griesbach brought Germany to accept the former view, and for a long time this view stood in the way of any advance in the criticism of the Gospels. That St. Mark is not an epitome or compilation of the other two, is now one of the assured results of criticism. As it became more and more evident from repeated attempts to show it, that the use of one gospel by another in the way of direct copying could not be defended, attention was turned to a possible origin back of them all — to some primitive form of gospel, which would explain all the facts. Hence (2) the solution by the supposition of a primitive gospel. By some (Eichborn, Ewald) this primitive gospel was supposed to be written; by others (Gieseler, Lange, Westcott, Godet) oral. The insurmountable objection to the method of solution by a primitive written source was in the number of translations and recensions postulated in order to account for our gospels in their present form. Eichborn and Ewald supposed nine such stages of work. These theories have proved too intricate and artificial for acceptance. The chief objections to the hypothesis of a primitive oral gospel, as directly the source of our gospels are: (1) That the supposition of some central apostolic tradition formed in or about Jerusalem makes it very difficult to account for the Gospel of St. John. Why did this tradition omit all that is found in the fourth Gospel? (2) "The agreement between the Gospels, in many instances, extends to phrases which are mere connecting links between the sections, which are just the kind that in fully oral tradition would be the first to vary." (3) "The likeness between the Gospels is not confined to agreement in the way of telling separate stories, but extends also to the order of arrangement (ex. Matt. xiv: 1, Mark vi: 14, and the way both narratives go back and explain the statement of the beheading of John). Criticism has not, however, cast away all that these theories have offered us. It is unquestionably true that the gospel existed first in an oral form, and it is also true that the oral gospel was in great part committed to writing before it became the content of our gospels. The solution, therefore, which is today accepted by the majority of scholars is that which postulates two main written sources. One of these is called the "Logia," and is attributed to St. Matthew; the other is "a narrative of events," attributed to St. Mark and taken by him from St. Peter. This conclusion reached by the way of patient, careful criticism, singularly accords with the testimony of Papias (see Eusebius, Hist. Ecc. III.), who says: "St. Mark, having become the interpreter of St. Peter, wrote down accurately, though not indeed in order, whatsoever of the things said or done by Christ." "St. Matthew wrote the oracles (Logia) in the Hebrew language, and everyone interpreted them as he was able." Several perplexing questions, however, have arisen in regard to each source, and all of them have not as yet been satisfactorily answered.

Let us look at them in order. In regard to the "Logia," the first question is, "What was their character?" Were they simply discourses, or discourses plus some introductory narrative material? One of the best discussions of this question is to be found in Lightfoot's 'Essays on Supernal Religion' (Essay on Papias). There is now general agreement in the judgment that they include an element of narrative. Again, "How are they related to the Gospel of St. Matthew?" The answer is that they form a large part of the Gospel, and for that reason have given to it the name of Matthew, though he did not write the book as we now have it. The original Matthew (Ur-Matthæus as Weiss calls it) contained simply the Logia, with a small number of incidents. The third question is, "In which Gospel do we get the Logia in their original form, in the book of St. Matthew or in that of St. Luke?" The best answer which has yet been given to this difficult question is this: "That the balance of probability is on the side of St. Luke's Gospel," and mainly for the reason that in St. Matthew we have aggregated unities like the Sermon on the Mount, the charge to the Twelve (chap. x.), the Parables by the Sea (chap. xiii.). In regard to the other source — The Narrative of Events — the first question of importance is this: Is our Gospel of St. Mark the original Narrative of Events? The description of Papias is confirmed by Irenæus, Clemens, Alexandrinus, Tertullian, Origen, Eusebius, and Jerome, so that there is sufficient witness to the relation of Mark and Peter, and the answer which criticism has given to the above question is, "that the Petrine source used by the two later synoptists was not an Ur-Markus, but St. Mark's Gospel, almost as we have it now."

Every student of the problem knows that these two "main documents," satisfactory as they are as the principal sources of Matthew and Luke, are only the "main sources." St. Luke has gone elsewhere for parts of his Gospel, and the relation of St. Matthew to St. Luke requires the supposition of more material than the Logia gives. Oral tradition has probably had its place along with written records. The problem yet requires much patient painstaking study.

The Gospel of St. Matthew.— (*a*) *Authorship.*— Papias is the first to tell us about a form of gospel written by St. Matthew (Eusebius H. E. III: 39) and Irenæus (Adv. Hae III : 1, 1), the first to name St. Matthew as the author of the first gospel. Just in what sense these statements are facts we must see later. Meanwhile a word about St. Matthew himself. He was a tax-gatherer before his acceptance of the call of Jesus (Matt. ix. 9). Promptly responding to the invitation of the Master to follow him, he became an eye-witness of much of the Lord's ministry. There is no good reason for denying his identity with the Levi of St. Mark ii. 14, Luke v. 27. Both his position as a tax-gatherer, requiring work with the pen, and his experience as a disciple fitted him to do the work which tradition has assigned to him.

Papias and Irenæus refer to this work as in Hebrew (Aramaic), but our first gospel is in Greek, and it gives no evidence of being a translation from a Hebrew original. The question then arises, what is the relation of our Greek Matthew to the Hebrew Matthew of tradition? Criticism in seeking to answer this question has reached the following conclusions: (1) That the Gospel according to the Hebrews, in either of its forms, Ebionite or Nazarene, was not identical with the Aramaic original of St. Matthew's Gospel; nor is our Greek Matthew a translation of the Gospel to the Hebrews. (2) That the Aramaic original of which Papias and Irenæus speak, was probably the collection of discourses now known as the Logia, compiled by St. Matthew, having very little narrative material, and reflecting in character the needs and conditions amid which these Logia at first took shape (See Weizäcker, Apostolic Age, Vol. II., chap. ii.) (3) That this Aramaic source has entirely disappeared. (4) That our present Gospel of St. Matthew originated in a desire to "expand the old Apostolic source, whose form no longer met the needs of the time, into a history of the life of Jesus which would correspond to these." (5) That the framework of St. Mark's Gospel was used for the narrative setting, but because of the importance and value of the discourse element, the resultant production was called the Gospel according to St. Matthew. (6) That other narrative material such as Chapters i., ii., xxviii., were taken either from other sources or from oral tradition (Weiss). (7) That this composite Gospel existed only in Greek form and is of unknown authorship. Space forbids entering upon the evidence for each of these statements; it can be found in the literature given at the end of the article.

(*b*) *The Purpose of the Gospel.*— It aims to show that Jesus was the Messiah, not in the way John does, by making evident the glory of His person in word and deed, but through the fulfilment of Old Testament prophecy. The author seeks at each step of the history to prove by Messianic prophecies (there are over 70 quotations and references to the Old Testament) the Messiahship of Jesus. This compels him to meet the objections of the Jews and also to lay bare their motives in opposing the teaching and claims of the Master. While, therefore, the Gospel is meant to strengthen and comfort Jewish Christians, it also has, as Godet claims, an apologetic aim.

The Gospel of St. Mark.— (*a*) *Authorship.* —There has been no reason discovered for disbelieving the testimony of Papias that Mark — the John Mark of Scripture — has given us in substance the "Memoirs of Peter" regarding Jesus. Some difference of opinion exists as to the meaning of the description "interpreter"— it being understood by some as the equivalent of "amanuensis"; by others as "translator." The Gospel bears abundant witness to the character of its depictions as being those of an eye-witness. They are circumstantial, pictorial, and vivid. Papias further says that "having become the interpreter of St. Peter, St. Mark wrote down accurately, though not indeed, in order, whatsoever he remembered of the things said or done by Christ." This statement about order, whatsoever he remembered of the things events given in the Gospel, which is progressive and helpful in understanding the public career of Jesus, but to the sequences of events in detail. A topical rather than a chronological plan is followed (see Bacon's 'Introduction to the New Testament,' pp. 189–190). So good is this order of St. Mark that both St. Matthew and St. Luke use it. Evidences of other sources besides the Petrine Memoirs are found, for example, in chapter xiii., for which the supposition of a separate written document seems needful; so too the narrative about Herod in chapter xiv. St. Mark adds some touches of his own.

(*b*) *The Purpose of the Gospel.*— The purpose of this vivid presentation of the activities of Jesus in Galilee and during the latter days in Jerusalem was not the mediating of the antagonistic tendencies in the church (Baur), nor the commendation of Paulinism (Pfleiderer), nor to counteract the effect of the delay in Christ's coming by making evident the Messianic character of the mission of Jesus (Weiss), but simply to show how "God anointed Jesus of Nazareth with the Holy Ghost and with power" and how He "went about doing good and healing all that were oppressed of the devil: for God was with him" (Acts x. 38). These are St. Peter's own words descriptive of the mission of Jesus. His Gospel gives the content of that description. Of course, the narrative was meant to be a support to faith and a means of winning men to faith.

The Gospel of St. Luke.— (*a*) *The Author.*— The Muratorian Fragment (c. 200 A.D.) is the earliest external witness to the name of St. Luke as the author of the third Gospel, "the third book of the Gospel, that according to Luke, the well-known physician." Irenæus follows with explicit testimony to the same effect, and all early tradition but seconds these witnesses. St. Luke was born, according to tradition, in Antioch, and was a Gentile. Godet's account of the strict supervision under which physicians were placed by the authorities at Rome argues an amount of culture for St. Luke quite above that of other men. St. Luke's name appears but three times in Scripture, Col. iv. 14, Philemon 24, 2 Timothy iv. 11. Of late years we have come to know him more fully as a writer, through the critical study of the Acts; and his character as a careful, philosophic historian has been ably set forth by Prof. Ramsay. (See Ramsay's 'St. Paul the Roman Traveller.') The common authorship of the Acts and the third Gospel is now generally accepted.

(*b*) *The Sources of the Gospel.*— The Introduction of the Gospel gives the author's plan of procedure and his purpose. Just what is involved in its designation of sources is difficult to say. He does not tell us whether they were oral or documentary, whether in Aramaic or Greek. The problem of the sources of St. Luke's Gospel is a complicated one, and entire unanimity has not been reached in its attempted solution. The following conclusions will give, in brief, some conception of the situation. (1) St. Mark's Gospel is one of his chief sources. Almost all of the contents of St. Mark (except vi. 45–viii. 20) are found in the third Gospel. Evidently St. Luke has used the Gospel of St. Mark as his framework, and here again criticism sees no need of postulating an Ur-Markus. It is to be noticed, however, that he omits some things recorded by St. Matthew and St. Mark, and records some things which St. Matthew and St. Mark omit. The explanations of this phenomenon have been different, but they have not invalidated the conclusion given above. (2) While St. Luke knew the Logia document in its original form, he was not familiar with our present Greek Matthew. The main reason for the latter part of this statement is discoverable in the way St. Matthew and St. Luke use the Gospel of St. Mark. "It is established," says Weiss, "as one of the indisputable results of Gospel-criticism that St. Luke's acquaintance with and use of the Apostolic source of the first Gospel is just as certain as his want of acquaintance with this Gospel itself." Where St. Matthew and St. Luke have material in common which is not found in St. Mark, another document is supposed to be the source, or oral tradition. (3) St. Luke has placed the great mass of the material which he took from the Apostolic source in the two sections which he has inserted into St. Mark's narrative, namely, in vi. 20–viii. 4, ix. 51–xviii. 14. (4) Besides these two main sources, the narrative of St. Mark and the Logia, St. Luke had other written sources, giving him the first two chapters, and the long Perean section. These may, indeed, have been parts of one source, which contained material covering the entire life of Jesus. The effect of St. Luke's hand, and the modifications of oral tradition are evident throughout the book. The uniformity of style and diction in the whole Gospel show that these varied sources were not merely put together, but were edited by St. Luke. The peculiarities of his Greek appear all through the Gospel.

(*c*) *The Purpose of the Gospel.*— It was written that Theophilus "might satisfy himself of the accuracy of the story which he had heard from others" (i. 4). Its appeal, through Theophilus, is to the Gentiles. "Luke," says Origen, "composed his Gospel for Gentile converts." In accord with this are its depiction of the humanity of Christ — the ideal man — and its broad spirit of universality.

Date and Integrity of the Synoptic Gospels.— (*a*) *Date.*— Much division of opinion exists as to the time of the writing of the Synoptic books. The materials out of which they were made originated, of course, much earlier than the gospels themselves. The time just before or just after 70 A.D. is that which now meets with much favor. Between 70–80 A.D. is the latest probable time for dating them.

(*b*) *The Integrity of the Gospels.*— Criticism has directed its attack mainly against the following parts of the Gospels: (1) Against the first two chapters of St. Matthew and St. Luke. The chief objections to these are (*a*) the wide differences in the accounts of the birth and infancy. (*b*) The character of the accounts themselves, containing angelic appearances, the visit of Magi, and the slaughter of the Innocents. (*c*) The miraculous conception. It is to be noticed that the difference in the accounts is fully explicable in the supposition that they are from different sources. St. Luke's story is undoubtedly from the Blessed Virgin Mary, and much in St. Matthew's story is traceable to Joseph. St. Luke's account in its delicacy, personages, and fidelity to the Old Testament point of view is inexplicable as a later Jewish-Christian fiction. Perhaps the angelic appearances are simply poetic descriptions of the conveyance of inward truths and facts. The story of the Magi has a rational explanation in an astrologer's interest in a planetary conjunction at a time when the widespread hope of a Messiah among the Jews would give it for these students of the heavens, a vital significance. Herod's well-known cruelty makes easily possible the massacre at Bethlehem. For the difficulties connected with the enrollment of Quirinius, see Prof. Ramsay's 'Was Christ born in Bethlehem?' After a possible satisfactory explanation of the attendant circumstances of the supernatural birth of Jesus, there yet remains an objection to the supernatural birth itself. This must be met on philosophic grounds, for it is really a philosophic objection. These chapters of Matthew and Luke are textually as well supported as any in the Gospels, and they have early and continued attestation in the Church. The silence of the New Testament regarding the miraculous conception is no argument against it, simply because of the nature of the subject.

(2) Again criticism has given special attention to the last 12 verses of St. Mark. The generally accepted conclusion is that these verses are a later addition to the Gospel, but that they embody a genuine apostolic tradition.

(3) The accounts of the Resurrection have also been the subject of destructive criticism. Here again we must distinguish between the accounts of the Resurrection, and the Resurrection itself. It has been truthfully said that "when we come to look into the narratives of the Resurrection, we find them unassimilated and unharmonized." Is this not due to the way in which our Gospels have come to us? Where so many witnesses were involved and so many occasions cited, is it not to be expected that there should be considerable variation in the testimony? The accounts have come to us from different sources. Some of them, like the walk to Emmaus, were personal memoirs; others, like those in St. John, were selected because of their value to him personally, for the purpose he has in view. There has been no studied attempt to fit them all to each other, but they all bear clear witness to the spontaneous, unmistakable acceptance of the fact of the Resurrection. Objections which go beyond this and impugn the fact, must be met on other grounds, and it is safe to say that the various theories which have involved the denial of an actual physical resurrection of Jesus, have thus far been quite inadequate to explain the faith of the Church. This leads us to mark as the great central point of attacks upon our Gospels (4) the miraculous element in them. Here is really the battleground to-day. All sane interpreters of these records will be in sympathy with the desire to avoid an exaggeration of the miraculous. This, however, is quite a different aim from that which tries to find for every miracle of Jesus a natural though wonderful method of procedure, for example, cures of the sick through the effect of a strong personality. Both philosophy and science take issue with the statements of the Evangelists in this matter. Meanwhile the study of documents shows that even in the residuum which all critics will acknowledge genuine, the miraculous element is present, and all schools of thought are compelled to acknowledge the character of Jesus itself as a miracle. The question is not now so much one of historical evidence as it is of philosophy.

The Gospel of St. John.— From the time in 1820 when Bretschneider published in Leipsic his 'Probabilities concerning the Nature and Origin of the Gospel and Epistles of John,' modern criticism has been engaged upon the problems of the Fourth Gospel. Authorship and historicity have been the two themes about which all this criticism has centred. The best history of the course of it will be found in Watkins' Bampton lectures for 1870. The day has gone by when this Gospel can any longer be called "A Philosophic Romance" or a "Theological Novel," and even since the day when Sanday reviewed the situation in the 'Expositor' (1891-2) a distinct advance has been made toward the traditional position. Partition theories are now in order, which means that we have a Johannine nucleus of history and discourse, used by another hand (preferably that of the Presbyter John) in working up the Gospel to its present shape. (See Wendt's 'The Gospel according to St. John.' We have already called attention to the differences between this Gospel and the Synoptics. It is almost entirely in consideration of the internal evidence that "problems" have arisen, for the judgment of Matthew Arnold is valid as regards the external evidence for authorship by St. John the Apostle, that "No one who had not a theory to serve would ever dream of doubting it." In order to appreciate the serious character of these problems, it will be necessary for us to consider the purpose and plan of the Gospel.

The Purpose and Plan of the Gospel.— The purpose is given in xx. 31, "These signs have been recorded that you may believe that Jesus is the Christ, the Son of God — and that through your belief you may have life in the knowledge of him." In the "glory" (i. 14) of Jesus we are to see, his interpretation to us (i. 18) in word and deed of the Father. We are called to look at Him, behind and in His work.

At once it is evident that the author is not aiming to give us a biography, nor a complete history. It certainly is not then a contradiction of history, if he chooses his material in order to make good his purpose. That he does select his materials is beyond question. The public announcement of the Messiahship of Jesus was at the Baptism. The earlier facts of His life, therefore, have no place in this Gospel. The author begins after the Temptation, when Jesus had entered upon the way of His public ministry, and is concerned only with the events of His public life. From this time each scene is to present Him to us in some new light, that at last, in the glory of them all, we shall say with St. Thomas, "My Lord and my God." Can the Gospel with such a definite plan as this be historical? Three things must be considered in making reply: (*a*) the facts themselves, (*b*) the discourses, (*c*) the representations of Christ. How are we to adjudge facts to be facts? Manifestly, by their verisimilitude as estimated from what we know from other sources of the historical situation in which they are placed.

Take for example the first chapter or the sixth, and estimate either in this way. Personages, situation, motives, and changing temper, are all alike such as only an eye-witness could give. All through the Gospel we have such evidence of an eye-witness. As far as the facts are concerned the relation of this Gospel to the Synoptics has been set forth by no one with more helpfulness than Godet (see Introduction to his Commentary on St. John). Under the two heads of (*a*) Correlations, and (*b*) Independence, he shows how the periods containing the facts fit to each other. In some instances

St. John is more truly historical than the Synoptics as, for example, in the placing of the Cleansing of the Temple, and in the dating of the Lord's death. When we come to (*b*) the Discourses, we enter a region peculiar, indeed, to the Fourth Gospel, and one which has caused much discussion. The solution of the problem which they offer will be facilitated by bearing in mind several considerations: (1) That they are for the most part, thematic — that is, they give us only great central teachings. (2) They come to us through the medium of the author's reflection.

Westcott calls our attention to the fact "that the discourses in Jerusalem show an intimate connection with the ideas which the festivals represented, which gained their full significance as men looked back upon them from the time when they had ceased to be." It was at these times that Jesus declared the meaning of His person and office, and the great themes impressed themselves upon a mind in sympathy with such forms of presentation. But the words heard in Jerusalem were larger, richer, fuller words when written down in Ephesus many years later. They record a spiritual mind's mature conception of the Master as that mind has discovered it in memories which from the first were striking and suggestive. Have we then a subjective element in these discourses? Unquestionably. Does that subjective element imperil the truth? Not in the least. It rather gives it to us in full proportions. These discourses are not a stenographic report of the words of Jesus. They are reproductions in the clear light of the Spirit's illumination. They contain the essential, eternal verities of Jesus' teaching. Hence we expect to find them all in the style of St. John, as they are; hence we expect to find interpretation added to them here and there, as we do; hence we find them grouped at times with no clear, definite situation given to them. The solution of the problem of the discourses lies not in the denial of their historicity, but in the admission of their subjectivity. The question then presents itself, "Have we the same Christ in the Fourth Gospel as in the Synoptics?" Yes; but seen from a different point of view. The Johannine Christology never rises higher than that given in Matt. xi. 25–28; Luke x. 21–22.

Authorship.— Two characteristics appear in the writer of the Fourth Gospel. (*a*) A memory for details, and (*b*) a mature, profound conception of Jesus. They point to the work of an old man, who had been an eye-witness of what he relates. It is sufficient for the purposes of this article to say that the supposition of the authorship by John the Apostle meets more of the alleged difficulties of the Johannine problem than any other supposition. Modern criticism, however, has received with much favor the name of John the Presbyter.

Literature on the Synoptic Problem.— Gloag, 'Introduction to Synoptic Gospels' (1895); Robinson, 'The Study of the Gospels' (1902); Rushbrook, 'Synopticon' (1880); Wright, 'Synopsis of the Gospels in Greek' (1896); Hawkins, 'Horæ Synopticæ' (1899); Weiss, 'Markus-Evangelium' (1872); 'Matthäus-Evangelium' (1876); Ewald, 'Das Hauptproblem der Evangelienfrage' (1890); Wendt, 'Die Lehre Jesu' (1890); Holtzmann, 'Die Synoptischen Evangelien' (1863); 'Einleitung in das Neue Testament' (1886); Westcott, 'Introduction to the Study of the Gospels' (1895); Wright, 'Composition of the Four Gospels'; Jolley, 'The Synoptic Problem for English Readers' (1893); Sanday, 'A Survey of the Synoptic Question' (1891); 'Inspiration,' Lecture VI. (1893); Burgon, 'The Last Twelve Verses of St. Mark.'

Literature of the Johannine Problem.— Thoma, 'Die Genesis des Johan. Evan.' (1892); Ewald, 'Das Hauptproblem der Evangelienfrage' (1890); Halcombe, 'What Think Ye of the Gospels?' (1893). J. S. Riggs,
Auburn Theological Seminary

Goss, Isham J. M., American eclectic physician and author: b. Oglethorpe County, Ga 16 Aug. 1819; d. Marietta, Ga., 25 Feb. 1896 He graduated at Emory College, Ga., and in 1844 in medicine from the medical department of the University of Georgia. For fourteen years he followed the practice of the regular or allopathic profession, when he was converted to American Eclecticism and became a leader of that school in the South. Several Eclectic colleges conferred upon him the honorary degree of doctor of medicine. In 1868 he filled the chair of practice in the Philadelphia Medical University and in 1877 the chair of Materia Medica and Therapeutics in the Georgia Eclectic Medical College, reorganized that year. He wrote 'Materia Medica' (1877); and 'Theory and Practice of Medicine' (1882).

Goss, Charles Frederic, American Presbyterian clergyman: b. Meridian, N. Y., 14 June 1852. He was graduated from Hamilton College in 1873, from the Auburn Theological Seminary in 1876, and was at first a home missionary. In 1894 he became pastor of the Avondale Presbyterian Church of Cincinnati. He was also appointed to the chair of Biblical literature in Cincinnati University, and published several volumes, including 'The Optimist,' 'The Philopolist,' and 'The Redemption of David Corson.'

Goss, Warren Lee, American writer: b. Brewster, Mass., 19 Aug. 1838. He studied at the Harvard Law School, served in the Civil War, first in the United States engineers and later in the 2d Massachusetts volunteers; was historian of the National Union of Ex-Prisoners of War. He has been active as editor, magazine-writer, and author of such volumes as 'The Soldier's Story of Captivity at Andersonville' (1866); and 'In the Navy' (1898).

Gosse, gŏs, **Edmund William**, English literary critic and poet: b. London 21 Sept. 1849. From 1875–1904 he was translator to the Board of Trade and since 1904 has been librarian to the House of Lords. In 1884–5 he lectured in the United States. He has made a special study of Scandinavian literature, and has published 'Studies in the Literature of Northern Europe' (1879). Other works of his are: 'Life of Gray' (1882); 'Seventeenth Century Studies: a Contribution to the History of English Poetry' (1883); 'From Shakespeare to Pope: an Inquiry into the Causes of the Rise of Classical Poetry in England' (1885); 'Life of Congreve' (1888); 'History of Eighteenth Century Literature' (1890); 'Life of Philip Henry Gosse, Naturalist' (1890); 'Gossip in a Library' (1891); 'Questions at Issue' (1893);

'The Jacobean Poets' (1894); 'Critical Kit-Kats' (1896); 'History of Modern English Literature' (1897); 'Life and Letters of Dr. Donne' (1899); 'Coventry Patmore' (1904). He has written a romance, 'The Secret of Narcisse' (1892); and several volumes of poems: 'Madrigals, Songs and Sonnets' (1870); 'On Viol and Flute' (1873); 'King Erik,' a tragedy (1876); 'The Unknown Lover,' a drama (1878); 'New Poems' (1879); 'Firdausi in Exile and Other Poems' (1886); 'In Russet and Silver' (1894); 'Collected Poems' (1896).

Gossyp'ium. See COTTON.

Gossypium Phospho, a valuable fertilizer composed of a mixture of cotton-seed meal and pulverized phosphate rock. The making of this fertilizer is an important industry in the South, where one factory has an output of 15,000 tons annually. The phosphate rock, which comes from South Carolina, passes through huge mills of great power, and is ground into a fine powder, after which it is carried through draft pipes to the top of a six-story tower, and there undergoes a process of refinement. The rich yellow meal which comes from the cotton-seed oil-mills is mixed with the ground phosphate, and adds materially to its strength as a fertilizer. The mixture thus obtained is collected into immense bins, and treated with sulphuric acid, assuming a semi-liquid state. It is then called gossypium phospho.

Gotha, Almanach de. See ALMANAC.

Go'tham, a parish of Nottinghamshire, England. The people obtained a reputation for stupidity and simplicity, and the satirical appellation of "the wise men of Gotham," owing to the tradition that King John journeyed through the town for the purpose of selecting a site for a palace, and the inhabitants not wishing to be burdened with the expenses of a royal residence, devised the plan of appearing stupid and foolish during the visit of his majesty. King John left in disgust; whereupon the Gothamites said: "More fools pass through than live in Gotham." The name Gotham is applied also to the city of New York. Thus used it appeared first in 'Salmagundi,' by Washington Irving and James K. Paulding. The authors may have had in mind the worldly wisdom of the city's inhabitants.

Gothenburg (gŏt'ĕn-boorg) **System,** a system of regulating the sale of spirituous liquors which had its origin in 1865, in Gothenburg, Sweden. A company is granted a monopoly of the sale of liquors in the town; managers at fixed salaries are placed in the public-houses, and after paying the expenses, and dividends not exceeding 6 per cent to shareholders (in Norway 5 per cent), the remainder of the profits are placed in the town treasury for the use of the general government and the agricultural society of the province. In Norway the profits, above the 5 per cent to shareholders, go to educational and charitable institutions. The system has been introduced into several towns in Sweden, Norway, and Finland. In the places where the system has been tried the number of drinking places has been lessened, the laws regarding the sale of liquors to minors and confirmed drunkards have been more rigidly observed; but the temptation to increase the revenue has in some places not promoted temperance.

Go'thia, the empire of the Visigoths, or Western Goths, which extended over Spain, and included Septimania, the territory which Theodoric held in Provence; Gaul, and the cities of Carcasonne, Narbonne, and Nimes. These he left to his son Amalarich, who, however, permitted Spain to be under the charge of the Gothic general Theudes, by whom he was eventually murdered. In the reign of Leovogild the kingdom of the Visigoths reached its climax of prosperity. He established his capital at Toledo (569–685) and encouraged art and literature. His sons Reccared and Ermengild were associated with him as co-regents. Ermengild, on becoming a convert to the Nicene faith as professed by Rome, was degraded from all dignity and imprisoned; he was promised his restoration on condition that he renounce the Catholic creed; refusing, he was put to death and was formally canonized in the 16th century by Pope Sixtus V. On the death of Leovogild, Reccared made profession of the Nicene creed, renounced Arianism, and he and his people became more closely amalgamated with the Gallic and Iberian peoples among whom they lived. In the course of the 7th century the Roman Catholic Church reached great power in the Visigothic state and ecclesiastical officials had the preponderating vote in the election of kings. Three sovereigns, Swinthila (620–631), Kindaswinth (641–649), and Wamba (672–680) tried to assert their independence, but each paid for his rashness by the loss of his throne. Witica (701–710) tried to remedy civil and ecclesiastical abuses, but the clergy opposed him, and the Gothic kingdom was already in a condition of deep decadence when the Moors arrived and defeated Roderick, his successor, on the banks of the Guadalete, August 711.

Gothic Architecture. The term Gothic implies barbarous, rude, uncivilized. It was applied by the writers of the 15th and 16th centuries, who, wishing to restore the Greco-Roman art to complete supremacy in Europe, thought to depreciate the style which it would replace. It is a most extraordinary instance of the ready adoption by the admirers of a style of a term first used contemptuously, for the term is in use in most languages in Europe. This is the style which followed the Romanesque architecture of Europe, rising out of it and being, in fact, Romanesque architecture with the addition of vaulting by means of ribs. This constructional change, introduced about 1165 in the royal domain of France, is explained under ARCHITECTURE. The improvement brought with it immense facility in vaulting internal spaces of irregular form; but inasmuch as in this way the whole thrust outward and horizontally was concentrated on a few definitely marked points, it became necessary to develop the buttress system (see BUTTRESS) and to make those masses of masonry very large and wide in the direction of the thrust. So it was that buttresses became what we see them in the choirs and apses of Gothic cathedrals — pieces of carefully built stone wall radiating from a common centre or, at least, forming a right angle with the general exterior wall of the church, their greatest dimension in the direction of the thrust coming from within.

and therefore they are much longer in-and-out than they are wide in the direction parallel to the wall. This, however, is merely the essential construction. Connected with this there arose many surprising changes. Thus the pointed arch, which had been well known in the eastern lands of the Mediterranean, which the crusaders must have seen in Egypt and Syria, and which was not unknown in the Romanesque architecture of France, became now an almost inevitable form, because these ribs of the vault could not be made to take perfectly circular curves across the open space from one point of support to another. They had to be made up of broken curves, that is, of two curves meeting one another at the apex or crown, and in this way the pointed arch would have originated had it not existed before. The Gothic style, however, adopted it as a decorative adjunct, treating all the external openings — windows, doorways and the separate members of arcades — with the pointed arch, and its decided and picturesque character soon affected the whole structure. Even where there was no vaulting, as in a dwelling house with floors of timber made of horizontal beams, window and door openings were still very commonly closed with the pointed arch.

As for the great height of the churches, that originated in the strong desire felt by the builder to get huge windows above the aisle roofs, that is to say, in the walls of the clearstory. The plan of the Gothic church being that of a high middle hall with much lower aisles, it was found that the windows in the walls of those aisles could not illuminate properly the whole interior. Moreover, it became a common practice to build chapels outside of the aisles, so that what had been windows became doorways leading from the aisles into the chapels. The clearstory windows, then, were almost the only light-giving openings, and as, in a moderate-sized church, the aisle would rise perhaps 16 feet to the spring of the vault and 28 feet to the crown or summit of the vaulting, the sloping roof of the aisle would rise at least 10 feet higher still, making a total of 38 feet to the sill of the windows which we wish to build in the clearstory. But those windows having their heads brought down to the shape of the pointed arch because they are crowded on both sides by the vault of the roof, will need to be at least 20 feet high to where their arch begins; so that in the small church which we are imagining here the height of the nave will be at least 130 feet. These would be the proportions of a Gothic church whose nave would be only 30 feet wide. But the great cathedrals had naves about 50 feet wide, and in consequence they would be from 170 to 175 feet high to the crown of the vault; and it may be repeated here that this vast height resulted in the first place from nothing more remote than the desire to get adequate space for windows. Of course in the end rivalry had something to do with it, and there is no doubt that a city starting a new cathedral had some pleasure in thinking that it would be higher and also wider than the churches of neighboring cities. The tendency to great height and to upward pointing masses is none the less a marked feature of Gothic art, and in connection with this the splendid Gothic towers must be considered, for they were always supposed to be roofed with sharply pointed spires. (See Tower, Spire.)

The necessity for the great windows mentioned above was still more evident as stained and painted glass became more splendid in effect and therefore involved a diminution of the daylight which could pass. These colored windows formed one of the special glories of Gothic art, and are, indeed, the most brilliant and also the most original decorative invention of the Middle Ages. (See Glass.) Another result of the great windows was the window tracery which supported the glass, that is to say, the invention of elaborate patterns wrought in the stone bars which divided up the immense windows. One window in Carlisle Cathedral is 27 feet wide. It is divided by vertical bars of stone into nine separate "lights," and these bars unite at the top of the window to produce an elaborately woven structure of beautiful effect.

Connected with this very surprising and unexampled system of building, the sculpture became surprisingly rich. That of the Romanesque churches had been, especially in France, very rich and varied, with splendid use of vegetable forms in leaf and flower, and a clever and picturesque employment of animal forms treated often in a very grotesque way. This was developed immensely by the Gothic stone-cutters, and by the middle of the 13th century there had taken shape a system of decorative sculpture the most admirably calculated to set off and adorn the structure itself, which the world has ever seen. In comparison with this, Greek architectural sculpture was ill adapted to its purpose as an adornment for magnificent buildings; and unequaled as were the Greek treatment of natural forms and power of design in pure sculpture, their art never undertook seriously the problem of decorating buildings. The Romans, in their sculpture of triumphal arches, set themselves more deliberately to the task of inventing an architectural sculpture, but never approached the variety, the richness and intrinsic interest of that of the 13th century.

Returning now to the structure of a Gothic church, it is to be noted that if we study the cross section of a church we shall see at once how the whole building is conceived. A very high middle hall is vaulted with stone. The vertically acting weight of that stone roof is supported on very slender stone pillars, but the thrust outward, nearly horizontal, is resisted by a strange structure called the flying buttress (q.v.). On either side of that hall is a much lower aisle, also vaulted, and the vault of this lower compartment thrusts inward against the great pillar which carries the high middle vault and also outward against the buttress built to receive it. Now what resists the inward thrust of the aisle vault? Nothing but the enormous weight of the load put upon the pier. This pier, standing between the middle hall and the aisle, would be pushed inward by the thrust of the aisle vault but for this superincumbent pressure; and the whole vertical height of that pillar somewhere from 120 to 180 feet may be relied upon to prevent that dislocation of its lower part, because all disturbing sideway thrust at the top is taken care of by the flying buttress. It is a wonderful structure for absolutely unscientific men to have worked out. It was, as can be shown, a matter of experiment. Engineering was as far as possible from being within the conception of the Gothic builders; for engineering is the application of mathematical computation to building, and the stone-cutters of the Middle Ages had no algebra, little arithmetic and only a feeble notion of geometry. Mathematics was in its infancy in the 12th century, and we cannot suppose that any of the great builders of that time knew how to compute the thrust or the weight of his building by any calculation whatever.

The history of Gothic architecture may be briefly stated as follows: During the years from 1180 to 1300 it spread all over what is now France; over the British Isles as far as they were civilized and prosperous; over the Low Countries at the north and Spain at the south, where, indeed, French architects were much employed; over the whole Rhine country except that the magnificent round-arched cathedrals of that region caused a certain stand to be made in favor of the original Romanesque; and over the more eastern countries of Europe in so far as Christian church-building was carried on freely. Some beautiful Gothic work was done in Hungary, Bohemia, and the lands on the Baltic. Italy alone received the style from the north with reluctance. The churches built for certain convents and monasteries in the 13th century were indeed completely Gothic of the Burgundian school — buildings as faultless in style as those of the north; but great cathedrals which were wholly out of the control of the conventual orders were built in a curious mixed style which we call "Italian-Gothic" and which needs to be designated by some such compound term. The Italians, with their classical and Greco-Roman affiliation, and the natural love of the southerner for broad, unbroken surfaces and rather dark interiors, would accept neither the huge windows of the true Gothic structure nor yet the system of buttresses and flying buttresses which made the exterior so picturesque, but also so irregular and diversified. They insisted on abundant space for wall paintings, for the putting up of wall tombs and relief sculpture of various forms, and for the decoration of the external walls by mosaic, flat carving in low relief and bands of parti-colored material. In this way there grew up the astonishing cathedral churches of Siena, Orvieto, Monza, Verona, and especially of Florence, and a great number of churches of the second rank, infinitely interesting on account of their beauty of detail, each one serving almost as a museum of lovely works of art, but never satisfactory as logical and complete structures in a coherent style. The style culminated in the great church of S. Petronio, at Bologna, a vast church which was begun about 1300 with the purpose of making it by much the largest church in Italy.

The epoch from about 1400 to 1520 was the time of the flamboyant or florid Gothic. The term flamboyant is properly applied only to the French buildings which have a curious flame-like tracery. In the partial abandonment of the system of ribbed vaulting, the style had lost its main reason for being, for although this was used in many churches, it was also neglected in others, where a solid cut-stone vault was used. The decorative form retained the common influence of the pointed arch, but the sections of moulding, the form of sculpture, the main masses of the building, became very much modified and always in the direction of extreme energy and even excessive picturesqueness. Those were the days of the magnificent towers covered with elaborate pinnacles to the very top, such as Antwerp in Belgium and Strasbourg on the Rhine. Those were the days of splendid porches covered with elaborate sculpture and having very noble statuary included in their adornment. It is a splendid style and lacks only the close coherence of decoration with the structure to receive unbounded admiration. The splendid town houses in the cities in Flanders, Hainault and Brabant form the culminating points of the style in civic architecture. A variety of flamboyant Gothic exists in Spain, which is of astonishing beauty and interest. In England the Tudor style (see TUDOR ARCHITECTURE) increased in popularity through the reigns of Henry VII., Henry VIII. and Elizabeth, and was completed by the introduction of fan-vaulting, the most beautiful architectural invention of the English, and the most original invention of the 16th century.

Gothic architecture disappeared on the complete admission of the classical style imported from Italy. This took place throughout the north of Europe as early as 1520, except in England, where throughout the period which we call Elizabethan and Jacobean there were occasional attempts at building in a mediæval way, usually in connection with previously existing buildings. In England, too, the close of the reign of James I. (1625) found a completely established classical style.

From that time on nothing was done until in the nineteenth century the study given to mediæval buildings was undertaken seriously by archæologists in the single direction of artistic curiosity, and by adherents of one or another Christian church or sect because of a supposed connection between the church and the Gothic style. It was in England that the most decided movement took place. It is known as the Gothic Revival, and has been the subject of much study in illustrated volumes and in the periodicals. As early as 1845 attempts were being made to build in the Gothic way; by 1855 much more was known of the style, and such buildings as the Oxford Museum and St. George's Church at Doncaster were built. Those two buildings represent two opposite types, the church being a faithful reproduction of a bygone style, the museum a new study of that style much recast and reshaped for the new requirements. The most important modern building in the mediæval style was the Westminster Palace or Houses of Parliament. These were, by special act of Parliament, required to be "Gothic or Elizabethan" in character, and the architect, Charles Barry, afterward made a baronet, adopted the latest of all styles that could possibly be called mediæval, that is, the Tudor style. Churches, especially those of the Church of Engand, were and still are almost exclusively built in some form of Gothic: and for thirty-five years, more or less, public buildings also were frequently designed in that way, but this tendency has disappeared. For the result of this movement see ARCHITECTURE. For the use of Gothic architecture in the United Stated see ARCHITECTURE, AMERICAN.

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RUSSELL STURGIS,
Author of 'Dictionary of Architecture.'

Gothic Art. The art of the times and the countries in which Gothic architecture flourished. The term is a misnomer, because even if the architectural style were rightly designated "Gothic," the wall-paintings, metal work, etc., of the time are not properly so described. Still no other term exists for those arts which prevailed in Europe from 1150 to the beginning of the Risorgimento in Italy (about 1375), and in the North until the decided beginning of the Renaissance (about 1500). There are certain arts of decoration which flourished in a wonderful way during this period, while others attained little excellence. Thus the pottery of the north of Europe and even of Italy during the period named, has never attracted much interest in modern times; very few examples of it remain, and what little there is that is effective in an artistic sense is decidedly Oriental (Saracen and Moslem) in character. Glass, too, is of little interest except in connection with windows, and apparently few glass vessels were made during the Middle Ages. On the other hand, metal-work was of singular interest. Bronze was not as common as it has always been in the East and as it was to be in Europe at a later period, but wrought iron reached a splendid development in the gratings, gates, window-bars, etc., of buildings, and in the singular enclosures made for tombs. Brass was cast in large sheets and hammered smooth and then engraved with arms and legends befitting the burial slab of a knight or noble lady; silversmiths' work was carried to a high pitch of excellence, and the common use of colored enamels applied to both bronze and to silver made the ecclesiastical implements and sacred vessels of the time extremely rich. Toward the close of the Middle Ages the complete plate armor of the nobles received a splendid decoration by means of reliefs and embossings, and by gilding in patterns and etching with acid. Very beautiful stuffs were hardly ever woven in Europe during this period; for splendid weaves France, Germany, and England sought the East; but the cloths and linens of the time were good and the common use of embroidery made the costume of the wealthy very splendid. The beauty of the costume, both in color and in form, affected the sculpture of the time; for, as the nude was hardly ever represented, the drapery of the figures became the chief object, with expression of face and gesture, of the architectural sculptors of the day. Both form and color were used freely in the beautiful ivory carvings which were richly painted and gilded.

Sculpture in connection with architecture is treated above. In the semi-architectural conditions of tombs and cenotaphs, life-size statues, usually recumbent, are found as early as the 13th century. These are of marble and other stone; and it is quite well ascertained that great numbers of statues in hammered bronze richly decorated with enamels existed at one time in the churches of western Europe; these also being of life-size for the most part. The raised chest or what seems the sarcophagus, the huge stone box which gives the name of altar-tomb to these monuments, often had its sides pierced with niches, and these occupied by statuettes of religious or symbolical meaning, and often of great beauty. The carvings of decorative objects are of great variety, such as mirror backs and boxes to contain small mirrors, panels of book covers, and statuettes of sacred subjects, sometimes 15 inches or more in height, in addition to elaborate bases upon which they stand.

Painting in the highest sense of the word, that is, the representation of human life and human sentiment, was used with reserve because it had to be applied either to the walls of the church and the palace, or to the vellum pages of a manuscript book. On this account we hardly think of the paintings of the Middle Ages as having led up to that of modern times; we think rather as the origin of modern work of the painting of the 14th century Italians, who themselves derived much of their art directly from Constantinople. Still there was a great skill showing itself in those two ways, and the comparatively few remains which exist in France and Germany of the paintings on walls and vaults during the years before 1500 are worthy to be compared with the splendid miniatures in the manuscripts. These last are not always religious; some manuscripts were of history and poetry and the illustrations given to those books were in keeping with their subject. There had been a great destruction of these splendid manuscripts, but many remain in public and private collections, and modern books have been devoted to their study and to the reproduction of their finest paintings. The special achievement in the art of decoration was in the brilliant windows of the time, but for this subject see GLASS, also GOTHIC ARCHITECTURE and WINDOW.

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RUSSELL STURGIS,
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Gothic Language, the language of the Goths, a member of the Teutonic branch of the Indo-European family. It is known through a Visigothic Bible translation of the 4th century A.D. The earliest historical indications concerning the home of the Goths place them along the lower course of the Vistula in modern Poland and Prussia between Warsaw and Dantzic. Here they remained as late as 150 A.D., but early in the following century, having been dislodged probably by the movements of their Hunnish neighbors, they appeared to the north of the lower Danube and on the northwestern shore of the Black Sea in modern Rumania and southwestern Russia as far east as Odessa. To the west on the Danube were the Visigoths, to the east, in southwestern Russia, the Ostrogoths. In 251 they defeated the Emperor Decius at Philippopolis, but in 270, after various incursions into Thrace and Greece, were driven back to their seat north of the Danube. They were known to the ancient historians and geographers as Gotones or Gothones, and later as Gothi, which points to the native name Gutans, or Gutos.

The only extant monuments of the language are: (1) Portions of a Bible translation, of a paraphrasing interpretation of the Gospel of John, and of a calendar contained in fragments of manuscripts written in Italy in the 6th century, presumably by Ostrogoths. (2) The signatures of Gothic witnesses on two Latin records or receipts, one at Naples, one formerly at Arezzo; the originals of which are now lost. A few Gothic words and names of alphabetic symbols in a Salzburg MS. now at Vienna. (3) A few Gothic words in a Latin epigram, a large number of proper names from Greek and Latin sources, and in old Spanish documents and inscriptions. (4) The scanty records of a Gothic language, probably Ostrogothic, preserved as late as the 16th century in the Crimea. The Bible translation, of which there remain portions of Matthew, Mark, Luke, John, Romans, 1 and 2 Corinthians, Galatians, Ephesians, Philippians, Colossians, 1 and 2 Thessalonians, 1 and 2 Timothy, Titus, Philemon, Esdras, Nehemiah, is associated always with the name Ulfilar or Ulfilas. He was probably himself a Goth, born about 310 A.D., made bishop of the Goths 341, removed 348, with a large body of his followers avoiding persecution, into Mœsia, south of the Danube; died 380 or 381, Ulfilas not only did the work of translation, probably of the entire Bible, but he invented an alphabet for it, using as a basis the Greek uncial alphabet of his time with preservation of its order, as well as of the numerical and phonetic values of the letters. He adapted it, however, to its purpose by the use of forms taken from the Latin and Runic alphabets, creating a system better for the purpose than either of the three.

The inflexion of nouns is distinguished by its relatively close approach to the original Indo-European system. Of the cases it preserves nominative, vocative, genitive, accusative, and dative, the latter including the original instrumental and locative, and to some extent the ablative.

In the remarks that follow we shall take the German and Latin as the bases of comparison. The Gothic article is as follows: *sa,* der; *so,* die; *thata,* das; gen. *this,* des; *thizos,* der; dat. *thamma,* dem; *thizai,* der; accus. *thana,* den; *tho,* die; *thata,* das; pl. masc. *thai,* fem. *thos,* neuter *tho,* die; gen. *thize,* der; dat. *thaim,* den; accus. *thans, thos, tho,* die. There are four cases, nominative, genitive, dative, and accusative; the ablative is only the dative with prepositions. The declensions are as follows: *a.* Strong: *fisks* (Lat. *piscis,* Germ. *Fisch,* fish), *fiskis, fiska, fisk;* pl. *fiskos, fiske, fiskam, fiskans.* *b.* Weak: *hairt-o* (Lat. *cor, cord-is,* Germ. *Herz,* heart), *-ins, -in, -o;* pl. *hairt-ona, -ane, -am, -ona.* Examples of promiscuous cases: *galaubein-as* (Germ. *Glauben-s*); *ahm-an* (Lat. *animum,* Germ. *Athem*); *hand-au* (dat. *Hand*), *-uns* (*Hände*), *-um* (*Händen*); *manag-eim* (dat. pl. *Mengen*); *vastjōs* (Lat. accus. pl. *vestes*); *sunus* (son), *-aus* (Germ. *Sohn-es*), *-au* (*Sohn-e*), pl. *-jus* (*Söhn-e*), etc.—Adjective: *gamain-s* (Germ. *gemein-er,* Lat. *communis*), fem. and neuter, *-a*; comparative degree: masc. *-za,* fem. *-zie,* neuter *-zo;* superlative: *-sts, -sta, -st.* Irregular: *gōda* (good), *batizo* (better), *batists* (best); *ubils, vairsiza* (evil, worse); *mikels, maizo, maizists* (Lat. *magnus, major, maximus*); *leitil, minniza, minnists* (*parvus* [little], *minor, minimus*). The numerals are: 1, *ains, aina, ain;* 2, *tvai, tvos, tva;* 3, *thrins;* 4, *fidvor, fidur;* 5, *fimf;* 6, *saihs;* 7, *sibun;* 8, *ahtau;* 9, *niun;* 10, *taihun, -tig;* 12, *tvalib, tvalif;* 20, *tvaimtig;* 30, *thrinstiguns,* etc.; 80, *ahtautehund;* 100, *hund;* 200, *tvahunda,* etc.; 1,000, *thusund.* Some of the pronouns are: *Ik, thu, is* (fem. *si,* neuter *ita;* Lat. *is, ea, id*); *meina, theina, izes* (*mei, tui, ejus*); *mis, thus, imma* (*mihi, tibi, ei*); *mik, thuk, ina* (Germ. *mich, dich, ihm*); dual. *vit, git* (we two, ye two); gen. *ugkis, igqvis* (of us two, etc.), etc.; *iains, silba, unsar, hveleiks, hvas,* etc. (Germ. *jener, selber, unser, welcher, was*). Examples of verbs: *visan* (Germ. *Wesen,* Lat. *esse*); *im, is, ist, siium, siith, sind,* (*sum, es, est; sumus, estis, sunt*); *vas, vast, vas, vesum, vesuth, vesum* (*fui, fuisti,* etc., Eng. was; future: *siiau, siiis, siiai,* etc.; *vairthan* (Germ. *werden*), *sōkian* (Lat. *sequi,* Germ. *suchen*) etc. The following verb is compared with Sanscrit and Latin: *bair-a* (Sans. *bhārā-mi,* Lat. *fer-o*),*-is* (*-si, -s*), *-ith* (*-ti, -t*); dual. *bair-aus* (Sans. *-ias*), *-ats* (*bhārā-tas*); it has no 3d person (Sans. *bhārē-tam*); pl. *bair-am* (Sans. *bhārā-vas,* Lat. *fer-i-mus*), *-ith* (*bhārā-tha, -tis*), *-und* (*-orti, -unt*); passive or middle: *bair-ada* (Sans. *bhār-ē,* Lat. *fer-or*), *-aza* (*-asē, -eris*), *-ada* (*-atē, -tur*), etc. The following are some of the adverbs, prepositions, and conjunctions: *aiv,* ever; *thar,* there; *her,* here; *iup,* upward; *uta,* outward; *af,* of; *at,* to; *fram,* from, of, for, since; *gau,* if; *inthammei,* whereas, Germ. *indem* (in that), etc.

Gothic Literature, the literature of the Goths, represented chiefly in the version of the Scriptures by Ulfilas, born in Cappadocia about 318, whence he was taken, together with his family, by the Goths, into Mœsia, became their second bishop about 348, and is considered as the translator of almost the whole Bible into Gothic (between 360 and 379). The *Codex Argenteus* (rather *Aureus et Argenteus*), containing a portion of the Gospels, translated by Ulfilas, with capitals of gold foil and the other letters of silver foil, deeply impressed into very fine vellum of a violet color, was made for the use of a Gothic king. It was a part of the plunder taken either by Clovis (507) from Toulouse, after the defeat of Alaric II., or by Childebert from King Amalaric (531). Anton Morillon, secretary to Cardinal Granvelle, found it in the monastery of Werden, near Cologne. Thence it was sent to Prague, and thence to Stockholm by Count Königsmark, after the storming of that city. Vossius, on visiting

Queen Christina, became its possessor (1655), and carried it to Holland, where it was purchased by Pufendorf (1662) for Count M. G. de la Gardie, chancellor of Sweden, who presented it to the University of Upsala (1669), having enclosed it in a silver case. It contained originally 640 pages, only 320 of which were legible in 1670, and a dozen leaves were purloined even of this remnant. Erik Benzel produced a splendid edition of it, and it was subsequently republished by Fr. Junius (Dort 1665), Georg Stiernhielm, from an exact transcript of the original by Derrer, which was burned at Upsala in 1702 (Stockholm 1671), and Edward Lye, from Benzel's edition (Oxford 1750). Johan Ihre, assisted by Sotberg, published a treatise on it, 'Ulphilas Illustratus' (Upsala 1752–5), and 'Fragmenta Versionis Ulphilanæ' (1763), which were reprinted by Dr. A. F. Büsching under the title 'Scripta Versionem Ulphilanam et Linguam Mœso-Gothcam illustrantia' (Berlin 1773). The version of the Bible was probably continued by others after Ulfilas, and the contents of the silver codex itself were revised in Latin versions. Fr. Ant. Knittel found at Wolfenbüttel (1756) a palimpsest with Gothic fragments of the epistle of Paul to the Romans (*Codex Carolinus*). Angelo Mai and Carlo Castiglione discovered at Milan five palimpsests, containing parts of Matthew, the epistles of Paul almost complete, some fragments of Ezra and Nehemiah, of a Gothic calendar, and of a homily. Castiglione edited the fragments of the epistles of St. Paul (1829–39). The epistles to the Hebrews and the Corinthians, the Apocalypse, and the Acts of the Apostles are wanting; but it is not known whether they were ever transalted into Gothic. Gothic signatures of names on documents were found at Naples (in the inscriptions of Donis), of which facsimiles were published by Sierakowsky and Massmann (fol., Vienna 1838). But the 'Gothicon' of Constantine Porphyrogenitus (lays sung at court by circus riders dressed in the garb of Goths, accompanied by the pandura, a sort of lyre), and the inscription on a yard-stick, are not genuine Gothic.

Goths, an ancient Teutonic tribe, whose earliest known home was the shores of the Baltic, between the Vistula and the Oder, where they were living in the 1st century after Christ. Thence they migrated in the 3d century to the regions adjoining the Black Sea. Many other tribes were incorporated with them, and by continual advances and conquests they established, under Ermenric (about 350), the great Gothic kingdom, extending from the Black Sea to the Gulf of Bothnia. This naturally brought the Goths into continual contact, on the west with the western Roman empire, and on the east with the eastern empire as centred at Constantinople. About the year 369 internal commotions produced the division of the great Gothic kingdom into the kingdom of the Ostrogoths (eastern Goths), on the shores of the Black Sea, from the Don to the Dnieper, and the kingdom of the Visigoths (western Goths), from the Dnieper to the Danube. About the year 375 vast multitudes of the Huns and of the Alans, which latter had been subdued by the Huns, poured out of Asia, and drove back the Ostrogoths upon the Visigoths. The Goths obtained permission from the Emperor Valens to settle in Thrace, but were driven to rebellion by the oppression of the imperial governor. In the war which ensued Valens himself was defeated and slain by them at Adrianople in 378. The Emperor Theodosius incorporated the Gothic army into his legions, and henceforth they had an important influence in the affairs of Constantinople. After many vicissitudes the Ostrogoths obtained a settlement in Pannonia and Slavonia, but not till the destruction of the kingdom of the Huns in 453. The Visigoths in process of time obtained a degree of power which excited alarm in Greece and Italy. In 369 Alaric made an irruption into Greece, laid waste the Peloponnesus, and became prefect of Illyria and king of the Visigoths. He invaded Italy about the beginning of the 5th century, and by that measure brought on the destruction of the Roman empire, since Stilicho, the Roman general, could only obtain a victory over Alaric at Verona (in 403) by withdrawing all the Roman troops from the borders of the Rhine. Alaric himself soon returned to Italy, and sacked Rome in 409, and a second time in 410. In 552 the Goths in Italy were finally overthrown in battle and expelled from the peninsula by Narses, general of Justinian. The Visigoths succeeded in establishing a new kingdom in the southern parts of Gaul and Spain, of which, toward the end of the 5th century, Provence, Languedoc, and Catalonia were the principal provinces, and Toulouse the seat of government. The last king, Roderick, died in 711 in battle against the Moors. Since the time of Constantine, Christianity appears to have taken root among the Goths, whence a Gothic bishop is mentioned as present at the Council of Nicæa, 325 A.D. Their form of Christianity was Arian, like that of their protector Valens, and their bishop Ulfilas. The introduction of Christianity among these Goths, and the circumstance of their dwelling near and even among civilized subjects of the Roman empire, greatly contributed to raising them in civilization above the other German tribes. See GOTHIC LANGUAGE; GOTHIC LITERATURE; GOTHIA; OSTROGOTHS; SEPTIMANIA; ULFILAS; VISIGOTHS.

Gottenburg, gŏt'ĕn-boorg, **Gothenburg**, or **Göteborg** (Swedish *Göteborg*, or *Götheborg*; Latin, *Gothoburgum*), Sweden, seaport, the second in the kingdom in respect to population and trade, capital of the county of the same name; situated on the Gota, five miles from its mouth, 255 miles west-southwest of Stockholm. It has a dry dock cut out of the solid rock; and the completion of the Gota canal, and also the railway facilities have greatly increased its commercial importance. Although founded in 1618, by Gustavus Adolphus, the town, in consequence of numerous fires, is quite modern,— the streets are at right angles and the houses well built. The manufactures include iron, steel, machinery, sail-cloth, linen, and leather, and there are oil-presses, cotton-mills, dye-works, and building-yards, at which a considerable number of vessels are launched; the most important industrial establishments are tobacco factories, porter breweries, and sugar-refineries. The trade is very extensive, the harbor being excellent and generally free from ice. Its commercial importance dates from the Continental blockade of 1806, when it became the chief British depot in northern Europe. The chief exports are iron and steel, copper, wood, tar, linseed, bark, bones, juniper berries, cranberries, and manufactured articles; the chief imports grain, sugar, coffee, tea, wine, salt, seal-oil, cotton yarn, and twist. Among social reforms the town is noted for its licensing system (see GOTHENBURG SYSTEM). Pop. (1897) 117,103.

Götterdämmerung, gĕt"tĕr-dĕm'mĕ-roong, «the twilight, or gathering nightfall of the gods,» the title of Wagner's closing opera in his Nibelungen cycle of dramas. The subject of the opera is what is called in Scandinavian mythology the *Ragnarok*, or end of the world. This was brought about largely by the admission of Loke, the god of evil and mischief, into Asgard, the abode of the gods. It was through Loke that Balder, the bright and good god, was slain and flung down into the abodes of Hel, the goddess of death. Confusion throughout the universe is the consequence. The sun and moon are swallowed by giants; continuous winters rage without an intervening summer; the earth trembles in the throes of earthquakes. Mountains topple down with a crash; the Fenriswolf breaks its chains and fetters. The Midgard serpent writhes to get free; the ship Naglfar, built of the finger-nails of dead men, passes over the sea, filled with giants of the frost and mountain; Loke leads the hosts of Hel and bursts upon the scene. The powers of evil rush to the battlefield Vigrid, while Heimdal blows his Gjallarhorn, Odin seeks the giants for advice, the other gods as well as the heroes of Valhal arm themselves and sally forth, and the battle begins. While the fight is still raging the immortal god Surt flings light and flame over the world, and the earth, reduced to ashes, sinks beneath the watery waste. See NIBELUNGENLIED; RAGAROK; and SCANDINAVIAN MYTHOLOGY.

Gottfried (gŏt'frēd) **of Strasburg**, German poet: probably b. Strasburg about 1200. He was not, like most of the Minnesingers (minstrels) of his age, a noble. Besides many lays, he was the author of the great chivalric poem, 'Tristan und Isolde,' derived from a Welsh original, but possessing as much originality of character as any other German classical work. For grace, elegance, and vivacity of description, richness of coloring, and melody of versification, this work stands alone in old German literature.

Gottheil, gŏt'hīl, **Gustav**, American rabbi: b. Pinne, Posen, 28 May 1827; d. New York 15 April 1903. Following in his boyhood the studies prescribed for Jewish youth, he was fortunate in broadening his education at the universities of Berlin and Bonn. In 1855 he was elected assistant rabbi at the Berlin Reform Temple, thus early showing his progressive tendencies. In 1861 he received a call to the Congregation of British Jews, Manchester, England, where he spent 13 years of effective work. In 1873 he was invited to the Temple Emanu El, of New York, first as assistant to Rev. Dr. Samuel Adler, and then, on the latter's retirement, as sole rabbi. In his new field his activity rapidly developed along the lines of education and benevolence. Under his personal impetus the Emanu El Preparatory School and the Jewish Ministers' Association were founded, and continued for some years. He organized the Emanu El Sisterhood of Personal Service, which, adopted by many other Congregations, has become a successful feature of communal benevolence. His voice and pen were largely enlisted in behalf of Judaism and the liberal movement, and he was often heard in Christian churches, while Christian clergymen occasionally occupied his pulpit. A favorite speaker at public gatherings, his enthusiasm, sympathy, and broad culture did much to win recognition for his co-religionists. In his last years he was an ardent champion of Dr. Herzel's movement to secure a place of shelter for persecuted Jews, the latest development of the Zionistic idea. Apart from contributions to a few magazines and reviews, his published works were a hymn book and 'Sun and Shield,' a book of daily devotion, in both of which he drew largely from non-Jewish sources.

Gottheil, Richard James Horatio, American Semitic scholar: b. Manchester, England, 13 Oct. 1862. He was graduated from Columbia in 1881, studied also at Berlin, Tübingen, and Leipsic, and became professor of Semitic languages in Columbia, director of the Oriental section of the New York public library, and (1898) president of the American Federation of Zionists, of whose principles he is an active exponent. He is also a member of the central committee of the general organization. He became an editor of the 'Jewish Encyclopædia' in 1901, and published 'The Syriac Grammar of Mar Elia of Zobha' (1887). He is a son of G. Gottheil (q.v.).

Göttingen, gĕt'tĭng-ĕn, Germany, town in the Prussian province of Hanover, in the valley of the Leine, 59 miles south-southeast of Hanover. It is a place of great antiquity, and was once famous for its fortifications. It contains a noted university, founded in 1734. Göttingen belonged to the Hanseatic League and enjoyed great prosperity until the Thirty Years' War. The manufactures consist chiefly of a few woolen tissues, tobacco, leather, paper, books, and philosophical instruments. Pop. 30,293.

Göttingen, University of, or **Georg-August University**, a German institution, was founded by George II. of England, known also as Georg August, elector of Hanover. The plan of the school was outlined as early as 1732, was established in 1734, and opened in 1737. Its popularity decreased after the expulsion of the seven professors: Albrecht, Dahlmann, Ewald, Gervinus, the two Grimms, and Weber, for political reasons, but it has recovered itself since 1866, and in 1901–2–3 it had an average attendance of over 1,000 students, and several eminent names among its professors. The principal building, to which William IV. of England contributed £3,000, was completed in 1837. Connected with the university are a museum with extensive and valuable collections, an observatory, a well-equipped school of anatomy, botanical gardens, and a library of about 500,000 printed volumes and nearly 6,000 manuscripts. It has also a pedagogical seminary, a gymnasium which dates from the 16th century, a museum, an art gallery of German and Flemish pictures. Consult: Pütter, Saalfield, and Oesterley, 'Die Georg-August Universitat.'

Gottschalk, gŏt'shälk, **Louis Moreau,** American pianist and composer: b. New Orleans, La., 8 May 1829; d. Rio de Janeiro, Brazil, 18 Dec. 1869. He studied in Paris and after his return to the United States in 1853 became the most popular pianist in America. His playing was confined to his own compositions. He traveled extensively in Mexico, the West Indies, and South America, and was taken fatally ill, while playing at Rio Janeiro his latest work, 'La Morte.'

Götz von Berlichingen. See BERLICHINGEN, GÖTZ VON.

Gough, gŏf, **John Bartholomew,** American temperance lecturer: b. Sandgate, Kent, England, 22 Aug. 1817; d. Frankford, Pa., 18 Feb. 1886. He came to America in 1829 and two years later became a bookbinder in New York. Falling into dissipation, he lost regular employment and was reduced to giving recitations and singing comic songs at low grog shops. In 1842 he was induced to attend a temperance meeting and take the pledge; and he then made up his mind not only to reform, but to influence others to do likewise. Save for a short relapse, a few months later, his pledge was kept, and ere long, as a temperance lecturer, he became one of the most popular of public speakers in America and England, which he visited on temperance tours 1853–5, 1857–60, and 1878. In later life he handled literary and social topics, as well as temperance themes in his lectures. He published an 'Autobiography' (1846; enlarged 1870); 'Orations' (1854); 'Temperance Lectures' (1879); 'Sunlight and Shadow, or Gleanings from My Life Work' (1880).

Goujon, Jean, zhŏñ goo-zhôñ, French sculptor and architect: b. Paris 1515; d. about 1570. He was employed with Pierre Lescot, architect of the Louvre, on the restorations of St. Germain l'Auxerrois, 1542–4; and after the accession of Henry II., decorated the Chateau d' Anet for the king and Diana of Poitiers. To him is ascribed what is considered the masterpiece of French sculpture, the 'Huntress Diana,' now in the Louvre collection, and the fountain of the Innocents at Paris was also his work.

Gould, goold, **Augustus Addison,** American zoologist: b. New Ipswich, N. H., 23 April 1805; d. Boston 15 Dec. 1866. He was graduated at Harvard 1825, and in 1856 became visiting physician to the Massachusetts General Hospital. His strong scientific tastes led him to take up investigations in botany, zoology, and conchology, and in the latter branch he became one of the most eminent authorities in the whole world. He published 'System of Natural History' (1833); 'Invertebrate Animals of Massachusetts' (1841); 'Otia Conchologica' (1863); 'Principles of Zoology' with Agassiz (1848).

Gould, Benjamin Apthorp, American astronomer: b. Boston, Mass., 27 Sept. 1824; d. Cambridge, Mass., 26 Nov. 1896. He was graduated at Harvard in 1844 and pursued the scientific study of astronomy at several foreign observatories, returning to America in 1848. In 1851 he assumed charge of the longitude department of the United States Coast Survey, and perfected methods for determining the longitudes telegraphically. By 1866, 20 longitudes in the United States had thus been determined. He was director of the national observatory at Cordova, Argentina, 1870–85, and there completed three extensive star catalogues, and conducted meteorological and climatological investigations. He was the founder and editor of the 'Astronomical Journal' (1849–61), and published 'On the Trans-Atlantic Longitude, as Determined by the Coast Survey' (1869); 'Uranometria Argentina' (1879); etc.

Gould, Elgin Ralston Lovell, American economist: b. Oshawa, Ontario, Canada, 15 Aug. 1860. He was graduated from Victoria University, was fellow (1882–4) and lecturer (1892–7) at the Johns Hopkins University, and professor in the University of Chicago (1895–6). In 1896 he became president of the City and Suburban Homes Company of New York, and at one time vice-president of the American Economic Association. He has written: 'The Housing of Working People'; 'Popular Control of the Liquor Traffic'; 'The Gothenburg System of Liquor Traffic'; 'The Social Condition of Labor.'

Gould, George Jay, American capitalist: b. New York 1858. He was the eldest son of Jay Gould (q.v.). In financial circles he was active chiefly in connection with his large railway interests, particularly as president, from 1888, of the Little Rock & Fort Smith Railroad, from 1892 of the Manhattan Elevated Railroad of New York, and from 1893 of the Saint Louis, Iron Mountain & Southern; the International & Great Northern; and the Missouri Pacific.

Gould, Hannah Flagg, American poet: b. Lancaster, Mass., 1789; d. Newburyport, Mass., 5 Sept. 1865. She was an aunt of B. A. Gould (q.v.), and at one time very popular as a verse writer. She published: 'Hymns and Poems for Children' (1854); 'The Golden Vase'; 'The Youth's Coronal' (1850); 'The Mother's Dream' (1853); etc. 'The Snow-Flake' and 'The Frost' are still remembered and quoted among her poems.

Gould, Helen Miller, American philanthropist: b. New York 20 June 1868. She is a daughter of Jay Gould (q.v.), and has achieved an extended fame through her benefactions for charitable and educational uses. At the opening of the war with Spain she not only contributed $100,000 to the United States government, but was active in the Woman's National War Relief Association, to which she was a generous contributor. Among other notable gifts of hers are that of $380.000 to New York University, etc., in 1898; $50,000 to the naval branch of the Young Men's Christian Association of Brooklyn; and $100.000 to New York University for a Hall of Fame for Great Americans, in 1900.

Gould, Jay, American financier: b. Roxbury, N. Y., 27 May 1836; d. New York 2 Dec. 1892. He was brought up to labor on his father's farm; and was for a short time a student at Hobart College. Here he learned surveying. After making surveys of Ulster, Albany and Delaware counties, he began his railroad career. This was directly after the panic of 1857. His first speculation was the purchase of the bonds of the Rutland & Washington Railroad. He himself became president, treasurer, and superintendent of the road. Soon afterward he effected a consolidation of his road with the Rensselaer & Saratoga line, withdrew his capital, removed to New York, opened a broker's office, and began dealing in Erie stocks and bonds. His aim was to gain control of the Erie. This he did by depressing the value of the stock and then buying it in. In association with James Fisk, Jr., he entered the directory of the company, was elected president, while Fisk became vice-president and treasurer. On the reorganization of the company, 1872, he lost official connection with it. He then invested in the Pacific railroads, secured control of several lines, built branches, and effected combinations which resulted in the establishment of what is known as the "Gould system." Jay Gould and his partner, Fisk in 1869 entered into a scheme to corner the gold market of New York and this resulted in the financial crisis and panic known as "Black Friday" (q.v.). The attempt netted them about $11,000,000.

Gould, John, English naturalist: b. Lyme, Dorsetshire, 14 Sept. 1804; d. London 3 Feb. 1881. His reputation as a taxidermist procured him the post of curator to the Museum of the Royal Zoological Society in 1827, and in 1832 he published 'A Century of Birds from the Himalayan Mountains.' He next undertook a work of much more extensive character, entitled the 'Birds of Europe,' published 1832–7. This was followed by: 'Birds of Australia' 1842–8; 'Mammals of Australia' (1859); 'Monograph of the Trochilidæ, or Family of Humming Birds' (1850); 'Monograph of the Odontophorinæ, or Partridges of America'; etc.

Gould, Sabine Baring. See Baring Gould, Sabine.

Gould, Thomas R., American sculptor: b. Boston 1818; d. 1881. He was a pupil of Seth Cheney, of Boston, and there established his first studio. From 1868 he was in Florence, Italy. His works include a statue of Hancock in the Lexington town-hall; portrait-busts of Junius Brutus Booth, Emerson, and Gov. John A. Andrew; and the ideal statues 'The West Wind,' 'Christ,' and 'Satan.'

Gounod, Charles François, shärl frän-swä goo-nō, French composer: b. Paris 17 June 1818; d. St. Cloud 18 Oct. 1893. He began his studies in the Paris Conservatory under Halévy, Le Sueur, and Paer, and carried the Rome prize with his cantata 'Fernando' in 1849. While in Rome he made Italian Church music his chief study. His mass in the style of Palestrina, which he composed in Vienna in 1843 after his return from Rome, was the first fruits of this study. On arriving at Paris he took charge of the music in the church of the Missions Etrangères, and produced no original work until April 1851, when his first opera, 'Sappho,' appeared. Gounod's next production was the five-act opera, 'The Bleeding Nun ('La Nonne sanglante') (1854). Following this was the comic opera founded on Molière's 'Le Médecin malgré lui' (1858), and the grand opera 'Faust et Marguerite,' which latter was a signal success and was produced with much enthusiasm in all the more important opera houses of Europe. Even in Germany, the home of the Faust legend in music and poetry, the originality, and wealth of melody of Gounod's music, together with his powerful orchestration were so manifest above all else in the opera, that his Faust became a favorite with the public. Later operas of his were: 'Philémon et Baucis' (1860), which was not popular; 'La Reine de Saba' (1862); 'Mireille' (1864); 'Roméo et Juliette' (1867), which was favorably received in every opera house of Germany; 'Polyeucte' (after Corneille's drama), which was a failure; finally the comic opera, 'Cinq Mars' (1877), and the last of his grand operas, 'Le Tribut of Zamora,' which was well received. Besides these operatic compositions he wrote much religious music, notably the 'Rédemption,' which was performed in England and later in Germany, and has been very popular in the United States. He also produced at Brussels his 'Mors et Vita,' and in addition wrote cantatas, symphonies, pieces for the piano and numerous songs. During the Franco-Prussian war (1870–1) he resided in England, where he formed the Gounod Choir, a chorus of mixed voices, whose concerts were widely popular. Consult: Claretie, 'Portraits Contemporains' (1875); Voss, 'Ein Lebensbild' (1895); Paguerre, 'Charles Gounod, sa vie et ses œuvres' (1890); Boret, 'Charles Gounod, His Life and His Works' (1890).

Goupil, Jules Adolphe, zhül ā-dōlf goo-pēl, French painter: b. Paris 7 May 1839; d. Neuilly 30 April 1883. He was a pupil in the studio of Ary Scheffer and achieved success by his powers as a portrait and genre painter. His most famous picture, 'Mme. Roland's Last Day in Prison,' is in the Luxembourg. His father, Adolph Goupil, did much to encourage the introduction of French art into this country: well known throughout Europe as a Parisian picture dealer, he opened a branch house in New York.

Goura, gow'ra, any one of a group of large, handsomely dressed pigeons of New Guinea, constituting the genus *Goura*, and distinguished by their fan-like crests, — the crowned pigeons. These birds are found near open or cultivated lands, ranging near the ground in small flocks, and feeding on buds, seeds, berries, and other fruits, and on worms, snails, and insects. In addition to the cooing heard in the nuptial season, they utter harsh, trumpet-like cries. During the heat of the day, or when alarmed, they hide in the thickest jungle. They make rude nests and lay only one white egg. The best-known species (*G. coronatus*) is a beautiful bird over two feet in total length. It is sometimes kept among poultry, and its flesh is much esteemed.

Gourami, goo'ra-mĭ. See Goramy.

Gourd, gōrd or goord, a plant of the genus *Cucurbita* or its fruit. In Europe the name is given generally to pumpkins, squashes, melons, etc.; but in America is restricted to those with hard-skinned, thin-fleshed inedible fruits, cultivated for ornament or because their excavated shells are useful as dippers, etc. See Calabash Gourd; Cucurbitaceæ.

The Hebrew word translated gourd in Scripture is apparently so much akin to the Greek word *kiki*, used by Dioscorides for the castor-oil plant (*Ricinus communis*), that the "gourd" of Scripture was probably that species. It is a euphorbiaceous plant. The wild gourd of Scripture is a plant which grew on a wild vine — that is, was procumbent, and had tendrils. It moreover produced "death in the pot"; discoverable in a moment by the taste. It was probably either the colocynth (*Citrullus colocynthis*), or the squirting cucumber (*Momordica elaterium*).

Gourd-seed. A fish. See BLACKHORSE.

Gourd-worm, the fluke-worm (q.v.) which affects the livers of sheep.

Gourgand, Gaspard, BARON DE, French general: b. Versailles 14 Sept. 1783; d. 25 July 1852. Entering the army as lieutenant of artillery in 1802, he distinguished himself in several important battles, and in the battle of Brienne saved Napoleon's life from the Cossacks. He subsequently became Napoleon's adjutant, and as his confidential secretary accompanied him to St. Helena, but for various political reasons left him in 1818. He was subsequently aid-de-camp to Louis Philippe, and became a member of the House of Peers in 1841. In the previous year he was made one of the commission appointed to bring the remains of Napoleon from St. Helena to France. He was passionately devoted to Napoleon and unreasonably jealous of those who attended upon the emperor in his exile. He assisted Napoleon in writing his 'Mèmoires' and was the author of 'La campagne de 1815'; 'Mèmoires pour servir a l'histoire de France sous Napoleon' (1822–3); 'Rèputation de la vie de Napoleon par Sir Walter Scott' (1827); and a remarkable journal kept during his stay at St. Helena, but which remained in MSS. till 1898. An English translation of selections from the journal by Mrs. Elizabeth Latimer (q.v.) appeared in 1903. The work is exceedingly prolix, but of great value, since it records with the minuteness of Pepys, or the precision of Boswell, the incidents of daily life and the conversations of the fallen emperor. In no other work can the personal side of Napoleon be so well studied as in Gourgaud's journal. An entire chapter is given to the emperor's criticisms on his own action at Waterloo, and of equal interest are his judgments concerning other great commanders from Cæsar's times to his own. His opinions regarding English character are essentially French in their character, and amusing from their entire misconception of it. But in this journal we are shown Napoleon's conversation on almost every conceivable subject, insignificant or important, and always with the frankest egotism.

Gourgues, Dominique de, dō-mē-nēk dė goorg, French soldier and adventurer: b. Mont-de-Marsan 1530; d. 1593. Captured by the Spaniards in Italy, where he was serving in the army of Maréchal de Strozzi (1557), he was condemned to the galleys and in 1559 his ship was taken by the Turks; the Turkish ship in turn fell into the hands of the Knights of Malta, who set him at liberty. After many voyages to Africa and South America he signalized his name by taking vengeance on the Spaniards of Fort San Mateo, who under Menendez had massacred the Huguenots of Fort Caroline, Florida. He razed Fort Mateo and killed in battle or hanged every Spaniard he found there.

Gourney, SIR **Goldworthy**, English inventor: b. Treator, England, 14 Feb. 1793; d. Reeds, England, 28 Feb. 1875. His early studies were in medicine, but he subsequently devoted himself to chemistry. Among important inventions by him are the oxyhydrogen blowpipe, lime-magnesium and oil-gas lights, the high-pressure steam jet, the tubular boiler, and steam carriage. He was knighted in 1863.

Gout, a disease of comparative infrequency, affecting for the most part the large joints of the foot or knee, and accompanied by a deposition in the joints of a salt of uric acid, notably sodium urate. It is a disease that has been observed for many centuries, and many of the older classical writers have left descriptions, jibes, and witticisms concerning it. Notwithstanding an immense amount of study of the many factors concerned with gout it remains true that the real essential causes of the disease are unknown. Gout is found throughout civilized communities, but it is no respecter of persons, alike affecting the rich and the poor, although it is more prevalent among the former. Whether the afflicted are the "fag-ends" of previously well-to-do families is unknown. Gout is thought to be much more common in England and in Germany than it is in the United States, and the few statistics available, while notoriously unreliable, seem to bear out this belief. Some observers believe that the disease is becoming more frequent in the United States. On this point, however, there are almost no reliable figures. It is a disease of middle years, and men are more often attacked than women.

The symptoms of gout may be grouped under three general heads, acute gout, chronic gout, and irregular gout. In acute gout there may be premonitory twinges of pain in the small joints of the hand or foot. These may be accompanied by dyspepsia, restlessness, and irritability. The urine is usually diminished in amount, is dark in color, and strong in odor. On cooling, a greater deposit of brick-dust urates occurs than is usual. This brick-dust sediment, it should be borne in mind, occurs in practically all healthy urine when cooled. It is not a sign of disease, and quacks would starve if the people did not believe their "brick-dust" horrors. The gout attack frequently commences in the middle of the night, or about 4 A.M., when the temperature of the body is nearly at its lowest point. There is excruciating pain in some one of the joints of the body, usually of the big toe. The pain is accompanied by swelling, redness, and stiffness of the joint, and there may be some constitutional disturbance with a rise of temperature to 102° and 103° F. The symptoms may slowly subside during the day, to recur with equal or diminished severity at a 24-hour interval. After 3, 4, or 6 days the swelling and pain gradually grow less and in 8 or 10 days the patient may be well. Other joints may be involved, and the attack may last only a few days or may persist for two weeks or more. Occasionally there are accompanying gastro-intestinal disturbances, with nausea, vomiting, diarrhœa, dyspnœa, and heart-depression. If an acute attack is followed by other attacks, a condition of chronic gout develops. The joints become sore and remain swollen, and a larger number of joints become involved in the reaction. The joints no longer lose their swollen appearance, since deposits of urates take place in the cartilages and in the ligaments, but become further enlarged and distorted. These local collections of urates are termed tophi, and they may be found in other joints — in the hands, knees, elbows, and even in the ear-cartilages. The frequent attacks of pain leave the patient much more irritable. He is apt to be dyspeptic, sallow-faced, and to show signs of disease in his heart and blood vessels. Under the term irregular gout have been grouped a veritable scrap-basket assortment of symptoms which different clinicians have thought were undeveloped cases of gout. By many authorities these irregular forms of so-called "gouty diathesis" are taken "with a grain of salt"; yet there is little doubt that a number of more or less definite symptoms are found in those who are moderately gouty which may be attributed to this disease. These irregular forms are frequent in gouty families and include certain forms of chronic eczema, attacks of biliousness with marked constipation, etc. Frequently there is a condition of arteriosclerosis (q.v.) with tendency to the development of slight dropsy or other symptoms of disease of the heart or kidneys. Nervous headaches or migraine may be another heritage, although migraine is such a common disturbance that its presence proves little for any of the many one-sided theories concerning it. Itching feet, hands, or eyeballs, irritable bladder with small quantities of acid, high-colored urine, are other symptoms attributed to irregular gout. Occasionally severe forms of eye-disease occur in those thought to be gouty, to account for which no other cause seems probable.

The cause of gout is really unknown. The theories are as numerous as the sands of the sea. A bad heredity is one of the most important factors, since from 50 to 60 per cent of gouty patients have had it left to them by their ancestors, one or two generations back. The boys seem more prone to this influence than the girls. Advancing age plays some part, the disease usually setting in before 50 years and generally after 40, although in the markedly hereditary forms the disease may come on much earlier, especially in the irregular manifestations. Alcohol is perhaps the most important contributory factor, those indulging in large quantities of fermented liquors seeming to be much more liable to contract the disease. Among the poor it is chiefly in the ale and beer drinkers that the disease is found. Overeating, lack of exercise, and minor injuries to the feet are also important causes of the development of gout. As for the general theories to account for the poisoning — for it seems like a poisoning — all at best are pure hypotheses. Uric acid is considered by many as the chief criminal, but beyond the fact that there is an increased amount of uric acid found in the urine during an attack, and deposits of a salt of uric acid in the joints, there is no proof of its causative influence. Many modern students believe this to be a purely secondary condition, and not a primary one. There is a marked increase in the metabolism of nucleoproteids (q.v.) which in large measure accounts for the increase in one of its products of oxidation, uric acid. Clifford Allbutt has well summed it up when he writes that we are far from sure that gout may not be due to some extrinsic element. The peculiar geography of gout is in need of careful inquiry; the effects of microbic infection of the kidney are unknown in their relation to the precipitation of uric acid. Again, some internal secretion may be at fault, as in diabetes. "Till we know then whether gout is a mere shortcoming in ordinary metabolism, or a peculiar perversion of it, or a static susceptibility of fibrous tissue, or a defect of some enzyme, or a perturbation of the nervous system, or again some factor from without, it appears we must confine the name of gout to the uratic precipitations which are known, and which can serve as a touchstone, and as to all other vague 'acidities,' 'flatulencies,' 'megrims,' and 'biliousness' of whatever occult kind, be content to treat them empirically, awaiting the results of the analysis of our nutritive life upon which biochemistry is actively and hopefully engaged." Summing up what is really known about the pathology of the disease, it seems established (1) that gout is a morbid condition, of which the most striking phenomena are acute attacks of arthritis (q.v.), which tend to recur and are accompanied by redness, pain, and œdema of the part; (2) that the affected joints are found to be the seat of a deposit of urate of sodium, which occurs first in the articular cartilages and afterward infiltrates all the surrounding structures; (3) that deposits of this material may also be found in other parts, such as the pinna of the ear, the bursæ, etc.; (4) that excess of uratic material may be demonstrated in the blood of a gouty patient, the amount being greatest before an acute attack, and least immediately after one; (5) that the influence of heredity in producing gout is undoubted; and that certain poisons, such as lead and malt liquors, may induce an attack. In the same manner our ignorance concerning the cause of gout may be summed up by saying (1) that it is not known how the excess of uratic matter is brought about, whether it is due to an increased intake with the food, to increased formation in the body, or to deficient elimination by the excretory organs; (2) that it is not known whether the uratic excess is the cause of the phenomena of the disease or is a mere casual accompaniment of the perverted state of nutrition; (3) that it is not known in the case of arthritic attacks whether the deposit of urate of soda is the cause or the effect of the local inflammation; in other words, that gout is a disease the cause of which is not yet understood.

The treatment, however, is on better foundations. Here empiricism has taught the general rule that most people eat and drink too much and that temperance in all things is beneficial in gout as in other experiences in life.

Treatment.— No routine line can be laid down that can be adapted suitably to all cases. Individualism — the treatment of the patient, rather than the disease — is the prime feature. The treatment for gout should include (1) the medicinal treatment of the gouty paroxysm, in acute gout; (2) the medicinal and dietetic treatment of the sub-acute and chronic conditions, and (3) the treatment of the affected joints, with the object of removing, if possible, the foreign deposits.

The horizontal or slightly elevated position for the limb, with a cradle to take off the weight of the bed-clothes, warm packs, soothing lotions such as the lead and opium wash, and an oil-silk covering constitute the main features in the local treatment of an acute attack. Internally, colchicum, in dosage to be determined by the physician, is the best remedy. A brisk cathartic aids the action of the colchicum, and a mild diuretic may be combined to advantage — citrate of potash, cider, lemonade, being reliable. The pain and insomnia should be controlled by the visiting practitioner. Opium in all its forms is to be avoided. In the treatment of chronic gout attention must be paid to diet. Malt liquors are to be avoided, and the heavy wines, such as port and burgundy. There is no good reason why any particular form of food should be eliminated, but it is paramount that simplicity and undereating rather than overeating should be the rule. The so-called uric acid theory of gout is a pathological hobgoblin. Copious drinking of alkaline waters is of value — largely because of the water. Potassium salts seem to be of service. A bracing air, low humidity, absence of cold east winds, constitute the chief climatic conditions to be sought.

Smith Ely Jelliffe,
Editor 'Journal of Mental and Nervous Diseases.'

Goutweed, or **Goutwort**, a species of wild carrot (*Ægopodium podagraria*) introduced from Europe, where in England it is known as masterwort, herb-gerard, and now a weed in waste places along the Atlantic coast.

Gouverneur, goo'vėr-nėr, N. Y., village in St. Lawrence County; on the Oswegatchie River, the Rome & W. R.R.; about 40 miles south of Ogdensburg. It has large marble works; the talc mines nearby are well developed, and considerable iron ore is mined, and wood-pulp is manufactured. It is in a good agricultural region. Pop. 3,700.

Government is the term used to describe the mechanism or *ensemble* of agencies through which a body-politic formulates and executes its will.

Governments de facto and de jure.— Since they act only as the agents of the sovereign political power, governmental agents in order legally to exercise the functions of their offices, are obliged to possess a delegation of powers from the state they represent. In case they are not able to produce a sufficient evidence of this authorization, their acts are *ultra vires*, and as such of no legal force, and they themselves are subject to civil or criminal suit at the instance of parties whose persons or property they may have injured by their acts.

It not infrequently happens, however, that persons claiming political authority, while able to produce satisfactory evidence of their official status and competence, do so by referring to grants of power from a political sovereignty, the legitimacy of which is not admitted by the parties over whom their authority is attempted to be exercised. It thus becomes necessary to distinguish between governments *de facto* (*sed non de jure*) and governments *de jure*.

The terms *de facto* and *de jure* are applicable to governments in a purely relative sense. That is to say, which of the two is properly descriptive of a given political organization depends upon the point of view of those who characterize it. Thus a government is *de jure* as well as *de facto* when it has been established by, claims to represent, and is in fact guided by the will of a state the legitimacy of which is recognized by the individuals over whom its control is extended. It is *de facto* but not *de jure* to any particular individual when, though actually in existence and able to exercise a certain amount of power, its legal character is denied by that individual. Thus in the case of an attempted revolution; from the standpoint of those who have repudiated their allegiance to the old state, refuse obedience to its government, and have organized for themselves a new political machinery, the old government has but an actual and not a legal existence, the new government being the only one in their eyes possessing a legal basis. Upon the other hand, from the point of view of those who still support the old state, the newly established government has but a *de facto* existence, the old government being conceived as the one legal organization. Thus, during the American Civil War, the existence of the southern Confederacy as a state was never recognized by the United States nor by foreign powers. The existence of a *de facto* Confederate government was, however, admitted, and its soldiers recognized as belligerents. The continued allegiance of its supporters to the United States was, however, always asserted by the United States, and no legal force of any sort was ever ascribed, then, or after the end of the war, to any of its acts. No formal treaty of peace was entered into with the southern Confederacy, the surrender of its armies being received simply as military acts, and its government permitted to go out of actual existence without any formal act to mark its demise.

The Ethical Right of Governments to Exist. — The concrete question as to the moral right of a particular government to exist and to coerce individuals, is often confused with the abstract one as to the moral justification for the existence of political restraint in general. These two questions are, however, quite distinct, and are to be answered upon quite different principles. So long as men's interests conflict, or, at least, so long as they are conceived by them to conflict, coercion of some sort must result, for the desires of all, under such circumstances, cannot be satisfied. Some will have to give way to others, or all yield in part. The force bringing about the final settlement may be individual, social, political, or religious, but in any case restraint is applied and the freedom of action of the individuals concerned correspondingly interfered with. This being so, it is clear that the question as to the ethical legitimacy of coercion by the state is not to be answered by viewing such coercion as a restraint upon individuals who otherwise would possess entire freedom of action. Rather it is to be viewed as a control of individuals who, but for the existence of political government and law, would be subject to the compulsion of other forces. In other words, so long as men's desires conflict there cannot properly be raised the abstract question as to the rightfulness of restraint humanly imposed, or even the question as to its proper amount. The conflict of desires makes coercion inevitable, and the extent of this conflict fixes its amount. The only questions, therefore, that rightfully may be raised are as to the form that the compulsion shall assume, and the general principles that shall guide it. The justification, then, for the existence of any particular political authority, if justification there be, consists in the fact that it furnishes a more intelligent, more beneficial, more just, and less painful form of restraint than that which, in its absence, any other force or forces would supply. A state and its government is but an instrument humanly devised for a people's good. It, therefore, has to be justified by its works. There is, thus, no theoretical difficulty in conceiving of a political authority so corruptly and oppressively administered as to cause evils overbalancing those that it prevents. In such a case, it has no ethical right to be. Practically speaking, however, there can be no question but that so grievous are the inevitable evils of lawlessness and anarchy that it is difficult to picture to oneself a political régime so evil in its effects as to render preferable to it a complete absence of political order.

To repeat, then, for the question so often stated in the abstract form as that of the right of the state to be, should be substituted that as to the right of its government to be and to exercise the functions that it does and to exercise them in the manner that it does. As the author of this article has elsewhere had occasion to state it: "The right to be of the political authority itself is not in issue, for, abstractly considered, that is, as apart from any particular form of organization, or manner of operation, there is no basis upon which a judgment may be founded. It is not until the state manifests its power and authority that material is afforded to which moral estimates may be applied."

The Doctrine of the "Consent of the Governed." — We are now prepared to examine the meaning and validity of that doctrine, promulgated in the Declaration of Independence, and accepted as fundamental in American political philosophy, according to which all governments "derive their just powers from the consent of the governed."

Without stopping to consider what the founders of the American Union probably meant by this phrase, it may be here said that the principle stated by it has a validity only in so far as it is held to state or imply that all governments should be so administered as to promote to as high a degree as is possible the good of all the governed; and that, therefore, the governed have at all times the moral right — though not necessarily the legal right — to see to it that this is done, and consequently the right, if there be no better way, of overturning an existing government and establishing in its place one more likely to subserve their own general good. Impliedly, then, the doctrine properly means that every state should be so organized as to render possible and easy the discovery of the best interests of the governed. As, however, generally speaking, these best interests are most certainly to be determined by the intelligent wishes of those concerned, this means, in the first place, that, so far as the state itself is able to provide them, agencies should exist for developing the intelligences of its citizens and thus qualifying them to know their own best interests; in the second place that adequate provision should be made for the free expression by the people of their wishes; and, finally, in the third place, that sufficient guarantees should exist that these wishes when made known will be heeded by those in power.

That the foregoing requirements of an ethically defensible government may be satisfied, it is necessary that all public officials shall be held strictly responsible, politically and civilly, for the manner in which they exercise the powers entrusted to them; that freedom of speech and press shall prevail; that the rights to petition, to assemble peaceably, and to bear arms shall exist; and that political privileges — the suffrage and the right to be elected or appointed to public office — shall be as widely extended as the intelligence and morality of the citizens will permit. Speaking negatively the doctrine of the "consent of the governed" does not support the legal right, nor, except in extreme cases, the moral right, of each individual citizen to refuse obedience to particular laws which he may consider unjust, nor at will to cast off his allegiance to his state, nor to claim the suffrage or public office as an abstract right.

The ethical right of one people forcibly to subject another people to its political authority, that is, to destroy the sovereignty of its state and annex its territory, as, for example, the right of the United States to control the political destinies of the Filipinos, or of England to extend her authority over the peoples of the South African Republic (Transvaal), and the Orange Free State, is a somewhat different question from that of the right of a particular government to exercise a control over its own citizens. There is an exceedingly strong presumption not only that a given people best knows its own interests and the means of advancing them, but that, stimulated by the consciousness of national independence, it will develop its latent potentialities in a manner that it will not, or cannot, do when subjected to an alien authority. But this presumption, however strong, is one that may be rebutted. It may be made sufficiently plain that a people, because of a lack of intellectual and moral development or a deficiency in natural ability and temperament, is not able either to perceive its own best interests or so to govern its conduct as to realize them when perceived, or, in determining upon its domestic or foreign policies, to give sufficient weight to the moral and legal rights of other states and their citizens. The interests of civilization are superior to those of any particular people. Judged from this general standpoint, it may, therefore, often happen that the forcible subjection of one people to the political rule of another is justified. This right of course appears most plainly in the case of the subjection of an uncivilized people to a civilized nation, but is not necessarily limited to such a case. The continued unsatisfactory political conditions existing among many of the peoples of South and Central America, of the races inhabiting the Balkan Peninsula and of the whole of the Turkish dominions certainly furnishes to the other states of Europe and America a very strong basis of right to intervention. The language of Prof. J. W. Burgess is hardly too strong when, after adverting to the fact that it is in the interest of the world's best civilization that law and order and the true liberty consistent therewith shall reign everywhere upon the globe, he declares that "a state or states, endowed with a capacity for political organization, may righteously assume sovereignty over, and undertake to create order for, a politically incompetent population."

Classifications of Governments.— As many different classifications of governments may be made as there are characteristics of governments suitable for selection as differentiating elements or factors. The best known of these possible classifications is the one that has come down to us from ancient times, which divides the various kinds of political organization into three main classes, according as the supreme political control is in the hands of a single individual, in which case the government is known as a monarchy; in the hands of a few persons, when it is described as an aristocracy; or in the hands of the general citizen populace, when it is termed a democracy. A further, or sub-classification divides each of these three types into normal and corrupt forms, the corrupt monarchy being termed a tyranny, the corrupt aristocracy an oligarchy, and the corrupt democracy an ochlocracy or mobocracy. A still further subdivision divides monarchies into elective and hereditary according to the source whence the monarch derives his right to office; and into absolute or limited (or constitutional) according as the monarch in the exercise of his authority, is, or is not, controlled by definite constitutional principles and by the action of other governmental officials selected by the people; aristocracies into particular types according to the principle, wealth, or birth, upon which membership in the ruling class is determined; and democracies into direct and indirect according to whether their people directly participate in the control of the state or delegate the exercise of their sovereign powers to officials selected by and responsible to themselves. In the latter case the government is known as a representative democracy or republic. The Constitution of the United States, without defining the term, provides that: "The United States shall guarantee to every State in this Union a republican form of government." The Federal courts, though they have several times been called upon to construe and apply this clause, have never attempted directly to determine the meaning of the term "republican form of government." The eminent constitutional jurist, Judge Cooley, gives, however, the following definition which has been generally accepted as correctly expressing the meaning of the phrase as employed in American law and American political thought:

By republican government, he says, is understood a government by representatives chosen by the people, and it contrasts on one side with a democracy, in which the people or community as an organized whole wield sovereign powers of government, and on the other with the rule of one man, as king, emperor, czar, or sultan, or with that of one class of men, as an aristocracy. In strictness, a republican government is by no means inconsistent with monarchical forms, for a king may be merely an hereditary or elective executive, while the powers of legislation are left exclusively to a representative body freely chosen by the people. It is to be observed, however, that it is a republican form of government that is to be guaranteed; and in the light of the undoubted fact that by the Revolution it was expected and intended to throw off monarchical and aristocratic forms, there can be no question but that by a republican form of government was intended a government in which not only would the people's representatives make the laws, and their agents administer them, but the people would also, directly or indirectly, choose the executive. But it would by no means follow that the whole body of the people, or even the whole body of adult or competent persons, would be admitted to political privileges; and in any republican state, the law must determine the qualifications for admission to the elective franchise.

Another term, often used as synonymous with democracy, is popular government. Strictly speaking, however, this latter term should be employed not to designate any distinct form of political organization, but to describe any government the actual administration of which is to a considerable degree subject to the control of the people. A popular government is thus, in effect, a free government and as such is properly to be contrasted with a despotic government in which the will of the ruler or rulers and not that of the ruled controls. It is in this sense that we speak of the movement toward popular government as having made great strides in England and elsewhere during the last 75 years, though monarchical forms have still been retained.

So closely connected with the advance of popular government, as to be almost identified with it, has been the development during the last century of constitutional government. Those general principles, written or unwritten, that determined the governmental organization of a state and fix the legal competences of its several organs and officials, taken collectively, are termed its constitution. In this sense every state has a constitution, and its government may be spoken of as constitutional. But in its stricter and more usual sense, a constitutional government is one in which the principles determining its specific character, and the extent and mode of exercise of its powers, are definitely determined, and, in general, reduced to precise written statement, and embodied in an instrument or instruments which are not subject to abrogation or amendment except according to certain specified formalities. By this means not only are definiteness of authority, and responsibility of those in power secured, but guaranties provided that existing political liberties shall not be changed except under conditions which usually include a popular assent directly or indirectly given. The value of constitutional government is thus usually but not necessarily that in it the exercise or the direct control of sovereignty is placed in the hands of the people. Its essential feature is that the manner in which the sovereign power is to be exercised by the state is definitely determined. A constitutional government, may therefore, both in form and effect, be but slightly popular in character. In fine, then, the difference between a constitutional and a popular government is that in the former the attempt is made to render the citizens secure against arbitrary action on the part of their rulers; in the latter, means exist for discovering and enforcing the wishes of the governed. The progress of popular government and of constitutional government, has almost always gone hand in hand, for the reason that it is but natural that, once established in the effective control of their states, the citizen bodies should have sought to render their power secure by the adoption of instruments of government that might not be altered except under certain prescribed conditions.

The truest tests of the excellence of all governments are the facilities they afford for the formation of an enlightened opinion of the people upon matters of political importance and the precise ascertainment of that "general will" when formed, and the exactness with which the policies it dictates are carried out in practice. The development of popular constitutional governments means that these results are being achieved to an increasing extent. As Prof. Lester F. Ward has said: "Government is becoming more and more the organ of social consciousness, and more and more the servant of the social will. Our Declaration of Independence, which recites that government derives its just powers from the consent of the governed, has already been outgrown. It is no longer the consent, but the positively known will of the governed, from which government now derives its powers."

A characteristic feature of almost all constitutional governments is the existence of a system of what have been called "checks and balances." According to this system the several functions of political rule are so distributed among different organs of government that no one of them is given sufficient power to assume an autocratic, despotic control of the state. Thus, in general, the making, the interpreting, and the enforcing of laws are placed in different hands. The executive is thus unable to take legal action without the authorization of the legislature, and the acts of both the legislature and executive are subject to review in the courts. Furthermore, the legislative body is usually divided into two chambers, the approval of both, together with that of the chief executive, being required for a valid act of legislation; executive officials are often elected for but short terms of office, and in case of nonfeasance or malfeasance of office are subject to impeachment and summary removal from office, and subject to civil and criminal suit for any illegal conduct while in office. In the United States of America the most powerful check of all consists in the fact that the courts have the power of declaring void all legislative acts inconsistent with the provisions of the written constitutions of the United States and of its constituent commonwealths. In those European states which possess written constitutions the courts have not this power, the legislatures being construed to be the judges as to the constitutionality of their own acts.

Presidential and Parliamentary Governments. — A very important classification of constitutional governments is that which divides them into Presidential and Parliamentary.

Presidential government, to accept the excellent definition of Burgess, "is that form in which the state, the sovereign, makes the executive independent of the legislature, both in tenure and prerogative, and furnishes him with sufficient power to prevent the legislature from trenching upon the sphere marked out by the state as executive independence and prerogative." Thus the governments of the United States and of Germany are of this type. Upon the other hand, "Parliamentary government is that form in which the state confers upon the legislature the complete control of the administration of law. Under this form the legislature originates the tenure of the real (though perhaps not the nominal) executive, and terminates it at pleasure; and under this form the exercise of no executive prerogative, in any sense and manner unapproved by the legislature, can be successfully undertaken." As further descriptive of this parliamentary type it should be said that this controlling power thus vested in the legislature, almost inevitably tends to become concentrated in its more popular chamber. The government of England best illustrates this form of government. That of France may also be placed in this category. Because the real executive power in a parliamentary government is almost always in the hands of a cabinet of officials holding office only so long as they are able to retain the support of the legislature, this form of political rule is often spoken of as Cabinet government.

The Sphere of Government.— The legal power of a constitutional government at any given time is determined by law. The sphere of political control thus marked out includes all those interests which the state has determined require public control. As we have already learned, legally the state is omnipotent, and therefore may subject to its regulation any matter that it sees fit. Actually, however, considerations of utility and expediency of course control. Regarding the exercise of certain powers, no opportunity for the employment of discretion exists. In order to maintain itself as a sovereign, independent body-politic, it is absolutely necessary that the state should obtain sufficient means, and exercise sufficient authority, to protect itself against attacks from foreign sources, and to maintain law and order, that is, to protect persons and their property throughout its own dominions. The powers, the exercise of which is thus called for, may, therefore, be termed "essential powers," and in the aggregate they constitute the essential sphere of the state. By some writers they are spoken of as "police powers." German writers, however, it should be said, use this term somewhat differently, designating as a "Police State" (*Polizeistaat*) one that English and American writers denominate a "Paternal State." The propriety of the exercise by the political power of these essential duties is not denied by any one except the anarchist. Contrasted to these essential, or, to use the adjective employed by President Wilson, the "constituent" functions of government, which must be exercised by a state in one way or another, are what may be called the non-essential or ministrant functions which all civilized states to a greater or less extent exercise. The activities included in this class are those performed by the state for the promotion of the economic, physical, and moral welfare of its people.

As not being absolutely essential to the very existence of the state, there are many who while admitting the necessity for, and the rightfulness of, political control in matters of police protection and national self-defense, assert that the assumption by the state of a right thus further to control the conduct of its citizens, is an ethically unjustifiable interference with their freedom, even though the aim of such interference is to advance their own good. In order to maintain this position, however, they are obliged to fall back upon a doctrine of "natural rights," the invalidity of which is now all but universally recognized. Starting, as from a premise, with the right of a particular state or government to be, as determined by the principles already laid down in this article, the conclusion necessarily follows that, in each individual case, the question whether or not a given matter, whatever its character, shall be subjected to public control, is one the answer to which should be determined wholly by expediency — construing of course expediency so as to include moral as well as material considerations. The arguments of those who urge the establishment of a socialistic or communistic régime are, therefore, not to be met by the simple predication of an abstract individualistic, *laissez-faire* doctrine, according to which an extension of state activities beyond the mere maintenance of order and national independence, is ethically unjustified whatever the results to which it may lead. The claims of socialists and communists, in other words, may properly be rejected only by showing that the actual results to which their proposed politics, if adopted, would in all probability lead, would be ethically unjust, or economically disastrous, or both.

This is not the proper place to discuss either socialism or communism. This one observation may be made, however, that the performance by the state of non-essential duties is not, in very many cases, a step toward socialism. The essential aim of socialism is to suppress competition. When there is assumed by the state a function which otherwise would certainly, or in all probability, not be performed at all, it can hardly be said that the field of private initiative is thereby lessened. Under the head of these non-essential, non-socialistic duties, may be grouped all those state activities that are educative rather than coercive, informative rather than controlling. Of this character, for instance, is almost all of the work done in the Departments of Labor and Commerce, and of Agriculture, the Bureau of Education, the Fish Commission, and other scientific bureaus of the United States government.

As to what the actual sphere of government in America and Europe is destined to become within the next few years we, of course, can only speculate. The probabilities, however, would seem to be that we are to see a considerable extension of state activities in the sphere of these non-essential, non-socialistic functions. The movement in this direction has for some time been very pronounced and is certainly one not to be deprecated. In the field of socialistic activities, namely, those the exercise of which by the state almost necessarily involves a corresponding diminution of the field of possible private enterprise, the greatest extension of public control within the immediate future will in all probability be seen in the assumption of the ownership and control by central and local governments of the so-called natural monopolies, and in the regulation by law of privately owned and managed industries in which the interests of the general public have become pronounced. Whether the movement toward increased governmental control in this last respect will proceed as rapidly as it has done during recent years one cannot say. The observation may be made, however, that, together with those forces, which, born of the increasing complexity of our social and economic life, tend to make necessary an extension of the activities of the state, there are other agencies the influence of which may be in the opposite direction. Out of an increased intellectual enlightenment and a more widely diffused spirit of altruism may easily arise both an increased ability and a stronger disposition to solve social and economic problems without a resort to the coercion of law. See STATE.

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Government by Injunction, a term used to characterize the putting down of strikes by judicial power of laying injunctions. The first direct interference of the national government in labor troubles was the dissolution of the great Pullman strike at Chicago in 1894, on the ground that it interfered with the carrying of United States mails. This was an executive act; but the courts have since interfered in cases where violence was making the transaction of government business impossible, and brought irresistible government power to bear.

Government Printing House, a large printing establishment at Washington, D. C., controlled and operated by the government for the publication of congressional proceedings, department reports, scientific bulletins, etc. It is considered the largest printing-office, public or private, in the world. A new building was erected in 1902 for its accommodation at a cost of about $2,500,000. Its floor space represents a total area of 14 acres. More than 4,000 persons are employed in this establishment. The cost of maintaining the establishment approximates $6,000,000 per year.

Government of the United States. See UNITED STATES.

Governor, in the United States. The head of an English trading corporation, as the East India Company or the Bank of England, was called the governor; hence it was natural to give that title to the heads of the colonies which grew out of them. These governors were elected by the people in Connecticut and Rhode Island, and down to 1686 in Massachusetts; in the crown colonies they were appointed by the sovereign, and in the proprietary colonies by the proprietor. The name, from the long struggles with the royal governors, had a disagreeable sound in the public ear in many colonies; and when the Revolution swept these away, in several cases they were replaced by councils, of whom the president or chairman was really the governor. Hence, in those times "President" of a State was often used as a current though not official title. Where and when a single executive was adopted, south of New York he was at first usually chosen by the legislature. At present, in most States the governor has a veto, which may be overridden in all cases by a two thirds vote of both Houses, and in some by a bare majority. Sometimes he has the power of granting pardons; in other cases he is one member of a board of pardons. He sometimes appoints commissions and executive boards. He is always commander-in-chief of the State militia, and is obligated to assist local officers in suppressing insurrections, and is empowered to call on the President for help if necessary; in turn, he is the President's chief agent in furnishing men and supplies in case of national war. And like the President, he sends a message to the legislature at the beginning of each session, recommending such legislation as he wishes.

Governor, a device which regulates the admission of steam to a steam-engine, according to the rate of motion. The intention is to maintain uniform velocity, and any acceleration of speed above a given rate causes a valve to be partially closed, diminishing the area of steam passage. The favorite form of governor has a pair of balls suspended from a vertical shaft, so as to swing outward when the shaft is rotated. The greater the speed the greater the centrifugal force, and consequently the farther the balls depart from the axis of rotation; the inclination of the ball arms is made effective in working the valve. See STEAM-ENGINE.

Governor's Island, a small fortified island in New York Bay, south of the Battery, and at the entrance to East River. It is separated from Brooklyn by Buttermilk Channel. In 1621, under the name of Nutten Island, it was a station of the West India Company. Later it was used as a residence by the colonial governors of New York, hence its present name. Wouter Van Twiller was the first governor (1637) to use the island for a country residence. In 1708 it was in use as a quarantine station, and in 1784 Gov. George Clinton leased the island to a company who used it for a summer resort and a race-course. Lord Cornbury in 1702 and Gov. Hardy in 1756 urged the erection of batteries on the island; but no definite action was taken until 1794, when there were rumors of a war with France, the State of New York appropriated $250,000 for the erection of a fort and earthworks. The general government appropriated $31,117, and the money was expended for the construction of Fort Jay in the centre of the island. Other sums were used later in improving the fort, but in 1801 the work ceased until 1806–7, when from "an enclosed work of earth and wood" the fort was improved and faced with permanent masonry at a cost of $30,000, and was named Fort Columbus, as at present. The designs for Fort Columbus, also Castle Williams, were made by Jonathan Williams, Lafayette's chief engineer of the army. The plans called for 104 guns for Fort Columbus and 100 guns for Castle Williams. The latter fort exists to this day (1903) practically as it was when completed in 1811. Its area is three fifths of a circle which is 200 feet in diameter, and the walls are 40 feet high. In 1861–5 Castle Williams was used as a prison for Confederates; at one time there were as many as 1,000 prisoners. After the War of 1812 a fortification called South Battery was built at a place to command Buttermilk Channel. Governor's Island is the army headquarters of the Department of the East, a most important military post, embracing the coast from Maine to Florida and including Porto Rico. It has less the look of war than many smaller forts, but it has a garrison usually of three companies, and it is used as a military prison, nearly all the prisoners being deserters. A little church, under the care of Trinity parish, Manhattan, residences for the officers and some storage places are the only buildings in addition to the forts. At the beginning of the 17th century the island was 1,500 feet long and 900 feet wide with an elevation above high-water of 20 feet. Its whole area then was 100 acres. The tide-waters have washed away a large portion of the island, and now (1903) the area is only 65 acres. The War Department has begun the work of reclaiming from the sea the land washed away. It is expected that in 1904 or 1905 the island will be restored to its former area. The need of modern forts and better defensive equipment on Governor's Island no longer exists since an excellent system of fortifications has been established at the entrance to The Narrows and along the shores of Long Island Sound.

Governor's Island, a fortified island belonging to Suffolk County, Mass., in Boston harbor. It is just north of the main ship-channel and of Castle Island. The fortifications form part of the system of defense of Boston harbor. Fort Winthrop, the keep or réduit, is an enclosed quadrangular fort with open barbette batteries.

Gow'er, John, English poet: b. probably about 1330; d. London October 1408. But little is known of his life save that he was rich and well educated, did not marry till late in life, and became blind about 1400. His tomb is still to be seen in St. Saviour's, Southwark. He was a personal friend of Chaucer, who, in dedicating to him his 'Troilus and Cressida,' addresses him as the "moral Gower" — an epithet that has indissolubly linked itself with his name. Gower wrote three large works in as many languages: the 'Speculum Meditantis,' in French verse, not now extant; the 'Vox Clamantis,' a tedious poem in Latin elegiac verse, written 1382–4, describing the rising of the mob under Wat Tyler; and the long poem entitled 'Confessio Amantis,' written "in our English . . . for England's sake," the date uncertain, but at least the poem was in existence in 1392–3. There are extant also 50 French ballads, written by Gower in his youth (Roxburghe Club, 1818).

'Confessio Amantis' consists of a prologue and eight books, written in verses of eight syllables, rhyming in pairs. The long prologue gives a sombre account of the state of the world at that time, and the poem opens by introducing the author himself in the character of an unhappy lover. It ends with the lover's petition in a strophic poem addressed to Venus, her judgment, and finally the lover's cure and absolution. Without originality, narrative power, pathos, or humor, Gower yet commands respect for the laborious equality of his verse, and his work remains a splendid monument of English. The best edition is that by Pauli (1857). There is a serviceable reprint by Henry Morley in his 'Carisbrooke Library' (1889).

Gower, LORD Ronald Sutherland, English author and sculptor: b. 1845. He was the second son of the 2d Duke and 20th Earl of Sutherland. Educated at Trinity College, Cambridge, he sat in Parliament for Sutherland, and also became known as the sculptor of such works as 'The Old Guard at Waterloo,' and the Shakespeare monument at Stratford-on-Avon. Among his writings are: 'My Reminiscences' (1883), a work of much interest; 'The Tower of London' (1901); and 'Old Diaries.'

Gowrie (gow'rĭ) **Conspiracy,** an unexplained episode in Scottish history. On 5 Aug. 1600, James VI., afterward James I. of England, came to Gowrie House, the residence of the Earl of Gowrie, in the suburbs of Perth, having been lured thither, according to one account, by the report of a suspicious person there held in custody. After dining, the king was led aside by Alexander Ruthven, younger brother of the earl, and the king's attendants were told that his majesty had left the castle. An attempt was made by Ruthven, either to murder or to bind the king, who struggled desperately and shouted for help. His retinue coming to his rescue slew Ruthven and Gowrie. The motives of the two brothers have been variously explained. The current belief is that they intended to capture the king and either give him up to England or administer the government in his name in the interest of that country and in that of the Scotch Presbyterian leaders. Others supposed that their object was merely to avenge the death of their father, who had been executed a few years previously. The heavy indebtedness of the king to Gowrie was another cause of irritation. Gowrie House was destroyed and the estates confiscated.

Goyanna, gō-yän'nä, Brazil, city in the state of Pernambuco; on the Goyanna River, about 20 miles from the Atlantic. It is a shipping port for sugar, dyewoods, cabinet woods, and cotton. Pop. 5,000.

Goyaz, gō-yäz', Brazil, a state completely enclosed between the states of Maranhão, Piauhy, Bahia, Minas Geraes, São Paulo, Matto Grosso, and Pará. Its area is estimated at 747,311 square kilometres, or, say, 287,714 square miles; but, as a large part of the Araguaya-Tocatins basin is unexplored, a precise statement in regard to the extent of its territory cannot be justified. The Goyaz plateau with the Pyreneus Mountain range constitute the watershed which divides the basin of the Tocatins and Araguaya rivers from the São Francisco and Paraná basins; the headwaters of the Araguaya and the Paraguay are near one another; and thus the point of divergence of great river-systems is found within this state. The climate of the plateau is excellent; among the mountains extremes of heat and cold are felt; and large districts are well adapted to agriculture. Forests extend along the river-courses, while the elevated lands of the interior have only occasional clusters of trees. The chief products are tobacco, rubber, and cattle; the gold and diamond washings which at one time were supposed to be important now yield very little. The capital, Goyaz, formerly called Villa Boa, has about 8,000 inhabitants. The population of the state was given as 260,395 in 1901, but of that number nearly all were Indians or Mestizos, the civilized element being inconsiderable as yet. The special interest attached to this state is due to a circumstance which is mentioned in a geographical sketch of Brazil (Washington 1901; compiled by the Bureau of the American Republics), in the following terms: "This state enjoys a splendid climate, and has been selected for the site of the future capital of the republic, the constitution providing for its location on the plateau of Goyaz. A special commission, at the head of which is the director of the observatory of Rio de Janeiro, has already marked the site for the new capital, which is a space 14,400 kilometres square on the Upper Tocatins, in the Pyreneus range of mountains. It has an elevation of from 200 to 300 metres above the level of the plateau and is drained by numerous streams of pure water, being the centre of the three hydrographic systems of Brazil. . . . It is here, near the point of divergence of her three great rivers, that Brazil wishes to establish the national capital." But the site thus selected has no natural means of communication with the Brazilian coast. The Tocatins-Araguaya is navigable for only about one tenth of its entire length; its course is broken by falls and rapids, and as it approaches the Gulf of the Amazon it becomes very shallow. Canals and railways would be required in order to make the rivers commercial highways; moreover the state is without seaboard — is, indeed, far inland. The isolation of the proposed capital suggests that of Bogotá.

Marrion Wilcox,
Authority on Spanish America.

Gracchus, gräk'ŭs, **Tiberius Sempronius** and **Gaius Sempronius,** two Roman statesmen: b. about 163 B.C. and 159 B.C.; d. 133 B.C. and 121 B.C. In their attempt to obtain reforms favorable to the commons, they awakened popular commotions of which they themselves became the victims. Tiberius served under the command of his brother-in-law, the younger Scipio, at the siege of Carthage, and was the first man to mount the walls. He was subsequently quæstor to the consul Mancinus, who at that time waged war against the Numantines in Spain. After the defeat of Mancinus, he concluded a treaty with the Numantines, which, without being disgraceful to the Romans, secured to the Numantines their independence. This treaty, however, was opposed by the aristocratic party and repudiated by the senate. Tiberius, nevertheless, upheld by the populace, in 133 B.C. was elected tribune of the plebs, and sought to reform the condition of the poorer citizens who were without land, and, since the great estates of the wealthy were cultivated by slaves, also largely without employment. He endeavored to attain his object by the revival of the Licinian Rogations of 367. It had been decreed, on the proposition of the tribune, Licinius Stolo, "that no one should possess more than 500 acres (*jugera,* each 28,000 square feet) of the public domain (*ager publicus*), and that the overplus should be equally divided among the plebeians." This law, which was now called the Gracchan, the Sempronian, or by way of eminence the agrarian law, he revived, but with the introduction of several softening clauses. The proposition of Tiberius Gracchus was met with the most determined opposition by the ruling party. To counteract his plans the senate gained over one of the tribunes, Marcus Octavius; and when Tiberius, after having, according to custom, exposed his law 19 days to the public view, proceeded to take the votes of the assembled people upon it, Octavius interposed with his veto, and thus seemed at once to have defeated the whole undertaking. Tiberius now exerted all the prerogative of his office, sealed up the treasury, and forbade all the authorities the discharge of their several offices. He saw, however, that this was of no service to his plan. He therefore took a step till then unheard of in Roman history. At the next assembly of the people he obtained the expulsion of Octavius from office, as faithless to the cause of the people. The bill was thus passed, and a committee consisting of Tiberius himself, his brother Gaius, and his father-in-law Appius Claudius appointed to carry out its various provisions. All the difficulties which stood in the way of the law now appeared in their full light. Even the preparatory business of ascertaining which was the public land, and which private property, was found to have its full share. Outcries and complaints were made from every part of Italy. When June of the following year came on, in which the tribunes for the next year were to be elected, Tiberius, who had endeavored to regain the favor of the people by some new propositions, offered himself again as a candidate for the office. The aristocrats used every effort to prevent his election, and the ferment in Rome was carried to the highest pitch. One election day went by without any election being made. On the next a vast multitude beset the forum, and the senate assembled in the neighboring Temple of Faith (Fides). Tiberius strove in vain to speak, and was killed in the tumult which followed. The place of the murdered Tiberius was filled by Licinius Crassus, father-in-law of Gaius Gracchus; and on his death Carbo, Fulvius Flaccus, and Gaius Gracchus constituted the committee appointed for the enforcement of the law.

In this way the parties had struggled with varying success, when, in 123 B.C., the younger Gracchus, who, as quæstor, had been with the army in Sardinia, obtained the tribuneship. With more various and shining talents than his brother, he united a stormy eloquence, which carried away his hearers. In the discharge of his office as tribune he first of all renewed his brother's law, which had meanwhile fallen into disuse, and revenged his memory by expelling many of his most violent enemies from the city. At the same time he carried through a law "that every month corn should be sold to the poor at a low fixed rate," and by another law effected some alleviations in the rigor of the military service, and ensured for the soldiers clothing, besides their pay. The people were animated with an unlimited enthusiasm for their favorite; his enemies were terrified and weakened; hence he obtained the renewal of his office for the following year with ease. His attempt to introduce 300 knights into the senate failed; but on the other hand, at his proposal the administration of justice was taken from the senate and transferred to the equestrian order. This gave rise to a new political power in the Roman commonwealth, which, holding a station intermediate between the senate and the people, had a most powerful influence in its subsequent history. The senate now resorted to a new but sure means of destroying Gaius. Livius Drusus, a tribune gained over to their interests, had the art to withdraw the affections of the populace from Gaius by making greater promises to them, and thus obtained a superior popularity for himself and the senate. Hence it resulted that Gaius did not obtain a third tribuneship, and Opimius, one of his bitterest enemies, was chosen to the consulate. In the ensuing civil disturbances Gaius was killed at his request by his slave.

Grace, William Russell, American merchant: b. Queenstown, Cork, Ireland, 10 May 1832; d. New York 21 March 1904. In 1846 he worked his way on a sailing vessel to New York; in 1850 went to Callao, Peru, where he became a clerk in the shipping office of Bryce & Company, and later partner in the firm, which eventually assumed the style of Grace Brothers & Company. He organized the firm of W. R. Grace & Company, now the leading American house in the South and Central American trade, with main offices at New York, and branches at London, San Francisco, Lima, Callao, Valparaiso, Santiago, and Concepcion. In 1891 he also established the New York and Pacific Steamship Company. He was Democratic mayor of New York in 1881–2 and 1885–6. His philanthropies were numerous, including the gift of one fourth the cargo of the U. S. S. Constellation, despatched to the aid of the Irish famine sufferers of 1880; and large sums for the building and maintenance of the Grace Institute, established by him in 1897 at New York for the instruction of women in domestic arts and sciences, trades, and occupations. He became a member of the American Museum of Natural History and the American Geographical Society, and organized and was elected president of the Nicaraguan canal syndicate, an organization of capital for securing to the United States control of the waterway.

Grace of God, an expression borrowed from St. Paul's writings. The Apostle frequently employs the term grace in the sense of a gift which enables those who have it to do what they could not do without it. In common parlance we use such expressions as the "gift of music," the "gift of poetry," as belonging to one who might acquire many accomplishments, but could never acquire what is meant by a gift for anything. St. Paul, speaking of his own conversion, his calling to the apostolate, and his many labors, says: "By the grace of God I am what I am." Again he addresses his followers in these words: "By grace are ye saved; not of yourselves, it is the gift of God."

The Church of England and the Protestant Episcopal Church in the United States teach that grace is the assistance given by God to those who believe in Him, so that they may please Him and keep His commandments. All the Reformed Churches agree on this point and they also agree that no man can do good works "as God hath willed and commanded them to be done" (39 Articles), that is, from a right motive and in a religious spirit of devotion, without the grace of God. They also teach that the principal means of grace is prayer, and study of the Scriptures, which latter make a man "thoroughly furnished unto all good works" (1 Tim. iii. 17). To these means of grace the Catechism in the Book of Common Prayer adds the two sacraments, of Baptism and of the Lord's Supper, which are not only means of grace, but also "outward and visible signs" and "pledges" of the grace received by those who participate in them. The following is the doctrine of the Roman Catholic Church regarding grace, which that Church has made plain by dogmatic definitions. As defined by the eminent Roman Catholic theologian, Perrone, grace is "that gratuitous inward aid (*auxilium*) which God affords to fallen man through Christ's merits, to enable him to perform supernatural acts, so that he may attain justification and persevere therein" (Prælect. Theol., c. de Gratia). The Roman Catholic Church's doctrine of grace is opposed on one side to the teachings of Pelagius, who denied the necessity of grace, and on the other to the teachings of those who held that without grace every act of man is a sin, and specifically that "the constancy of Socrates, the continence of Xenocrates . . . must be regarded, not as virtues but as vices" (Melanc. Loci Theol.); and that "from man's corrupt nature proceeds naught that is not worthy of condemnation" (damnabile: Inst. i. 2). Roman Catholic doctrine holds the middle ground between these extremes. As against the Pelagians the Roman Catholic Church teaches that for all acts conducive to salvation (*salutares*) the inner grace of the Holy Spirit is necessary (Conc. Trid. Sess. VI., can. ii. 3). As against Melancthon, Baius, and the Jansenists, the same Church teaches that fallen man, before he receives the gift or grace of faith, can perform acts that are morally good. Further, the Roman Catholic Church, in opposition to the teaching of Calvin, teaches that a man once justified may fall from that state. Again, the Roman Catholic Church teaches that in all his acts conducive to salvation (*salutaribus*) man is free; in other words, grace imposes on man no necessity.

The Council of Trent in Can. iv. of Sess. VI., thus defines the Roman Catholic doctrine of the freedom of man's will while co-operating with grace: "If one shall say that man's free will, moved and stirred by God, co-operates not, by giving assent to God so inciting and calling, toward disposing and fitting himself for grace of justification; or that he cannot, if he wishes, dissent; but that like some lifeless thing he cannot do anything at all and is wholly passive: be he anathema." The Roman Catholic Church further teaches that the state of grace and holiness in which man was constituted in Paradise was supernatural, something added to the perfection of his human nature; in contradiction to those who teach that this state was in the same sense natural to him as any of his mental or bodily faculties. In consistency with this view such teachers hold that in his fall Adam lost all power and faculty for doing any good act, and that whatever he did was sin.

Graces (Greek, *Charites*, translated by the Romans *Gratiæ*), the goddesses of grace, from whom, according to Pindar, comes everything beautiful and agreeable, through whom alone man becomes wise and glorious. According to Hesiod, and most poets and mythologists, Zeus was their father, and Eurynome their mother. Hesiod gives them the names of *Aglaia* (brilliancy), *Thalia* (the blooming), and *Euphrosyne* (mirth). Homer mentions them in the 'Iliad' as handmaids of Hera (Juno), but in the 'Odyssey' as those of Aphrodite. He conceived them as forming a numerous troop of attendant goddesses, whose office it was to render happy the days of the immortals. Later poets considered them as allegorical images. They not only improve corporeal charms, they have an influence also upon music, eloquence, poetry, and other arts; and the execution of acts of benevolence and gratitude is likewise superintended by them. In the earliest times the statues of the Graces represented clothed forms; at a later period they were represented as nude. They had many temples in Greece, partly dedicated to them alone, partly in common with other deities, particularly Aphrodite, the Muses, Eros, Hermes, and Apollo. Their festivals were called in Greece Charisia. It was customary to swear by the Graces, and libations of wine were offered them at meals. The most celebrated Graces of modern sculpture are those of Canova and Thorwaldsen.

Gradientia, grā-dĭ-ĕn'shĭ-a. See Urodela.

Gradual (Lat. *Graduale*), in the liturgy of the Roman Catholic Church, an antiphon which is sung by the choir or recited by the celebrant of the Mass, immediately after the intoning or the reading of the Epistle (first lesson). The gradual nearly always consists of two or three verses from the Psalms, suggestive of thoughts pertinent to the office of the day. Thus the gradual for the festival of Holy Innocents (28 December) is from the 123d Psalm (in the English Bible 124th): "Our soul is escaped even as a bird out of the snare of the fowler: the snare is broken and we are delivered; our help standeth in the name of the Lord who made heaven and earth." *Graduale* or *Liber Gradualis* is also the name of a service-book of the Latin Church's liturgy: it takes its name from the gradual as just explained, and contains all the graduals for the Sundays and festivals of the entire year, for the use of the choir.

Graduation Act, of 4 Aug. 1854, "An Act to Gradually Reduce the Price of the Public Lands to Actual Settlers." All public lands which had been in the market for 10 years and upward prior to the passage of the act were to be sold for $1 per acre; all 15 years, 75 cents; all 20 years, 50 cents; all 25 years, 25 cents; all 30 years, 12½ cents — except United States reservations, grants to States for railroad purposes, or mineral lands held at over $1.25 per acre. No one was to have over 320 acres including lands previously taken up.

Gra'dy, Henry Woodfin, American journalist and orator: b. Athens, Ga., 24 May 1850; d. Atlanta, Ga., 23 Dec. 1889. He was graduated from the University of Georgia in 1868, studied at the University of Virginia in 1868–70, began his journalistic career with contributions to the Atlanta *Constitution*, and for that journal in 1870 described a press tour of Georgia and the resources and possibilities of the State. At Rome, Ga., he edited the *Courier*, and later established and edited the unsuccessful *Daily Commercial*. In 1871 he became Georgia correspondent of the New York *Herald*, and in the same year purchased an interest in the *Herald* of Atlanta, publication of which was suspended in 1876. He then established the *Courier*, which did not long continue, and in 1880 bought a quarter interest in the *Constitution*, of which paper he remained until his death editor and part owner. He was an able journalist, writing for the New York *Herald* some noteworthy letters, including an account of the Hamburg riots in South Carolina; and while editor of the *Constitution*, publishing in its columns vivid descriptions of the Charleston earthquake, and in various magazines articles on the condition and promise of the South. He also became locally known for his oratory, largely through his lecture, 'Just Human,' given at Atlanta. In 1886, at the annual banquet of the New England Society in New York, he made a distinguished address on 'The New South,' which was widely printed and at once gave him a national prominence. Other well-known speeches by him were one on prohibition at Atlanta in 1887, one at the Texas State Fair in Dallas in 1888, and his final and greatest effort, 'The Future of the

HENRY WOODFIN GRADY.

Negro' (December 1889), before the Merchants' Association of Boston. Grady was the first to present to the North the views of the more enlightened portion of the reconstructed South,— its belief that the «struggle between the States was war and not rebellion,» but at the same time its readiness to identify itself with the united progress of the nation. His eloquent services in this behalf were of much importance. He aided in the establishment of the Confederate Veterans' Home, the election of Gen. J. B. Gordon as governor of the State, and the organization of the Atlanta expositions of 1887 and 1889. He declined public office, but was frequently mentioned for nomination to the United States Senate. Consult the 'Life,' by Lee (1896).

Graebner, grĕb'nĕr, **August L.**, American Lutheran theologian: b. Frankentrost, Mich., 10 July 1849. He studied at Concordia College (Ft. Wayne, Ind.) and the Concordia Theological Seminary (St. Louis, Mo.), was ordained to the Lutheran ministry in 1878, and was professor of theology in the Lutheran Theological Seminary from 1878–87. In 1887 he became professor of theology in Concordia College (St. Louis). His writings include theological works in German; and in English: 'Life of Luther' (1883); 'Life of John Sebastian Bach' (1885); 'Outlines of Doctrinal Theology' (1898); and other volumes.

Graffiti, grăf-fē'tē, the name given by archæologists to the rude designs and inscriptions of popular origin drawn or engraved with the style upon the walls of ancient towns and buildings, particularly of Rome and Pompeii. Many of these are valuable for the light they throw on popular habits and modes of thought, and the illustrations they often in consequence afford of ancient authors. Graffiti have been found in Greece and Egypt. Some are traced with chalk or plaster, but the majority are scratched on stone or plaster with the stilus, which helps to account for their preservation. Those in Pompeii are found in the Latin, Greek, and Oscan languages, showing that the ancient language of Campania was still extant among a portion of the populace. The inscriptions are most frequently amatory or humorous, sometimes malicious or obscene. In Rome they occur frequently in the catacombs, particularly of Sta. Agnese and San Calisto. Many of these are by Christians, some by Pagans, in ridicule of Christianity. See GRAPHITOLOGY.

Graft'age, the process and practice (origin unknown) of propagating plants by the insertion in one of a bud (stock) or twig (scion) of another. It also includes the discussion of all questions relating thereto. The stock may be a complete plant, as in peach budding, or only a part, in which case it may be either a root or a stem part. In some instances (inarching, see below) both plants may have roots. Since the process is dependent upon the coalescence of the cambium (q.v.) of stock and scion the first essential is to make these two surfaces abut; the second is to check evaporation from the cut surfaces.

The many scores of styles of graftage fall naturally into three main groups:

1. *Inarching*, or *grafting* by *approach*, the uniting of two plants before the severance of the scion from the plant upon which it grows. After union the scion is severed below the point of contact and the parts of the stock above this point are removed. The method is rarely practised except with subjects hard to graft by more popular methods and for correcting defects of form, such as Y-crotches in fruit trees, a living brace being formed between the two arms. Since it is the only graftage found in nature, it is supposed to be the progenitor of modern methods.

2. *Budding* or *bud-grafting*, the inserting of a single bud beneath the bark of the stock or in some cases (for example, annular or ring budding) in the place of a piece of bark removed. It is always practised upon small stocks preferably under two years old and always when the bark readily separates from the wood as in spring or late summer. Since spring is a very busy season in nurseries, budding is practically all done during summer. The universally popular method is the shield, so-called from the shape of the scion. It is practically the only method employed in propagating the stone fruits — peaches, plums, etc. The seedling stocks, which are usually not less than one fourth inch in diameter, are stripped of their leaves close to the ground, are cut through the bark twice on the shady side, the cuts forming a T, the bark lifted gently with the specially formed ivory knife-handle, and the bud inserted and tied with raffia, bast, or cotton. A small portion of the bark and a little of the leaf stalk accompany the bud, the latter to act as a handle. In about two weeks, if the bud has taken, the binding is cut on the side opposite the bud to prevent «strangulation.» In case of a failure other attempts are made. No visible growth occurs during that season, but in the spring the bud should become a shoot and the original top of the seedling stock should then be cut a few inches above the union, and later, when the union is firm this stub is cut off short. At the close of that season the tree is ready for sale.

3. *Grafting proper*, the inserting of a twig into a stock. The methods under this heading may be divided according to the maturity of the scion whether dormant or growing, and also as to the position the graft occupies, whether upon the root, the crown, the stem or the branches. By far the largest amount of grafting is done with dormant wood, and probably upon roots, though grafting upon the branches is widely popular. In *whip-grafting*, which is the one most practised with roots, especially in the nursery propagation of apples and pears and performed in early winter, the seedling roots are specially grown and are as nearly the size of the scions as possible. Both stock and scion are formed alike, two cuts being made, one rather long, diagonally across, and the other parallel with the direction of growth, thus forming a sort of tongue. The tongue of each is then fitted into the slot of the other, the pieces wrapped with waxed string, and stored in a moist, cool place until spring, when they are planted in the nursery. Usually they are sold after two seasons' growth.

Cleft-grafting is most frequently used upon parts of trees above ground or with grapes just below the surface. The stock is sawed across at right angles to the direction of growth, split with a knife and held open with a wedge until the twigs (scions) bearing two or three buds and whittled to a wedge form below are inserted, one at each end of the slit. The wedge is then removed and the wounded surfaces waxed. This method is practised most upon stocks too large for whip-grafting, limbs even as large as three inches in diameter being sometimes used. As a rule small stocks give more satisfactory results. The method is universally employed to change long-established trees to other varieties.

Some other frequently employed methods are: (1) *Bridge-grafting*, which is used for saving young trees that have been girdled by mice or rabbits or otherwise deprived of their bark. The edges of the injured surface are trimmed above and below, and scions, with wedge-shaped ends, are fitted beneath the bark at each of these points. The whole is then covered with wax. Any sprouts that appear are rubbed off so as to force all growth into the stem. The scions soon unite upon their sides as well as to the original trunk. (2) *Veneer-grafting*, which is widely used in greenhouses, consists in inserting a scion upon the side of the stock, binding and protecting it from the air. The method is practised with both ripened and immature wood.

Protection from the air is gained in budding by bringing the bark of the stock in close contact with the scion and by bandages; in grafting, by applying a bunch of damp moss (a greenhouse practice) or covering of grafting wax, grafting clay, etc. (outdoor practice). One of the most popular waxes is made as follows: Melt and thoroughly mix together 3 pounds of mutton tallow, 5 of beeswax, and 10 of resin; pour into cold water and work with the hands until the color of pulled molasses taffy. Apply closely while warm enough to spread readily by pressure of the hand. For use in *whip-grafting* balls of woolen yarn are soaked in melted wax and wound around the grafts. Soft waxes are less useful, since they are likely to melt on warm days and in warm climates. No horticultural practice except that of cuttage can compare with graftage in extent of usage and apparent necessity. Like cuttage, its strong points are ease and certainty of operation, maintenance of a variety "true to type" with the comparatively rare exceptions of bud variation, and the modifications which it permits in the habits of plants. Some of the more important of these last are dwarfing, produced by grafting a strong growing scion upon a small growing stock, as pear upon quince; hastening or increasing fruitfulness, as when scions from bearing wood are top-grafted or budded upon young established trees already in the orchard; to counteract injuries (see *bridge-grafting* above); to change poor or unproductive trees into useful ones (see *cleft-grafting* above); to make possible the growing of certain trees upon uncongenial soils, as peaches budded upon plum stocks for heavy soils and plums upon peach stocks for light soils, etc.

Much popular misconception exists as to the limits of grafting. In many instances the possibilities have been found wholly within the individual species: that is, various different but related species fail to unite and grow. Generally, however, the limits are within the genus; for example, plums, peaches, cherries, apricots, etc., readily thrive upon one another. Again there are a few instances of different genera which unite, as among cacti. Genera are, however, arbitrary, man-made groups. Permanent unions between oaks and roses, grapes, and pears, and similar widely separated plants have not been reported by reputable horticulturists. Consult: Bailey, 'Cyclopedia of American Horticulture' (New York 1900-2); id., 'Nursery Book' (id. 1896); Fuller, 'Propagation of Plants' (id. 1887); Baltet, 'L'Art de Greffer,' and its English translation, 'Budding and Grafting.'

Grafton, Charles Chapman, American Protestant Episcopal bishop: b. Boston 12 April 1830. After a course in law at Harvard, he studied divinity and was ordained priest in 1858. He was rector of the Church of the Advent, Boston, 1872-88, and in 1889 was consecrated bishop of Fond du Lac. His writings include 'Plain Suggestions for a Reverent Celebration of the Holy Communion.'

Grafton, Mass., town in Worcester County; on the New York, N. H. & H., and the Boston & A. R.R.'s; about 6 miles southeast of Worcester and 9 miles northwest of Milford. In 1728 the first permanent white settlement was made, and the town was incorporated in 1735. As early as 1660 John Eliot (q.v.) established here a settlement of Indians whom he had converted. The manufactures are cotton goods, threads, boxes, boots and shoes, emery, and underclothing. Pop. (1900) 4,869.

Grafton, N. Dak., city, county-seat of Walsh County; on the Park River, the Great N., and the Northern P. R.R.'s; 15 miles west of the Red River of the North. It is in the great wheat region, and is the trade centre of Walsh County. It has grain elevators, flour-mills, and cattle-yards, and manufactures farming implements. It is the seat of the State Institute for the Feebleminded. Pop. (1900) 2,378.

Grafton, W. Va., city and county-seat of Taylor County, located in the northern part of the State, 100 miles southeast of Wheeling, and on the Tygart Valley River, and the Baltimore & O. R.R. The city is the terminus of four branches of the Baltimore and O. R.R., and owes its importance to the establishment of the Baltimore & O. R.R. machine shops. It also has flour and planing mills, a wooden pump factory, foundries, cigar and glass factories, and is also engaged in mining and agriculture. There are eight churches, public and parochial schools, and five banks, with a combined capital of $310,000, and there are two weekly papers published. A national cemetery is within the city limits containing 1,261 graves, 600 of which are nameless. Municipal affairs are administered by a mayor and council of eight members, elected for two years. The city owns its waterworks and electric lighting plant. It was founded in 1854, incorporated in 1856, and received its charter as a city in 1899. The population are mainly English and German. Pop. (1900) 5,650.

A. J. Wilkinson.

Graham, grā'am, **Charles Kinnaird,** American civil engineer: b. New York 3 June 1824; d. Lakewood, N. J., 15 April 1889. He entered the navy in 1841, during the Mexican war served with the Gulf squadron, after study of engineering was appointed constructing engineer of the Brooklyn navy-yard, whose great dry-dock and landing-ways were built by him. At the outbreak of the Civil War he volunteered in the Federal army, and during the War he was twice wounded at Gettysburg and there taken prisoner; commanded the gunboat flotilla in Gen. Butler's expedition up the James River, and was brevetted major-general of volunteers (1865). He was successively chief-engineer of the New York dock department in 1873–5, surveyor of the port in 1878–83, and naval officer in 1883–5.

Graham, Isabella (Marshall), American educator and philanthropist: b. Lanarkshire, Scotland, 29 July 1742; d. New York 27 July 1814. From 1774 she was a teacher in Scotland, where, in Edinburgh, she inaugurated the work which led to the organization of the Society for the Relief of the Destitute Sick. In 1789 she removed to New York, and there for several years conducted a successful school. Her philanthropies were many, and were particularly in the interests of education, religious and secular. She founded in 1814 the Society for the Promotion of Industry Among the Poor.

Graham, James Duncan, American topographical engineer: b. Prince William County, Va., 4 April 1799; d. Boston 28 Dec. 1865. Graduated from the United States Military Academy in 1817, he entered the corps of topographical engineers, in which he attained major's rank in 1838, was astronomer to the survey which determined the boundary line between the United States and the republic of Texas (1839–40), and later United States astronomer in the joint survey of the boundary between the United States and the British provinces. In the determination also of the boundary between the United States and Mexico he held a similar post. Subsequently he directed harbor improvements in the lakes of the North and Northwest, in which he was the first to detect the presence of a lunar tide, and was superintending engineer of the Boston harbor sea-walls and of repairs in various harbor-works along the Atlantic coast.

Graham, John, Viscount Dundee, commonly called Claverhouse, Scottish commander: b. near Dundee, Scotland; d. Killiecrankie 17 July 1689. He went abroad and entered the service, first of France and afterward of Holland, but returned to Scotland in 1677, where he was appointed captain of a troop of horse raised to enforce compliance with the establishment of Episcopacy. He distinguished himself by an unscrupulous zeal in this service, and waged an exterminating war against conventicles. The Covenanters were driven to resistance, and a body of them defeated Claverhouse at Drumclog on 1 June 1679. The Duke of Monmouth, however, defeated the insurgents at Bothwell Brig on 22 June, and Claverhouse was then sent into the west of Scotland with absolute power, and exercised it in such a manner as to lead to the belief that in addition to the persecuting policy of his superiors he was actuated by personal revenge. The more terrible he made himself to the Covenanters the more acceptable his career was to the government. In November 1688, after William had landed, he received from James in London the titles of Lord Graham of Claverhouse and Viscount Dundee. When the king fled he retired to the north, followed, by order of the Convention, by Gen. Mackay. Claverhouse was joined by some of the Highland chiefs occupying Perth, and finally encountered Mackay in the pass of Killiecrankie, whom he defeated, but was killed in the battle. Attempts have been made by Sir Walter Scott and others to throw a halo of sentimentality and heroism around his character; but it is clear that he was the willing instrument of a cruel government, and had himself little sentiment or softness in his nature. See Napier, 'Memorials and Letters of John Graham of Claverhouse' (1859–62); Mowbray Morris, 'Claverhouse' (1887).

Graham, Sylvester, American reformer: b. Suffield, Conn., 1794; d. 1851. He studied at Amherst College, was ordained to the ministry of the Presbyterian Church about 1826, and became known as a lecturer on temperance and dietetics. His proposed cure for alcoholism was based upon a vegetarian diet. The article of food made of unsifted wheat flour and known as Graham bread was introduced by him into general use. His writings include: 'Bread and Bread-Making,' and the 'Graham Lectures on the Science of Human Life' (1839).

Graham, Thomas, D.C.L., Scottish chemist: b. Glasgow 21 Dec. 1805; d. London 16 Sept. 1869. He was educated at the University of Glasgow, and in 1828 communicated to the Royal Society of Edinburgh the results of experiments on the absorption of vapors by liquids. In 1831 he laid before the Royal Society of Edinburgh the result of a series of experiments on 10 different gases, from which he arrived at the conclusion that gases tend to diffuse inversely as the square root of their specific gravities, a conclusion which has been received as the law of the diffusion of gases. In 1837 he was elected professor of chemistry in the University of London, and soon afterward was appointed assayer to the mint. In 1840 he received the gold medal of the Royal Society, and the next year was chosen first president of the Chemical Society, which he had assisted in founding. He now began to be employed as consulting chemist in various mercantile and public undertakings, and it was by his recommendation that wood-spirit, or methylic alcohol, was used to render spirits sold free of duty for trade or scientific purposes unfit for consumption as a beverage. In 1846 he assisted in founding the Cavendish Society, of which he was elected president, an office he retained till the close of his life. At the same time he was engaged in investigations on the diffusion of liquids, and was the earliest to fully develop that theory. He made many other important discoveries, and was the author of 'Elements of Chemistry' (1837) and various professional papers.

Graham, William Alexander, American politician: b. Lincoln County, N. C., 5 Sept. 1804; d. Saratoga Springs, N. Y., 11 Aug. 1875. He was graduated from the University of North Carolina in 1824, was admitted to the bar in 1826, and entered practice at Hillsboro. From 1833 he was repeatedly elected to the House of Commons, of which in 1839–40 he was speaker. In 1840–3 he was in the United States Senate, in 1844 and 1846 was elected Whig governor of North Carolina, declined a third term, and in 1850–2 was secretary of the navy, in which capacity he organized Perry's expedition to Japan. Though at first opposed to secession, he later identified his fortunes with those of his State, and in 1864 took his seat in the Senate of the Confederacy. Subsequent to the war he was an executor of the Peabody fund for the promotion of education in the South, and a member of the commission for settlement of the undetermined boundary line between Virginia and Maryland.

Graham Land, a tract of land in the Antarctic; discovered in 1832 by Bisco, master of a British sealer. In 1894 Larsen, a Norwegian, reported the discovery of a continent, one portion of which he named King Oscar II. Land and another part Foyne Land. Both proved to be on the coast of Graham Land. The Belgian expedition of 1897–8 explored the west coast, and gave it the name of Palmer Land, in honor of Nathan Palmer, an American sealer, who discovered this coast in 1818. Capt. James Cook (q.v.) reported, in 1774, finding land in the Antarctic, but not a continent.

Grail, The Holy. The cup or bowl from which Christ drank at the Last Supper. The history of the grail as given in most romances is substantially as follows: After the Last Supper the cup came into the possession of Joseph of Arimathea, who caught in it some of the blood that flowed from the wounds of the crucified Saviour. Being miraculously conveyed to England to escape persecution, he carried the precious vessel with him. Throughout his life it furnished him with food and drink, and with spiritual sustenance as well; and at his death he charged his successor to guard it faithfully. It was handed down from generation to generation, the Fisher King being a descendant of Joseph. This vessel is the grail. According to other versions, the grail chooses its own knights. It possesses miraculous properties, and at times is instinct with divine life. To discover its abiding-place and become one of its guardians is the ambition of good and valiant men, but only the pure in heart may find it. One form of the legend represents three of Arthur's knights, Galahad, Perceval, and Bors, as being blessed with a sight of the holy relic. Galahad is said to have had it in his possession, who at his death transferred it to Perceval, and after the death of the latter the cup was taken up into heaven. Students of folk-lore connect Perceval of the Christian legend with the Siegfried of early German literature and Celtic mythology, but the account of a sacred spear and bowl, as given in the grail romances, appears to be mainly of Christian legendary origin, and to be based upon the lives of saints and certain apocryphal books of the New Testament, principally the Gospel of Nicodemus. It is probable that the Perceval story was familiar, in one or more of its many different forms, to the people of western Britain, before their conversion to Christianity. When the French romancers of the 12th century began to develop the grail idea,— the idea of a sacramental symbol, dwelling among men but discoverable only by the brave and pure,— they wove into their narrations tales of chivalry, mysterious adventures, and legends of folk-lore. Chrestien de Troyes, who was possibly the first writer from whom a grail romance has come down to us, was evidently intending to fuse certain elements of the grail and Perceval legends. He began his work about 1189, but died without completing it. Chrestien's poem was taken up by several other French writers after his death. An introduction was fitted to it, in which a violent attempt was made to reconcile the Christian and heathen elements. Many thousands of lines were also added, by various hands, in the early years of the 13th century. Meanwhile, probably before the end of the 12th century, Robert de Borron had written, in Old French verse, a trilogy, 'Joseph,' 'Merlin,' 'Perceval,' of which the 'Joseph' and part of the 'Merlin' have been preserved. It was he especially who gave to all the material a Christian character. There are also later prose adaptations of his work. Great difficulty is occasioned by our ignorance of where to place the French prose romance, the 'Queste del Saint Graal,' generally attributed to Walter Map, or Mapes, and another, the 'Grand Saint Graal,' often accredited to Borron. In these the Christian symbolizing tendency is strong, and the story of Perceval is buried under many complicated tales of knight-errantry. They were, however, probably written before 1204. The 'Queste' having been one of the romances followed by Malory in his 'Morte Arthure,' the Galahad story has had a marked influence upon later literature. There are several other members of the early cycle of grail romances, but only one is of great importance,— the 'Parzival' of Wolfram von Eschenbach. The 'Parzival' is his *magnum opus*. It is also the finest narrative poem of which the authorship is known, between the era of classical antiquity and the 'Divine Comedy' of Dante. Furthermore, it is the most complete, and virtually the final, mediæval handling of the two great themes which are involved in the legend of the holy grail, and which Wolfram more thoroughly blends than any other poet.

During the next 250 years it was the mission of the legend of the holy grail to be the spiritualizing tributary of a broader stream of literature, the full current of Arthurian romance. It then remained in obscurity until the 19th century. Modern English and German poets in reviving the story of the grail, have been moved by the same moral earnestness as Wolfram von Eschenbach, and by the same desire to show the way to seekers after the spiritual life. The best-known of the many modern embodiments of this legend are Tennyson's 'Holy Grail' and the text of Wagner's musical drama 'Parsifal.'

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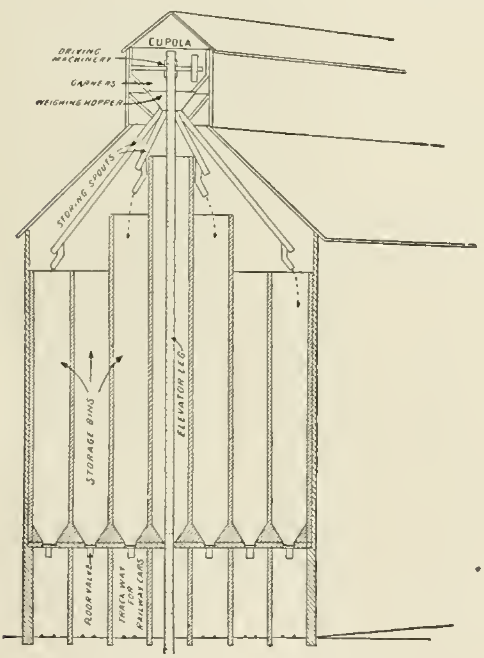
Grain, any cereal cultivated on account of its seed for the production of meal or flour. All kinds of grain contain nutritious particles of a similar character, although they vary, both in their quantity and in their mixture, in various grains. These elements are: (1) Gluten, which affords the strongest nourishment for the animal body. (2) Fecula or starch, which is very nutritious, although not so much so as gluten, which, however, it seems to render more digestible. (3) A sweet mucilage, which is more nutritious than starch, but is small in quantity, and renders the grain liable to the vinous and acetous fermentation. (4) A digestible, aromatic substance contained in the hulls, which consist of a fibrous matter. (5) Moisture, which is predominant even in the driest grain, and increases the weight of the mass, although it lessens the specific gravity; it affords no nourishment, hastens the decomposition of all kinds of grain, if they are not kept very dry, and influences germination. See articles under names of different cereals.

Grain Elevator, a structure equipped with elevating machinery for the purpose of loading, storing, and cleaning grain which is subsequently unloaded directly into railway cars, canal boats, or grain-carrying vessels for transportation.

It consists of a rectangular building or "house," surmounted by a smaller structure called the "cupola." The house is divided into a series of deep storage bins, while the cupola contains the machinery for operating the "elevator leg," the turnhead spouts, the garners, the weighing machines, and the cleaning machinery. It is usually constructed of timber with brick outside walls for the house, and corrugated sheet iron for the roof and walls



Sectional Diagram of Grain Elevator.

of the cupola. Many elevators, practically fireproof, are built with solid brick walls enclosing steel bins surmounted by steel framed cupolas roofed with terra-cotta or sheet iron, while the bins of some of the European structures are made of steel skeletons embedded in concrete. In the United States further protection is obtained by housing the steel storage bins and the operating machinery in separate fireproof buildings, the grain being handled between them by a system of pneumatic conveyors.

The elevator leg consists of a framing the foot of which extends below the floors of the bins, while its head reaches to the topmost story of the cupola. Within this framing a belt conveyor, made up of several thicknesses of canvas and sheet rubber, usually 36 inches wide and three quarters of an inch thick, is operated by steam power. The belt, which is of the endless type and carries a series of metallic buckets, passes over two pulleys, one at the foot and the other at the head of the leg and lifts the grain to the turnhead spouts in the cupola.

Unloading and storing is accomplished as follows: The grain-laden cars are usually run up along the side of the building so that each car is placed directly under an elevator leg. Two men in each car, operating shovels by ropes from a steam-driven shovel shaft, shovel the grain into the pits of the elevator leg, and thus fill the buckets of the conveyor, which, operating continuously, carries it up to the cupola, where the buckets are tipped over automatically and their contents discharged into the turnhead spouts. From these the grain passes by gravity into the garners, thence into the hoppers of the weighing machines, which are usually gauged exactly for 100 pounds, thence to the cleaners if desirable, and finally through a system of spouts to the storage bins.

When used for unloading grain from ships to railway cars the elevator legs are placed outside the house and their feet lowered into the hold of the vessel through the hatchways. The conveyors carry the grain to the turnhead spouts from which it passes to the storage bins, and thence through the floor valves of the bins to the cars placed beneath them. Under such conditions they are called "marine elevators," and when the arrangement is mounted on a barge or float to permit of its being moved from place to place, it is commonly known as a "floating elevator."

To unload grain from an elevator into the grain-carrying vessels of the Great Lakes, the vessel is made fast alongside of the house, and its hatches being removed, the grain is poured by gravity in a perfect torrent into its hold through great spouts which extend to the hatchways from the floor valves of the bins. The discharging capacity of these spouts ranges from 12,000 to 60,000 bushels per hour, and load vessels of the greatest capacity in two or three hours.

The loading and storing capacities of individual elevators vary greatly according to their location. Innumerable small structures capable of handling only a few thousands of bushels each are located along the lines of railway traversing the grain-bearing regions of the Western States; but those at the large centres of flour manufacture and grain transportation, such as Minneapolis, Duluth, and Chicago, are of mammoth proportions, with individual capacities ranging from 500,000 to 5,000,000 bushels. One of the medium sized elevators at Duluth is 285 feet long, 85 feet wide, and 150 feet high. Nine belt conveyors driven by a 200 horse-power steam engine lift the grain to a height of 145 feet to the turnhead spouts. Each belt carries 125 buckets having a capacity of one peck each, so that the total load at any working instant is about 270 bushels or 15,000 pounds, representing an unloading capacity of 12,000 bushels per hour. The storage bins are each 60 feet deep by 20 x 10 feet cross section, with a capacity of 12,000 cubic feet, thus giving the elevator a total storing capacity of 1,500,000 bushels.

The cost and rendering of elevator service is fixed and regulated by different conditions in the different States. In Illinois the elevators are compelled to receive and store, up to their full capacity and without discrimination, all the grain brought to them for that purpose, provided it is free from disease or other impurities. The maximum charge allowed for this service is 1¼ cents per bushel for the first 10 days or any portion thereof, and ½ cent per bushel for each subsequent 10-day interval. The elevators at each of the three cities mentioned have a total capacity of about 35,000,000 bushels, and each group handles about 70,000,000 bushels of grain annually.

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Grain, Handling and Transportation of. The methods of handling the grain produced in the Northwest, the various stages through which it passes from the field to the consumer, the means and appliances employed and incidentally the volume of grain handled, and the cost and method of transportation are important factors in the agricultural development of the Great West.

The States of Minnesota and the Dakotas are the spring wheat States, producing the bulk of that incomparable variety in the United States. The process of seeding and harvesting is much the same with the small farmer with his 160 acres as the large one with his thousands of acres. Both use similar machinery, differing only in the amount used. It is a self-evident fact that in the production of grain and the manufacture of flour, as well as in all other manufacturing industries, the profit depends in a very large degree upon the volume of business done. The tendency in all lines has been to cheapen the cost by increasing the volume.

Minnesota and the Dakotas produce a yearly average of 133,000,000 bushels of wheat, 55,000,000 bushels of corn, 87,000,000 bushels of oats, 1,000,000 bushels of rye, and 22,000,000 bushels of barley. At most towns in these spring wheat States, along the lines of railroads are small elevators, to which the farmer takes his grain either to sell, store, or ship, according to his inclination or ability. These elevators receive the grain for storage or for shipment to the primary or semi-terminal elevators at Minneapolis or Duluth. Well-informed farmers and dealers estimate the cost of production of a bushel of wheat to be from 40 to 45 cents. The average cost of transferring the grain from the farm or initial point of shipment to either Minneapolis or Duluth (rates being about the same) is about 10 cents per bushel. The charges for storing grain at these points are about three fourths of a cent per bushel for the first 15 days, including cleaning.

The average yearly receipts of wheat in round numbers at Minneapolis for the last 12 years were 73,000,000 bushels, of which about 54,000,000 bushels were manufactured into flour. The elevator capacity at Minneapolis is 36,000,000 bushels.

State Inspection.— In Minnesota the State inspection of grain is accomplished by well-qualified men having a technical knowledge of their work and experienced as well, under rules prescribed by the State Board of Appeals. The board of inspection is composed of six members, three of whom are located at Minneapolis and three at Duluth. If the inspector's report is not satisfactory to the buyer or seller, the aggrieved party can appeal to the Appeal Board, whose decision is final. The mode of inspection is as follows: The first step of the inspector is to go with the sealer, who opens the car, breaking the railroad seal for the inspector, who enters the car, and takes several samples of grain by probing to the bottom of a car in several places with an instrument provided for that purpose. From these samples he mixes and makes a general sample, from which his report as to grade under the rules is made. The car is then resealed with a State seal, the railroad seal number and the seal number substituted by the State having been duly recorded by the sealer.

Weighing.— After the cars of grain have been transferred to the elevators, the grain doors are removed, which allows the grain to fall into pits under the cars. The assistant weighers take the number and initial of the car, see that no grain is left in the car and that the shipment has been elevated to the scale floor at the top of the elevator. The grain is then carefully weighed and distributed to the different storage bins of the elevator and, after cleaning, is ready for shipment eastward. The charge for inspecting and weighing a car of grain is 50 cents. The record of every car inspected and weighed is carefully preserved by the two departments, each of which gives to every owner or agent a certificate of grade and weight. These certificates form the basis of settlement of the consignor with the consignee, the freight bills of the railroad companies and supply the necessary information to the grain registrar, whose duties will be more clearly defined hereafter. The State employs a scale expert, whose duty it is to examine and test the scales used at Minneapolis and Duluth, to see that they are in perfect condition at all times.

Grain Registration.— In those elevators termed regular, under the rules of the exchanges at Minneapolis and Duluth, great care is used to prevent any irregularities as to grade and quantity. After the grain has been inspected and weighed as before described, and the elevators have reported to the State registrar, he issues certificates which show the name of the elevator, the date the grain was received, the number and initial of the car, the number of bushels and the grade. These receipts must be returned to the registrar and canceled before the grain can be shipped. The registered receipts are mainly used as collateral upon which to obtain money at the banks, and are considered and approximate as nearly to perfect securities as any found in the West. Many years of experience have proven that this standard of securities has been very high and safe.

Duluth as a Semi-terminal Point.— Duluth is a primary or semi-terminal market, the same as Minneapolis. The system of inspection, weighing and registration is identically the same; but Duluth, being the point where rails and water meet, and being Minnesota's only lake port, the method of shipment of grain is different from that at Minneapolis. The elevator capacity at

Duluth is 34,000,000 bushels, the average receipts of wheat for past 12 years being in round numbers 62,000,000 bushels, of which some 8,000,000 bushels are manufactured into flour at the Duluth-Superior mills. The balance is mostly consumed in eastern markets, although some years a million bushels have been exported.

Water Transportation.— On the Great Lakes large steel freighters carry the products of the prairie farms of the West at greater reduced cost than in years past. The evolution is from the little 100-ton steam-barge of 30 years ago to the 10,000-ton steamer of to-day, and it frequently happens that vessels loading at the elevators at the head of the Lakes, take at one load all the grain grown on a whole township of land.

The question of cheap transportation eastward of the varied and enormous products of the Northwest has been the subject of congressional legislation for many years; and that it was wisely considered by that body is evidenced by the governmental appropriations of over $10,000,000 since 1881 for the purpose of building locks, widening and deepening canals and improving the channel through the river at Sault Ste. Marie. That the full benefit of the improvements at the "Soo" be fully realized to the end that vessels might load to their full capacity, an appropriation was made a few years ago of $3,150,000 for deepening the channels in the joint harbor of Duluth and Superior, to 20 feet, thus enabling vessels trading between Duluth and Buffalo to load to that depth. The benefit of this is shown by the fact that the average size of vessels trading at the head of Lake Superior has grown from 336 tons in 1885 to 1,940 tons in 1902. With economy in production by the aid of improved labor-saving machinery, and larger and better vessels operated at less sums proportionately, it is no wonder that the cost of seeding and harvesting the grain and transporting it to the seaboard has been reduced to the minimum.

Loss in Transit.— The average loss per 1,000 bushels of wheat in transfer from Duluth or Chicago to Buffalo in 1902 was 14 pounds, or about one peck for each 1,000 bushels, showing that the weighing of grain by the large elevators has been reduced to a science. Quick despatch at the Duluth elevators during the season of large receipts is proverbial and it is frequently the case that some of these large vessels load at the rate of 60,000 bushels per hour. The average freight rates on grain from Duluth to Buffalo for the last six years has been 22 mills per bushel. From Buffalo to New York the rates for the same period have averaged about three and one third cents.

With closer trade relations with Canada by removing the duty on wheat, the amount of grain that would find its way east via the Great Lakes would be greatly augmented. About 75 per cent of the grain going east by water from Duluth, goes to Buffalo, 11 per cent to Chicago and Lake Erie ports, and 14 per cent to Canadian ports.

H. B. Moore,
Secretary Duluth Board of Trade.

Grain Insects. Stored grain, corn, nuts, and the like, are frequently infested and injured by various insects. About 40 kinds of weevils (q.v.) lay their eggs upon dry grain, and their grubs bore into and devour the kernel, so that when they are numerous great damage may ensue. It has been estimated that the annual loss in the United States from this cause alone is about $40,000,000. The most important of these pests are the granary-weevil (*Calandra granaria*) and the rice-weevil (*C. oryza*). The former is wingless, evidence that it was domesticated ages ago. It multiplies so rapidly, developing from egg to adult in about six weeks, that five or six generations might be produced annually in a warm temperature. The rice-weevil has well-developed wings, which it seldom uses, showing a strong tendency to become wingless in time. Much injury to stored grain is also caused by other beetles, particularly by three species (*Silvanus surinamensis, Cathartus gemellatus* and *C. advena*), but they usually follow the attacks of other insects. The cadelle (*Tenebroides mauritanicus*) is to be included in this category, as it has a pernicious habit of gnawing into kernels of grain and destroying the embryo or germ. Great harm in granaries is done also by small moths related to the clothes-moth, whose caterpillars bind the grains together, forming clots, which both spoil the edible quality of the cereal, and clog mill machinery. The most familiar of these is the European *Sitotroga cerealella*, often called Angoumois grain-moth, but known as "fly-weevil" in the southern States, where it is so prevalent that grain can nowhere be stored for a long time. Another imported grain-moth, troublesome in the United States since about 1890, is *Ephestia kühniella;* and a third (*Tinea granella*), is especially harmful to wheat in Europe, but not prevalent in America. Injury by the Angoumois grain-moth and the rice-weevil, which obtain entrance to the grain in the fields, can be largely prevented by early harvesting and by threshing as soon as possible. The standard remedy for all grain insects, however, is bisulphid of carbon, applied at the rate of one or two ounces to every hundred pounds of infested grain, which is effective in proportion to the tight closing of the bins. Exposure should last as long as possible, unless the seed is desired for planting, when an exposure of 24 hours is sufficient and will not detract from the germinating power. In buildings that cannot be tightly closed a larger quantity of the insecticide must be used, and repetition of treatment is necessary in warm weather at intervals of six weeks or more. Frequent stirring about of the grain is helpful against these insects; and granaries whenever emptied should be thoroughly cleaned and whitewashed. See Flour and Meal Insects.

Grain-poisoning. See Ergotism.

Graining. (1) In leather manufacture, the process of rubbing leather with a board to raise the grain. The leather having been shaved to a thickness at the beam, and daubed, is hung up to dry, and is then folded, grain side in, and rubbed on the flesh side with a pommel or crippler to give the leather a granular appearance and render it supple. The hide is then extended and rubbed on the grain side. This is termed bruising. Also a process for giving markings to the surface of leather to imitate the wrinkled appearance of morocco, hog-skin, and some other leathers.

(2) In painting, the imitation of the natural grain of wood by means of tools. Combs,

brushes, rollers, and the corner of a folded rag are used in making the various patterns.

(3) In lithography, a mode of giving a certain texture to the face of a stone. One stone is laid on another with a quantity of sifted sand of a given fineness, and by a peculiar oscillation and gradual progression the surface is cut into a set of fine prominences more or less deep and distant, according to the character of the work to be placed on the stone.

Grakle, grăk'l, the name of several kinds of birds. In the United States the blackbirds (especially the larger ones) of the family *Icteridæ*. (See BLACKBIRD.) In India and eastward a myna (q.v.) or some related bird formerly classified in the miscellaneous group *Gracula*.

Gramineæ, grā-mĭn'e-ē. See GRASSES.

Grammar, in its widest sense is the science of language, treating of the words of which language is composed, and their mutual relations when combined in a sentence for the expression of thought. Universal grammar is the science of verbal expression throughout all languages; comparative grammar studies the words and grammatical forms of a group of kindred languages — the Aryan group, for example; a particular grammar deals with the words and grammatical forms of a single language. But the study of words, their meanings, their origins and their histories may be regarded as belonging to lexicography rather than to grammar proper: the proper field of grammar would then be the study of the methods by which the relations between words in a sentence and between sentence and sentence are determined. The English language as it exists differs in important respects from the Germanic dialects from which it is sprung: it has lost great part of its native vocabulary and has taken to itself a very considerable portion of the vocabulary of Latin, either direct from that language or through the French. And its mode of expressing the relations between words has been immensely simplified by eliminating the inflexions which in those early dialects were very numerous. The grammatical rules which regulated English speech in the several stages of its development became antiquated as the change proceeded, and now English is less under control of grammatical rules than perhaps any of the other languages of culture.

Here comes into view the important difference which exists between the languages which express by inflexions the mutual relations of words in a sentence, and the languages which indicate those relations merely by the position of the words. English is the type of a language almost without inflexions: Latin is an example of one that abounds in inflexions. English has but one case inflexion of nouns, the s of the possessive case; and an objective case inflexion of pronouns: he, him; they, them; who, whom, etc. As Marsh observes (Lectures on the English Language, 393) this inflected possessive of nouns expresses in modern English almost exclusively the notion of property or appurtenance and applies to persons or to animated creatures: hence we say "a man's hand," "a horse's hoof," but not "the house's roof." Though the Germanic dialects from which English is sprung had inflexions of adjectives, both for gender and number, no trace of them now remains in English. In Latin, nouns, pronouns, adjectives, verbs, all have numerous inflexions to denote all manner of relations between the words of a sentence. An adjective is of the gender of the noun to which it belongs: Good man is *bonus vir*, good girl, *bona puella*, and these two phrases are in the nominative case plural *boni viri, bonæ puellæ*. Declinable parts of speech in Latin have six cases in singular and plural, viz.: nominative, genitive, dative, accusative, vocative, ablative. The verb in English has but two inflections, the d or ed of the past indefinite or præterite, as, sail, sailed, and the participial inflexion ing. But the Latin verb has four modes, indicative, subjunctive, imperative, infinitive, also present and future participles and the two forms called "supines": all these in the active voice, and all constituting inflexions. The tenses, each with a distinctive inflexion for the three persons and for singular and plural are the present, imperfect, perfect, pluperfect, future, and future-perfect: not all of these tenses run through all the modes. In the passive voice the perfect, pluperfect, and future-perfect are not inflexional.

English being practically uninflected, position in the sentence determines the mutual relations of the words. In the sentence "Titus teaches Julia the letters," no different arrangement of the words can be made without rendering the whole unintelligible. But convert the sentence into Latin, and in whatsoever order the words be written, the sense is ever the same: "*Titus Juliam literas docet*," or "*Literas Juliam docet Titus*," etc. Again, "Proteus drove his flock to view the high mountains" (mountain tops) — *Proteus pecus egit altos visere montes;* no change of position of the words affects the sense. In passing it may be noted that Horace's phrase, "*pecus egit visere*," drove (his) flock to see, is in Latin a poetical license, and in prose the idea would be differently expressed: but the phrase in English is grammatically correct both for prose and poetry.

English knows nothing of grammatical gender: in other languages grammatical gender attaches to all nouns, whether distinguished by sex or not. The modern Latinish languages, French, Spanish, and Italian, attribute gender, masculine or feminine, to all nouns; but Latin has also a neuter gender. In Latin *domus* (house) is feminine, *murus* (wall) masculine, *jumentum* (beast of burden) neuter; and of course adjectives qualifying such nouns must agree with them in gender. In English there is a tendency even toward eliminating nouns feminine which designate women as engaged in sundry employments — that of instruction, authorship, etc., and to substitute for instructress, authoress, etc., instructor, author, doctor; so, too, women are masters of arts, bachelors of arts, etc.

The subjunctive mode of verbs in English has gone almost quite out of use. In Latin the subjunctive form possessed very great importance in defining with precision a writer's or a speaker's meaning. A notable peculiarity of English grammar is that it permits a word to serve both as noun and adjective, as when we say a sword thrust, a marble building: such phrases would be rendered into Latin by *gladii ictus* (thrust of sword), *ædificium marmoreum;* rendered literally, they would be unintelligible.

Equally peculiar to the grammar of English is the use of nouns as verbs, as "to shovel snow," "to pen a letter"; or even of proper names, as "to burk," to "boycott"; and "macadamize," might better have been "macadam." English cannot be compared with Latin grammar with regard to the use of the definite article, for Latin has not the article: but when English is compared with other modern European languages, as German, French, Italian, etc., the English article is seen to be a "definite" article indeed. In those languages such words as time, life, humanity, patriotism, always have the article, but in English only when a definite time, life, etc., are in question.

JOSEPH FITZGERALD,
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Grammar-schools. See EDUCATION, SECONDARY.

Gramme, grăm, the standard unit of French measures of weight. A gramme = 15.43248 grains troy, from which the equivalents in English measure for the other weights can easily be found; thus:

		Grains Troy		Pounds Avoirdupois
Centigramme	=	.1543234	=	.0000220462
Decigramme	=	1.543234	=	.000220462
GRAMME	=	15.43234	=	.00220462
Decagramme	=	154.3234	=	.0220462
Hectogramme	=	1543.234	=	.220462
Kilogramme	=	15432.34	=	2.20462
Myriagramme	=	154323.4	=	22.0462
Quintal	=	1543234	=	220.462

See METRIC SYSTEM.

Gram'ophone. A sound-reproducing apparatus invented by Emile Berliner. In principle it is similar to the phonograph (q.v.) and the graphophone (q.v.), but differs from these by employing a glass disk coated with lampblack instead of a cylinder of wax for its record. This disk carries a stylus connecting with a diaphragm which is vibrated by the sound-waves, and records those vibrations upon the lampblack surface in the form of a long spiral, as the disk is revolved in a horizontal plane. Unlike the record cylinders of the phonograph or graphophone, the disk cannot be used directly to reproduce the sounds thus recorded, and for that purpose a corresponding disk of hard rubber, prepared from a metal die photo-mechanically etched from the original markings on the lampblack coating of the glass disk is employed.

Gram'pians, Grampian Hills, or **Grampian Mountains.** (1) The mountain system of Scotland, extending across the country from northeast to southwest, for a distance of about 150 miles, and separating the Highlands from the Lowlands. Its limits are not well defined, but it may be said to commence near the southwest end of Loch Awe, on the west coast of Argyleshire, where the main ridge runs, in a well-marked course, along the northern boundaries of Perthshire to Cairn Ealer, where it separates into two distinct branches — one stretching north-northeast on the north side of the Dee, and terminating near Huntly; the other running nearly due east on the south side of that river, and terminating in the neighborhood of Stonehaven. With the exception of Ben Nevis, the Grampians comprise all the highest mountains in Scotland. Among these are Ben Cruachan, 3,689 feet; Ben Lomond, 3,192 feet; Ben Lawers, 3,984 feet; Schichallion, 3,547 feet; Ben Macdhui, 4,296 feet; Cairngorm, 4,084 feet; Cairntoul, 4,241 feet. The more remarkable passes are those of Aberfoyle, Glenshee, and Killiecrankie.

(2) A low range of mountains in the western part of Victoria, in Australia, are called Grampians.

Gram'pus, or **Cowfish,** a genus of porpoises of the family *Delphinidæ*. The species inhabiting the North Atlantic (*Grampus griseus*), reaches a length of about 12 feet. The head is globose, with a slight indication of a beak; the lower jaw shorter than the upper; dorsal fin high and falcate. The upper surfaces of the body are gray in color, the belly grayish white. The body is usually marked with numerous, irregular, light-colored lines which are believed to be due to the attacks of the cuttlefish. The young have the front of the head yellowish white, and six or seven vertical white lines on the sides. There are from 6 to 14 rather large, blunt teeth in the lower jaw, but none in the upper jaw. On the Atlantic coast of North America the grampus occurs singly or in small schools, ranging southward to New Jersey. It also occurs on the coasts of Europe. A closely allied species (*G. Stearnsii*) inhabits the North Pacific, and the genus has been reported from the Cape of Good Hope and New Zealand. The grampus feeds upon cuttlefish, and yields oil of superior quality. The name grampus (from the Italian *gran pesce,* meaning simply "large fish") is applied also to various other cetaceans, and especially to the killer whale (*Orcinus orca*) and to the blackfish (*Globicephala*).

Gran Chaco, grän chä'kō, **El,** a territory of Argentina, Bolivia, and Paraguay, S. A., bounded south and west by Santiago del Estero, and west by Tucuman and Salta. Area, about 275,000 square miles. It is watered by the Vermejo and Pilcomayo and numerous other branches of the Paraguay. In the west it is intersected by spurs of the Andes, and in the east forms extensive plains and marshes, with tracts at times entirely inundated, while in the south are vast sandy deserts, interspersed with salt pools. It is thinly inhabited by Indians, who live chiefly by hunting and fishing. In some parts the forests are extensive, and the vegetation rich. Pop. 10,422.

Granada, grā-nä'da (Sp. grā-nä'dā), (1) An ancient kingdom, subsequently a province of southern Spain, bounded by Andalusia, Murcia, and the Mediterranean. It was part of the Roman province of Boetica, and after the Saracen invasion became an independent Moorish kingdom until it was conquered by Ferdinand and Isabella in 1492, when it became one of the 13 old provinces; it had an area of 11,100 square miles, and since 1833 is divided into the provinces of Granada, Almeria, and Malaga. (2) The modern province, with a coast line of 66 miles on the Mediterranean, has an area of 4,928 square miles. It is picturesquely diversified by mountains and valleys, the chief range being the Sierra Nevada, which attains a maximum altitude of 11,781 feet in the Cerro de Mulhacen, the loftiest summit in Spain. The province watered by the Guadalfeo, the Jenil, and Darro is comparatively fertile and well cultivated; and abounds in mineral wealth. Pop. (1900) 492,460. The capital is (3) Granada, the ancient metropolis of the Moors. It is romantically situated on the rivers Darro and Jenil, at the foot of the snow-capped Sierra Nevada, which forms a background to the crescent-shaped city, with its terraced streets, turrets, and gilded cupolas rising above each other, the whole crowned by the Alhambra (q.v.), the famous citadel palace of the Moorish rulers. Seen from a distance the city has an imposing appearance, but the interior is in a state of decay, and the streets are narrow, irregular, and dirty. The principal buildings besides the Alhambra are, the Generalife, the royal Moorish summer palace, commanding a magnificent prospect; the cathedral, an irregular but splendid building; the archiepiscopal palace; and the residence of the provincial captain-general. Granada is the seat of a university founded in 1531, of several colleges, a normal school, and a school of art. It has various manufactures of local importance only, such as silks and woolens, leather, paper, hats, etc. Granada was founded by the Moors before 800, near the site of the ancient Illiberis, and from 1036 to 1234 was included in the kingdom of Cordova. In 1235 it became the capital of a new kingdom, and attained almost matchless splendor. In 1491 it remained the last stronghold of the Moors in Spain, and mustered 60,000 men to resist Ferdinand and Isabella. The defense proved unavailing, and the besiegers took possession in 1492. A year later it was made the seat of an archbishopric. The great body of its inhabitants still were Moors, and its prosperity continued almost without diminution till 1610, when it declined with the decree expelling the Moors from Spain. Pop. (1900) 75,900.

Granada, Nicaragua. (1) City, capital of the department of Granada; on Lake Nicaragua. It was founded in 1522 and was formerly the chief town of the republic, but has suffered greatly from the civil wars. It is a trading centre for dyewoods, cacao, gold and silver filigree hand-made ornaments, and hides. Pop. 11,879. (2) The department of Granada lies between the Pacific and Lakes Nicaragua and Managua; area about 2,600 square miles. The Mombacho Mountain, an extinct volcano, is the highest peak.

Granadil'la, the edible fruit of certain tropical species of passion-flowers (q.v.).

Gra'nary, The, an ancient burial ground in Boston, Mass., in Tremont Street. Here are buried Paul Revere, Samuel Adams, John Hancock, Peter Faneuil, Chief Justice Sewall, and several of the old colonial governors of Massachusetts.

Granbery, John Cowper, Bishop of the M. E. Church South: b. Norfolk, Va., 5 Dec. 1829; d. Ashland, Va., 1 April 1907. Graduated Randolph-Macon College in 1848, he entered the Methodist ministry in that year, was a chaplain in the Confederate army in 1861–5, and in 1875–82 professor of moral philosophy and practical theology in Vanderbilt University. His publications include: 'Twelve Sermons' (1896) and 'Experience the Crowning Evidence of the Christian Religion' (1900).

Gran'bury, Texas, town, county-seat of Hood County; on the Brazos River, the Fort W. and R. G. R.R. The chief manufactures are flour and farm implements. It has a cotton-gin, and is a trade centre for the products of the surrounding agricultural region. Pop. (1901) 3,773.

Gran'by, Canada, town, in Shefford County in the province of Quebec; about 40 miles southeast of Montreal. It is in an agricultural region, and its manufactures are chiefly for the local trade. Pop. (1901) 3,773.

Granby Token (1737), a private copper coinage issued by John Higley of Granby, Conn., where there were copper mines afterward used as Tory prisons and workshops. The obverse was a deer, with the legend "Value Me as You Please"; Roman numerals III and crescent. The reverse was three hammers on a triangular field, each surmounted by a crown, and with the legend "I Am Good Copper."

Grand, Sarah, pseudonym of Frances Elizabeth Clarke, English novelist: b. Ireland. When 16, she married Lieut.-Col. M'Fall, with whom she traveled in India, China and Japan; in 1901 she visited the United States. She has been active in the woman's movement, in England, serving as president of a Society for Woman's Suffrage, and of the Woman's International Progressive Union, and as vice-president of the Scottish Association for the Promotion of Woman's Public Work. Her first novel was 'Ideala,' written at 26, but the first work to give her a wide reputation was 'The Heavenly Twins' (1893). Her other writings include: 'Singularly Deluded'; 'A Domestic Experience'; 'Our Manifold Nature' (1894); 'The Beth Book' (1897); 'The Modern Man and Maid' (1898); 'Babs the Impossible' (1900).

Grand Army of the Republic, a patriotic association, organized in the interest of the surviving representatives of the military and naval forces of the Civil War, the families of those dead, and such objects as they think cognate with these. The membership is of soldiers and sailors of the War, honorably discharged or continuing, and State militia on active duty subject to national call during that time. It was worked up in Illinois in the winter of 1865–6, by Dr. B. F. Stephenson and Rev. W. J. Rudolph, the surgeon and the chaplain of the 14th Illinois Infantry; the first post was organized at Decatur, Ill., 6 April 1866; the first national "encampment" was held at Indianapolis 20 Nov. 1866. Its assigned objects are fraternity, commemoration, and assistance among the above classes; and it has aided in establishing soldiers' homes and memorials, and maintaining and educating soldiers' orphans. It also caused the institution of Memorial Day. It ruled in 1869 that it should not be used for partisan work, nominations, or debates, but naturally it has been a powerful factor in political calculations and the shaping of party conduct regarding both nomination of candidates for office and legislative action. It has also given out strong utterances against restraining liberality in pension legislation, and has used its influence to prevent official restriction in the expenditure of money under such legislation. It has headquarters in Philadelphia, and in 1902 reported 6,416 posts throughout the country, each State being a department with a commander. The membership was 263,745; it had been over 400,000 at one time. The deaths during the year were 8,299. There is a national council of administration of 45. It holds annual meetings or encampments in the chief cities; the uniform is dark blue with black slouch hat. Its badge is a bronze star hung from a strap and ribbon flag; on the star in relief are a soldier and sailor clasping hands in front of a figure of Liberty, with two freedmen in the foreground, the United States flag on the sides. See WOMAN'S RELIEF CORPS.

Grand Cañon of the Colorado. See COLORADO RIVER; CAÑON; POWELL, JOHN WESLEY.

Grand Falls, or **Colebrooke,** Canada, port of entry, in Victoria County in New Brunswick; on the Saint John River, which is navigable to this point. The falls, which give the name to the place, are about 80 feet in height. Considerable trade is carried on in the agricultural products, and the small game which is abundant in the vicinity. Pop. 1,545.

Grand Falls, a cataract of the Grand River, in Labrador, British America. These falls are in a cañon of the Grand River, 25 miles long and nearly 500 feet deep. About four miles above the falls the river begins a rapid descent of 200 feet to the falls, where the precipice is 320 feet deep and 200 feet wide. Below the falls is another rapid descent of about 300 feet, and then a gradual descent to the ocean. The total descent from the beginning of the first above the falls to the ocean is about 2,000 feet. This cañon was discovered in 1839 by a Hudson Bay Company official named McLean: but no further report being made its existence became a memory until 1891, when it was rediscovered and in 1894 surveyed by the Canadian Geological Survey. (See GRAND RIVER.) Consult 'Report by Canadian Geological Survey.'

Grand Forks, N. Dak., city, county-seat of Grand Forks County; on the Red River of the North and the Red Lake River, and on the Northern P. and the Great N. R.R.'s; about 25 miles west of Crookston and 80 miles north of Fargo. It was settled in 1871 and incorporated in 1881. It is situated in an agricultural and lumbering region. Its chief manufactures are flour, lumber, foundry products, bricks, woolen goods, and steam-boilers. In addition to the trade in its manufactured articles it has a large trade in live stock, wheat, oats, and potatoes. It is the seat of the North Dakota State University, opened in 1884, the Grand Forks College, the Northwestern Normal College, and Saint Bernard's College. The city owns the electric-light plant for street lighting and the waterworks. In the last decade the city increased in population over 50 per cent. Pop. (1900) 7,652.

Grand Gulf, a locality in Mississippi, on the Mississippi River, south of Vicksburg. The Confederate batteries at this place were attacked by the forces under Farragut 31 March 1863, and frequent shelling and bombarding occurred from that time until May 3, when the place surrendered to the land and naval forces under Grant and Porter.

Grand Haven, Mich., a port of entry, city, and county-seat of Ottawa County, on Lake Michigan, at the mouth of Grand River, and on the Detroit, G. H. & M., and the Chicago & W. M. R.R.'s, 110 miles northeast of Chicago. It has an excellent harbor with two lighthouses; there is steamboat connection with the principal lake ports, and a large trade in lumber, grain, flour, leather, etc, is carried on. The city was founded in 1835; it is a summer resort of some popularity, with a noted mineral spring; has municipal waterworks and electric lighting plant, electric street railroads, a public library, and a fine park. Among its educational institutions is Akeley College for Girls. Its industries include the manufacture of lumber, wooden-ware, furniture, refrigerators, machinery, pianos, brass novelties, matches, shoes, barrels, etc.; market gardening is lucratively engaged in and the lake fisheries are important. Pop. (1900) 4,743.

Grand Island, Neb., city, county-seat of Hall County; near the Platte River; on the Burlington & M., the Union P., the Saint J. & G. I. R.R.'s; about 85 miles west of Lincoln and 127 miles southwest of Omaha. The first permanent settlement was made in 1869, and it was incorporated in 1872. It is situated in a fertile agricultural region. The chief manufactures are sugar, beet sugar, flour, canned fruits and vegetables, and brooms. Large repair shops for the Union Pacific Railroad are located here. There is an extensive trade in the manufactured articles, live stock, and wheat. Grand Island contains a number of wholesale establishments and is the distributing centre for a large section of the northwest of Nebraska. The State Soldiers' and Sailors' Home and St. Francis Hospital are located here. It is the seat of Grand Island College, opened in 1892 under the auspices of the Baptist Church, and it has a large free library. The present city charter, of 1901, provides for the election of a mayor every two years and a city council, in whom is vested the government. The city owns the waterworks. Pop. (1900) 7,554.

Grand Junction, Colo., city, county-seat of Mesa County; at the junction of the Grand and Gunnison rivers, on the Colorado and M. and the Denver & R. G. R.R.'s; about 97 miles northwest of Gunnison. It is in the midst of a good farming country, where the land is irrigated. It has a pyritic smelter, and a beet-sugar factory, flour- and lumber-mills. Its trade is chiefly in coal, lumber, bricks, grains, fruits, and vegetables. It is the seat of the Teller Institute, a school for Indian pupils. The waterworks and street car lines are owned by the municipality. Pop. (1900) 3,503.

Grand Jury. See JURY.

Grand Lake, one of the shallow bodies of water in the southern part of Louisiana, about 50 miles long. Its chief inlets are Atchafalaya and Grand rivers, and Lake Vernet. Its outlet is Myrtle Bayou, which flows in Atchafalaya Bay, an arm of the Gulf of Mexico.

Grand Manan, mă-năn', an island at the entrance of the Bay of Fundy, off the coast of Maine. It belongs to Charlotte County, in New Brunswick, Can.; area, about 100 square miles. On the north coast, at Indian Beach, is a settlement of Indians. Fishing is the chief occupation, but the large forests still furnish material for ship-building and some lumber. The island is a favorite summer resort, because of its climate and abundance of small game. Pop. 2,590.

Grand Prix de Rome, grän prē dė rōm, a prize given annually by the Academy of Fine Arts in Paris to the most successful competitor in painting, music, sculpture, etc. The winners of the prize become the charge of the government for four years and are sent to Rome to reside. See ECOLE DES BEAUX ARTS.

Grand Rapids, Mich., city and county-seat of Kent County, second to Detroit in population and importance, is situated on both sides of Grand River, about 30 miles from Lake Michigan, 152 miles from Detroit, 180 miles from Chicago; lat. 42° 57′ 49.02″ N., lon. 85° 40′ 1.65″ W.

Railroads.—The first railroad into Grand Rapids was the Grand Trunk, from Detroit to Grand Haven, in 1858. Since then have been built the Grand Rapids & Indiana, the Michigan Central, the Lake Shore & Michigan Southern, and the Pere Marquette. These roads radiate in 11 different directions, with through trains to all important Michigan cities, Chicago, Cincinnati, and Toledo. The Grand Rapids & Indiana and the Pere Marquette have extensive shops, the latter established in the past year and representing an investment in land, buildings, and equipment of over $500,000. Two interurban lines run out of the city, the Grand Rapids, Holland & Lake Michigan to Holland and Saugatuck, with South Haven, Saint Joseph, and Chicago future objective points; and the Grand Rapids, Grand Haven & Muskegon. Another line is under contract to be built (1905) to Ionia and thence to Lansing, and lines south to Kalamazoo and north to Rockford are projected.

Industries.—Grand Rapids is the base of supplies and the distributing point for western and northern Michigan. It has large wholesale and jobbing houses in groceries, provisions, clothing, dry goods, millinery, carpets, crockery, drugs, paper, cigars, boots and shoes, knit goods, sporting goods, hardware, mill supplies, and in other lines. The chief industry is the manufacture of furniture (see FURNITURE INDUSTRY), with 38 factories, capital $8,005,713, employing 6,654 hands, and annual product valued at $9,409,097. These statistics are from the special United States census taken in 1904. New York and Chicago in their order exceed Grand Rapids in the volume of their furniture production, but Grand Rapids is the recognized leader in design, finish, and quality. Semi-annually, in January for the spring season, and July for the fall, buyers come here from all parts of the United States and from foreign lands to inspect the new styles and to place orders. The semi-annual visitors number from 800 to 1,000. Between 300 and 400 manufacturers of furniture and kindred lines in other parts of the country semi-annually send their samples here for the buyers to inspect. The outside manufacturers occupy large furniture exposition buildings, built for their use, in the heart of the city. There are four of these exposition buildings, one occupying an entire square, five stories high, and two more are projected.

Other important industries and the value of the annual product are (1904): Flour and grist-mill products, $2,370,787; machinery and foundry, $1,265,298; bread and bakery goods, $1,178,138; lumber and planing-mill, $967,396; carriages and wagons, $494,617; hosiery and knit goods, $590,472; wood ornaments, $419,827; men's clothing, $337,900; tobacco and cigars, $574,726; shirts, $111,625; miscellaneous, $11,-802,898. The census shows a total of 389 factories, with $25,915,861 capital, employing 15,707 hands, paying $7,392,748 in wages, using $14,615,-176 worth of material, and producing goods valued at $31,032,589. The largest sticky fly-paper and carpet-sweeper factories in the world are located here. Twenty-five per cent of the total United States production of gypsum is from the Grand Rapids quarries.

Fruit-growing.—Grand Rapids is also the centre of the West Michigan fruit belt, which extends along Lake Michigan from Saint Joseph to Traverse City. The 1904 peach crop in Michigan was a partial failure, but 479,000 bushels of peaches were marketed here; also 741,000 bushels of apples; 57,000 bushels of cherries, 52,000 bushels of plums; 8,300 barrels of pears; 200,000 crates of strawberries; 96,000 of blackberries; 91,500 of raspberries, besides large quantities of other fruit. The value of the crop marketed here was estimated at $1,850,-280. This does not include the large quantities of fruit purchased from this city as a base in Mason, Oceana, Muskegon, Ottawa, Allegan, and Van Buren counties and shipped direct to the consuming market. With an average crop the peaches marketed here will exceed 1,000,000 bushels. This is also an important winter lettuce centre, Chicago, Cincinnati, Saint Louis, and even New York drawing on the Grand Rapids growers for their supplies. One of the most popular varieties of winter lettuce originated here and is named the Grand Rapids.

Banks.—The city has five national banks capitalized at $2,300,000, five state banks capitalized at $650,000, and one trust company $200,000. A sixth state bank, capital $100,000 will begin business early in the summer of 1905. The January 1905 statement showed total loans and discounts, $15,868,050.88; stocks, bonds, and mortgages, $6,495,646.93; commercial deposits, $7,733,544.54; savings and certificate deposits, $11,486,877.91; and total deposits, $21,-415,024.93. The bank clearings in 1904 were $101,037,199.30.

Churches, Schools, etc.—All the Christian church denominations are represented with congregations and churches. The bishops of the Grand Rapids Catholic diocese and West Michigan Protestant Episcopal diocese live here. The Catholics have a cathedral. The total value of church property is estimated at $1,500,000. The Catholics hold $455,800; Holland Reformed, $228,100; Methodist Episcopal, $153,900; Congregational, $117,900; Baptist, $110,100; Protestant Episcopal, $100,200; Lutheran, $98,800; Presbyterian, $68,200; and other denominations in smaller amounts.

The Holland Theological Seminary, one of the chief educational institutions of the Holland Reformed Church in America, is located here. The Catholics, Lutherans, and Holland Reformed Churches have parochial schools accommodating about 5,000 pupils.

The city owns one high school and 35 ward schools, estimated in value at $1,510,000, managed by an elective board of education of 24 members and the mayor *ex officio*. A movement is on foot to reduce the board to a smaller body. It is also proposed to build a manual training school to cost $60,000. The school enrolment is about 15,000; the cost of maintenance by direct taxation is about $400,000.

The Ryerson public library, a gift to the city of his birth by Martin A. Ryerson of Chicago, contains 65,000 volumes. It is controlled by an elective board of five members. The museum, under the control of the board of education, occupies property costing $30,000, and is especially strong in natural history specimens.

Public Institutions.— The Michigan Soldiers' Home, maintained by the State, with accommodations for 1,000 veterans and 200 widows, is located three miles north of the city. The Michigan Masonic Home, maintained by the Michigan Grand Lodge of Masons, with 250 inmates, is located three miles east of the city. There are three large hospitals, two orphan asylums, one home for the aged, two refuges for unfortunate women, and several minor philanthropics. The city maintains a hospital and the county has a farm and hospital.

Public Buildings.— The public buildings are city hall, valued at $300,000; court-house, $250,000; federal building and post-office, $350,000; county jail, $50,000; Ryerson public building, $350,000; museum, $30,000; police headquarters, $66,000. A bill was favorably reported in the last Congress appropriating $500,000 for a new government building.

Newspapers, Theatres, etc.— The city has three daily newspapers, *The Grand Rapids Herald* (morning), and *The Press* and *The Post* (evening). The city has four theatres.

Clubs and Societies.— The Peninsular Club with 350 business men members owns a club house in the heart of the city valued with real estate at $150,000. The Lakeside Club with 800 members has a club house at Reeds Lake costing $60,000. The Kent County Club owns 100 acres of land and a $15,000 club house in the north part of the city. The Germans have four club houses and halls; the Irish, the Danish and the Polish each one. The Ladies' Literary Club, the Grand Rapids Woman's Club, the West Side Ladies' Literary Club, and the St. Cecelia (musical) Society, all made up exclusively of women, own club houses. The Ladies' Literary club house, built about 30 years ago, was one of the first of the kind in the country. The Young Men's Christian Association has nearly 1,000 members and owns and occupies a building that cost $60,000. The Grand Rapids board of trade has 1,200 members.

Parks and Resorts.— The city has John Ball Park of 100 acres, the original 40 acres of which was the gift of John Ball; the Antoine Campau Park of five acres, the gift of Martin A. Ryerson; Highland Park of eight acres; Fulton Street Park occupying a square, and numerous small parks. The parks are estimated in value at $350,000. Comstock Park of 100 acres is owned by the West Michigan Fair Association, and if it shall cease to be used for fair purposes the property will revert to the city. Reeds Lake, three miles east of the city, and North Park, near the Soldiers' Home up the river, are popular nearby summer resorts. The Lake Michigan resorts at Saugatuck, Holland, Grand Haven, and Muskegon are one hour away by rail. The northern Michigan resorts are easily accessible.

Public Utilities.— The city owns its own waterworks, with Grand River as a source of supply and 150 miles of mains of all sizes, also owns its own electric lighting plant, garbage burner and market. There are 286 miles of street, of which 173 miles are improved. Of the latter, 7 miles are asphalt, 9 brick on concrete foundations, 4 cedar block on concrete, and 6 macadam. Six bridges owned by the city span the river, one at Bridge Street being of concrete construction, four steel and one wood Commercial lighting is furnished by the Grand Rapids Gas Light Company and Edison Electric Light Company, each having a monopoly in its field. The Grand Rapids Railway Company with 60 miles of track, mostly double, controls the street railways.

Government.— Municipal affairs are conducted by a mayor, elected for a term of two years, and a council of 24 aldermen, two from each ward elected for two-year terms, half retiring each year. The fire and police departments, the health, the poor, and the public works departments are under the control of boards appointed by the mayor. The total bonded indebtedness of the city is $2,203,000, of which $1,025,000 is water, $218,000 schools, and $460,000 street improvements. The property owned by the city is estimated in value at $5,593,483.66, not including the schools, library and museum properties. The expenditures for public improvements in 1904 aggregated $233,846, of which $212,091 was for street improvements and $21,755 for sewers.

History.— In 1828 Louis Campau established an Indian trading station here, and in 1831, after the government survey, made the first entry of land. The first settlers, Joel Guild and family, arrived in June 1833. Grand Rapids was incorporated as a village in 1838 and as a city in 1850.

Population.— (1850), 2,686; (1870), 16,507; (1890), 64,147; (1900), 87,565, and the State census of 1904 gave it 95,718. Thickly settled suburbs will add approximately 10,000.

LEWIS G. STUART,
Managing Editor, 'The Grand Rapids Herald.'

Grand Rapids, Wis., a city and the county-seat of Wood County, on the Wisconsin River, the Wisconsin C., the Chicago, M. & St. P., the Chicago & N., and other railroads, about 70 miles northwest of Oshkosh. The river is spanned by a fine bridge connecting with Centralia, a suburban municipality prior to 1900, when it was incorporated with Grand Rapids. Lumbering and agriculture are the chief occupations of the inhabitants and there are lumber, pulp, paper, and flour mills, manufactures of furniture, foundries and machine shops. In the neighborhood are deposits of kaolin. Pop. (1900) 4,493.

Grand Rapids & Indiana Railway Company. This company, fifth in succession, owning a completed line of railroad starting at Fort Wayne, Ind., running thence northerly through the city of Grand Rapids and the western section of Michigan to the Straits of Mackinac, 366.63 miles main line, with spurs and branches in Michigan, aggregating 413.69 miles, had its inception first in January 1854, at Hartford, Ind., where a company known as Grand Rapids & Indiana Company No. 1 was formed with the idea of building a railroad from Louisville, Ky., to the Michigan pineries, but accomplished nothing more than locating a line from Hartford to the northern State line of Indiana, and also as far as Sturgis, Mich.

In May 1855 the Grand Rapids & Southern Railroad Company was organized in Michigan by the same interests to build a railroad from Grand Rapids to the Indiana State line, and consolidated with the first company in September 1855, forming Grand Rapids & Indiana Company No. 2. Upon this company the State of Michigan, by an act of 14 Feb. 1857, conferred the lands granted to the State by an Act of Congress 3 June 1856, to aid in the construction of a railroad from Grand Rapids to some point on Little Traverse Bay.

In June 1857 the Grand Rapids & Mackinaw Railroad Company and the Grand Rapids & Fort Wayne Railroad Company were created and consolidated, forming Grand Rapids & Indiana Company No. 3.

The first 13 years of the life of this enterprise is replete with failures to construct any portion of its line between Fort Wayne and Grand Rapids. With the aid derived from the bonds voted by the cities of Fort Wayne and Grand Rapids it finally completed in December 1867 the first 20 miles of road from Grand Rapids north to Cedar Springs. As early as 1860 and 1861 the company had made two mortgages, the first to secure $5,000,000 and the second $4,500,000.

On 30 Sept. 1869 a contract was entered into by the Pennsylvania Railroad Company, lessee of the Pittsburgh, Fort Wayne & Chicago Railway, the Continental Improvement Company, and the Grand Rapids & Indiana Railroad Company, for an issue of $8,000,000 seven per cent bonds, secured upon the lands and road, running 30 years from 1 Oct. 1869— $4,000,000 of which were guaranteed by the Pittsburgh, Fort Wayne & Chicago Railway Company, and $4,000,000 unguaranteed. With part of the proceeds of these bonds and the proceeds of $3,000,000 of debenture bonds, the Continental Improvement Company completed the road from Fort Wayne to Petoskey (Little Traverse Bay) in November 1873. The cost of road and equipment as per settlement contract was $10,848,250.

In June 1871 the Grand Rapids & Indiana Railroad Company took a lease for 99 years of the Cincinnati, Richmond & Fort Wayne Railroad, then building, and which was completed in December 1871, from Richmond, Ind., to Adams (five miles east of Fort Wayne), 86 miles, to be used as an outlet south of Fort Wayne for the traffic of the Grand Rapids & Indiana Railroad.

The Continental Improvement Company, under a contract with the Traverse City Railroad Company, dated December 1871, completed the Traverse City Railroad from Traverse City to Walton Junction, 26 miles, in December 1872, and this road was leased to the Grand Rapids & Indiana Railroad Company for 50 years from January 1883, rental being net earnings, which were guaranteed to equal annual interest on first mortgage bonds, $250,000.

In June 1881 the Grand Rapids, Indiana & Mackinaw Railroad Company was organized in the interest of the Grand Rapids & Indiana Railroad Company for the purpose of extending its road from Bay View to Mackinaw City. This portion of the line was open for operation in July 1882. This company was consolidated with Grand Rapids & Indiana Company (No. 3) in October 1884, under the name of Grand Rapids & Indiana Company (No. 4).

The Bay View, Little Traverse & Mackinaw Railroad Company, line from Bay View to Harbor Springs, Mich., six miles, completed its road in 1882; was sold under foreclosure proceedings in February 1888, and purchased at sale by the Grand Rapids & Indiana Railroad Company, which owned all its stock and bonds.

The Muskegon, Grand Rapids & Indiana Railroad Company was organized in the interest of the Grand Rapids & Indiana Railroad Company in February 1886. The road was completed from Muskegon to Grand Rapids, 37 miles, in December 1886, and leased to the Grand Rapids & Indiana Railroad Company for 99 years from time of its completion, June 1886, rental being net earnings, which were guaranteed by the lessee to be equal to the fixed charges (interest on $750,000 five per cent bonds), and 20 per cent of gross earnings of all business interchanged; but the excess of expenditure over earnings forced the sale under foreclosure 10 June 1896.

A new company was organized as the Grand Rapids & Indiana Railway Company, was incorporated in Indiana and Michigan in July 1896, and commenced operation of the road 1 Aug. 1896, with a capital stock of $6,000,000. Of this, $4,291,000 was exchanged for third mortgage 5 per cent bonds, and $1,500,700 for debts, and also provided for a second mortgage of $5,000,000 (2 per cent first year, 3 per cent two years, and 4 per cent thereafter), of which $3,062,000 were exchanged for second mortgage bonds and certain debts of the old company; the remainder held in treasury for necessary betterments to the property in its then depleted condition.

For the year ending 31 Dec. 1904 the total earnings were $3,302,346, and the operating expenses were $2,680,487, thus showing net earnings for the year of $621,859.

By economical management and wise expenditures for betterments and additions, the company was enabled to make a slight return in the shape of dividends to its shareholders, first in 1900, beginning with 1 per cent and now paying 3 per cent; but is confronted by such hostile legislation in Michigan, both in the reduction of its passenger fares and increased taxation, to such an extent that it is a serious question whether it can continue the small return to those who furnished the capital, so long in advance of its needs, to develop western Michigan and northern Indiana.

W. R. Shelby,
Vice-President G. R. & I. Ry. Co.

Grand Remonstrance, a document of protest against misgovernment, drawn up by the House of Commons on 22 Nov. 1641 and presented to Charles I. of England on 1 Dec. 1641. The causes leading up to this written protest were many, and its passage, by a majority of 11, by the House after a long, stormy debate, was undoubtedly hastened by the outbreak of rebellion in Ireland, and also the absence of the king, who at the time was in Scotland. The Puritan leaders had become disgusted with the intrigues carried on by the king with the Earl of Montrose, and in this document the grievances were set forth in such a manner that they were in fact an indictment of the whole governmental policy of the king. The imprisonment of members of Parliament without cause, the billeting of soldiers, the high-handed methods of the Star Chamber, High Commission, and the Council of the North, the excessive abuses of the commercial monopolies, and the unwarranted extension of the royal forests, as well as other minor grievances, in all 204 sections, were the points discussed in the manifesto. In it were also asked the appointment of new ministers, and that to a synod of learned divines be given the task of Church reform. King Charles ridiculed the document when it was presented for his consideration; on 10 December gave an indirect reply to the criticisms contained therein in shape of a proclamation on religion; on 23 December answered the petition in an extremely evasive manner; and on 3 Jan. 1642, before the House of Lords, impeached the leaders in the Commons who were most opposed to him, and who had been most instrumental in the passage of the document.

Grand River, a tributary of the Colorado River, which has its rise in the northwestern part of the State of Colorado, in the Rocky Mountains, and flows south by west into the State of Utah to latitude 40° 39', and then almost directly south to 35° 40', where it unites with the Green River (q.v.) to form the Colorado. Its length is almost 400 miles. Its chief tributaries are the Dolores and Gunnison. There are many deep cañons along its course through the mountains, and although much of the valley land is fertile, but few settlements have as yet been made.

Grand River, in the southern part of Iowa, has its source in the central part of Adair County and flows southeast through several counties in Iowa and Missouri, a distance of about 300 miles, into the Missouri River at Brunswick, Mo.

Grand, or **Hamilton River**, in Labrador, is the largest river in this section of British America which flows into the Atlantic Ocean. Part of its course is through a mountainous region, and it is the outlet of several lakes. The Canadian Geological Survey of 1894 gives the first reliable descriptions of this river and the adjacent country. See GRAND FALLS.

Grand River, in Michigan, has its rise in Jackson County, flows north and west in an irregular course for about one half its distance, then west by north to Lake Michigan. Its whole length is nearly 300 miles, although a direct line from its source to its mouth is only about 100 miles. It is navigable from Grand Haven, at its mouth, to Grand Rapids, a distance of 40 miles.

Grand Traverse Bay, an extension of Lake Michigan projecting into the State of Michigan, and named from Grand Traverse County, by which it is bounded on the south. The southern part of the bay is divided into two arms by Preogenise Point, the western arm being bounded by Leelenaw County and the eastern arm by Antrim County.

Grand Trianon, grän trē-ä-nôn, Versailles, France, a one-storied palace of considerable extent, formerly a private residence of the French sovereigns, and originally built for Madame de Maintenon by Louis XIV. The palace is visited for its historic interest; its numerous apartments retain much of the original furniture, and contain several fine modern works of art. It is called the Grand or Great Trianon to distinguish it from the Petit Trianon (q.v.).

Grandledge, Mich., city in Eaton County, on the Grand River and the Pere M. R.R.; 14 miles northwest of Lansing. The manufactures are flour, canned goods, sewer-pipe, furniture, and foundry products; and its trade is in its manufactured articles, and the products of the surrounding agricultural country. Pop. (1900) 2,161.

Grand Old Man, The, a name popularly applied to W. E. Gladstone (q.v.).

Grandpré, grän-prā, Canada, village in King's County, in the province of Nova Scotia; on the Minas Basin. Longfellow's poem, 'Evangeline,' has made famous this village and the country around. In 1613 the French settlers living here were driven from their homes by British soldiers. (See NOVA SCOTIA.) Consult Eaton, 'Acadian Legends and Lyrics.' •

Grandville, grän-vēl. See GERARD, JEAN I. I.

Granet, grä-nā', **François Marius**, French painter: b. Aix, in Provence, 1775; d. there 21 Nov. 1849. After studying under Constantin and David, in 1802 he went to Rome, spending much of his life there. He gained an enviable reputation as a painter of architectural subjects, though no small number of his works are historical. He was appointed custodian of the paintings in the Louvre in 1826, and upon his death bequeathed his fortune to his native city for the erection and maintenance of a museum there. The most famous of his works are: 'Interieur de l'église des Capuchins à Rome' (1819); 'Englise souterraine d'Assise' (1823); 'Le Tasse visitè dans sa prison par Montaigne'; and 'Prise d'habit au couvent de Saint-Claire à Rome.'

Grange. See GRANGERS.

Grangemouth, Scotland, city and seaport of southeast Stirlingshire, situated near the confluence of the Carron and Forth rivers, and about three miles northeast of Falkirk. Situated as it is, close to the Firth of Forth, and at the entrance of the Clyde Canal, it is one of the most important of Scottish ports, ranking third in value of imports and exports. The immense docks are 28 acres in extent, the timber basins cover 32 acres, and the total quayage amounts to about 2,300 yards. The principal industries are ship-building and coal-mining, while the manufacture of iron and steel, brick and tile is carried on to a considerable extent. The total value of imports in 1898 was about $13,000,000, an increase from $5,500,000 in 1888; the exports in 1888 were valued at $3,500,000, which in 1898 increased to $11,000,000. The main article exported was coal, and the imports consisted mostly of timber, pig-iron, and iron ore. The town has a building for its administrative purposes; there are also a public library, a public institute, and a large park. Pop. (1901) 7,968.

Granger, grān'jėr, **Francis**, American politician: b. Suffield, Conn., 1792; d. 1868. He was the son of Gideon Granger (q.v.). Graduated from Yale in 1811, he began the practice of law in 1814, was elected from Ontario County to the State legislature of New York in 1825, was re-elected in 1826, and was a delegate to the Harrisburg (Pa.) Protectionist convention. He was prominent in the anti-Masonic movement of the time. In 1834 he was a leading candidate of the newly organized Whigs for the nomination for governor, and in 1834 and 1838 was elected to Congress, and in 1841 became postmaster-general in President Harrison's cabinet. He sat again in Congress in 1841–2, led the stampede of the Whig convention at Syracuse in 1850, and in 1861 was a member of the Peace convention held at Washington.

Granger, Gideon, American politician: b. Suffield, Conn., 19 July 1767; d. 31 Dec. 1822. He was graduated at Yale College in 1787, and having been admitted to the bar, rose to eminence in his profession, and was elected a member of the legislature of his native State. He had an active part in establishing the Connecticut school fund, and in 1801 President Jefferson appointed him postmaster-general. He retained office during both of Jefferson's terms, and was reappointed by President Madison, whose policy he nevertheless opposed. He was consequently displaced in 1814, soon after Madison's second inauguration. He then removed to Canandaigua, N. Y., and was chosen a member of the senate of New York in 1819. He promoted internal improvements, and gave 1,000 acres to further the construction of the Erie canal.

Granger, Gordon, American soldier: b. New York 1821; d. Santa Fé, N. M., 10 Jan. 1876. He was graduated from the United States Military Academy in 1845, served with distinction in the Mexican war, during the Civil War was appointed, in 1862, to the command of the Army of Kentucky, with rank of major-general of volunteers, was prominent at Chickamauga, commanded a division at Fort Gaines (Ala.) (1864), and the Thirteenth Army corps in the capture of Fort Morgan. Brevetted major-general for the capture of these forts, he was mustered out of the volunteers in 1866; in that year was promoted to be colonel, and afterward was commander of the district of New Mexico.

Granger, James, English writer and print collector: b. Shaston, Dorset, in 1723; d. Shiplake, Oxfordshire, 4 April 1776. After graduating from Christ Church, Oxford, in 1743, he took holy orders and was assigned to the vicarage of Shiplake. After a long pastorate there he went on a tour through Holland, in 1773. He wrote: 'A Biographical History of England . . . with a preface showing the utility of a collection of engraved portraits, etc.' (1769). By 1824 his works had received enough additions to make six volumes. In 1806 the Rev. Mark Nohle edited another edition of his works, and since then several editions of his works, together with additions by other authors, have appeared. Two of his sermons were also published, entitled 'An Apology for the Brute Creation' (1772); and 'The Nature and Extent of Industry' (1775).

Granger, Robert Seaman, American soldier: b. Zanesville, Ohio, 24 May 1816; d. Washington, D. C., 25 April 1894. A graduate of the United States Military Academy, he served in the Seminole, Mexican, and Civil wars, and in the last named was brigadier-general of volunteers in 1862–5. During the Civil War he commanded the military district of northern Alabama, in 1864, in the same year defended Decatur against Hood, and in 1865, during the occupation commanded northern Alabama.

Granger Cases (said by Justice Field during the trial to be the popular term outside for the whole group; but only as being in the farmers' interest, not because the Patrons of Husbandry, or any of its lodges as such, had anything to do with them), six cases decided in the United States Supreme Court, October term, 1876, all bearing on the same point and decided on the same principles. They were Munn *v.* Illinois; Chicago, B. & Q. R.R. Co. *v.* Iowa; Peik *v.* Chicago & N. W. R.R. Co.; Chicago, M. & St. P. R.R. Co. *v.* Ackley; Winona & St. P. R.R. Co. *v.* Blake; and Stone *v.* Wisconsin. The first, whose decision ruled the others and was given at much the greatest length, was to test whether the act of the Illinois legislature, 25 April 1871, to regulate public warehouses and the inspection and handling of grain, was constitutional. The case was an extreme one: the act was passed for warehouses only in "cities of over 100,000 people" (Chicago), and was therefore a special discrimination; it laid a host of minute, costly, and laborious impositions on warehousemen and elevator owners, and obliged them to publish daily in the newspapers a table of the charges made the previous year, which must not be increased during the current year — therefore, of course, never, as each year was a canon for the next. The court decided that, according to immemorial common law, the government had a right to regulate the use of property for the public good, and to fix maximum charges for public services of those with whom the public has no choice but to deal. Such regulations were never supposed to deprive private owners of their property, but the devotion of property to a use in which the public has an interest subjects it *pro tanto* to public control. In other words, the public is a partner in public corporations. The forms of law may be changed at the will of the legislative body, so long as they only give new effect to old provisions. And warehouses exclusively within one State may be regulated by State legislation, even though their business involves interstate relations. Justice Field made a powerful dissenting argument, concurred in by Justice Strong, on the ground that the legislature had no right to meddle with private business, and it was simply giving that body the power to confiscate private property, contrary to the Constitution. The railroad cases were all against the power of the States under legislation to enforce maximum transportation rates. The decisions were the same in essence, but the court declined to pronounce that the roads would forfeit their charter if they disobeyed the law, which, nevertheless was not repugnant to the Constitution. The division of the court was the same; and Justice Field again stated the case for the companies. It was, that the charters of the roads were constitutional, and the right to reasonable compensation was the essential feature of the grant; that what was reasonable was a question for the judges and not the legislature to determine. Such regulation of fares as would take from a company the power to meet its just obligations was illegal, and only the courts could determine the facts; this, therefore, was taking away private property without process of law. Such an interpretation of the limits of legislative power over corporations places them at the mercy of every legislative majority. It makes all business public business, and practically destroys all the guaranties of the Constitution.

Grangers, the popular name for the Patrons of Husbandry, a secret association in the interests of agriculture. In 1866 the government sent O. H. Kelley (on the staff of the Department of Agriculture) to inspect and report on agricultural conditions in the South, and suggest means of improving them; he found them very wretched, and the farmers poor, backward, and disintegrated. Considering organization the first requisite for self-defense, and for securing improved methods and needed legislation, he, with six others, formed in December 1867 the National Grange (Farm) of Patrons of Industry. Only farmers could be members; but their women were admitted both to membership and office. The machinery was like that of other secret societies; the local bodies were called granges, and each State had its State grange. There were four «degrees» in local granges, one in State «Pomona,» and two in national («Flora» and «Ceres»). For the first four years the growth was slow; in 1872 it began to spread rapidly, in a year it had over 10,000 granges, and in 1875 its membership was 1,500,000, distributed through every State in the Union. By its rules the order was to have no part in political work, nominations, or discussions, and as an order it had none, but the members could not be expected to neglect the very object of its existence, and almost immediately they began work against railroad rates and discriminations, trusts, «futures,» oleomargarin, etc., besides forming the chief part of the great movement against hard money (see GREENBACK PARTY) — in all of which their organization, and the consequent bid for their support from political parties, aided them enormously. It is therefore not surprising that «granger» has become a typical adjective for all measures in the supposed interest of the western and southern farmers, or of which they form the chief support, the word having the sanction of the highest court (see GRANGER CASES). The Department of Agriculture as a Cabinet office, the act for founding experiment stations, and the Interstate Commerce Bureau are among the more legitimate fruits of the order; others are the subject of much difference of opinion. It has also done much to form co-operative societies, and attempted to make the grain-elevator system a portion of it. The political element, however, was discrediting the whole movement by its excesses and ill judgment, and finally took separate shape as the Farmers' Alliance and the Populist Party (qq.v.), leaving the diminished Patrons of Husbandry to a useful and growing social and industrial influence. Consult: 'American Annals of Political Science,' Vol. IV.; 'Popular Science Monthly,' Vol. XXXII.

Granite, an unstratified rock, normally consisting of three simple minerals, feldspar, quartz, and mica, or, in Dana's nomenclature, of orthoclase, quartz, and mica. For a long time the universally accepted view which is still the prevalent one, was that it is an «igneous» rock of a «plutonic» type. The difficulty has, however, to be encountered that it is not seen in process of formation on the earth's surface. This has been met by the hypothesis that it originates beneath the surface and under high pressure, produced in most cases by earth, but in some instances by a weight of incumbent water. Like surface volcanic rocks it has been fused and afterward cooled; but it does not, like them, comprehend tuffs and breccias, etc., but assumes a crystalline texture, destitute of pores, or cellular cavities to which gases entangled in lava or any such rock give rise. It is in favor of its igneous origin that it has in many places broken through ordinary sedimentary or metamorphic strata, sending veins through them in various directions. It rarely, however, overtops or caps them, as if coming up molten through a crater it had overflowed them above. Hence the term proposed for it — «underlying» — to distinguish it from the volcanic rocks, called «overlying» rocks. It is of all ages, some granite in the Alps having broken up the strata during Tertiary times. Granite encloses fluid cavities, having in them water, containing chlorides of potassium and sodium, with sulphates of potash, soda, and lime. Granite hills have a peculiar rounded form, with a scanty vegetation. They are easily distinguishable from the flat-topped precipice flanked basaltic hills. Von Buch considers that granitic mountains so much tend to be portions of a sphere, that he looks upon them as ellipsoidal bubbles, which were forced upward only in a partially fluid state; then, when the upper dome-shaped surface contracted, many granitic blocks were formed. Granite is of much economic value as a building stone. The production of granite in the United States in 1900 was valued at $12,675,617. The leading States in its production were Maine, Massachusetts, Vermont, and Delaware. See GEOLOGY; STONE.

Granite State, The, the popular name of New Hampshire. Fine building granite is quarried at many points, notably at Plymouth, Concord, Milford, Pelham, etc.

Grant, Sir Alexander, English educator: b. New York 13 Sept. 1826; d. Edinburgh 30 Nov. 1884. He went to India in 1859, and in 1862 became principal of the Elphinstone College, Madras, and in 1863 was made vice-chancellor of Bombay University. In 1868 he returned to Scotland to become principal of the University of Edinburgh, a position which he held till his death. He wrote: 'Story of the University of Edinburgh' (1883); and annotated and edited Aristotle's 'Ethics' and Xenophon.

Grant, Frederick Dent, American soldier: b. St. Louis, Mo., 30 May 1850. The eldest son of Gen. Ulysses S. Grant (q.v.), he was graduated from the United States Military Academy in 1871, was assigned to the 4th cavalry, was aide-de-camp to Sheridan in the latter's Indian campaigns, in 1874 served in the Black Hills expedition, and in 1881 resigned from the army with rank of colonel. Later in business at New York, he was minister to Austria in 1888–93, and a police commissioner of New York in 1897 during the Strong administration. At the outbreak of the Spanish-American war (1898) he became colonel of the 144th New York volunteers, was in the same year appointed brigadier-general of volunteers, served for a year in Porto Rico, and subsequently commanded the military district of San Juan. He was also stationed in the Philippines, and appointed brigadier-general in the regular service in 1901.

Grant, James Augustus, British soldier and explorer: b. Nairn, Scotland, 1827; d. there 11 Feb. 1892. He accompanied Capt. Speke in his search for the sources of the Nile (1860–3), when they explored the Victoria Nyanza and were rewarded by the discovery of the river issuing from the north of the lake. This expedition was described in a volume entitled 'A Walk Across Africa' (1874).

Grant, Robert, American author and judge: b. Boston, Mass., 24 Jan. 1852. He was graduated from Harvard in 1873 and the Harvard Law School in 1879, and has practised law in his native city since 1879. He was one of the water commissioners of Boston 1888–93, and in the latter year became a judge of probate and insolvency for Suffolk County, Mass. He has published: 'The Little Tin Gods on Wheels' (1879); 'Confessions of a Frivolous Girl' (1880); 'The Lambs,' verse (1882); 'An Average Man' (883); 'Face to Face' (1886); 'Jack Hall' (1887); 'Jack in the Bush' (1888); 'The Reflections of a Married Man' (1892); 'The Opinions of a Philosopher' (1893); 'The Art of Living' (1895); 'The Bachelor's Christmas' (1895); 'Search Light Letters' (1899); 'Unleavened Bread,' a novel which has been widely read (1900).

Grant, Ulysses Simpson, American general and 18th President of the United States: b. 27 April 1822, in a small two-room cabin situated in Point Pleasant, a village in southern Ohio, about 40 miles above Cincinnati; d. Mt. McGregor, N. Y., 23 July 1885. His father, Jesse R. Grant, was a powerful, alert, and resolute man, ready of speech and of fair education for the time. Ulysses Grant grew to be a sturdy, self-reliant boy. He loved horses, and became a remarkable rider and teamster at a very early age. At the age of 17 he was a fair scholar for his opportunities, and his ambitious father procured for him an appointment to the Military Academy at West Point.

His record at West Point was a good one in mathematics and fair in most of his studies. He graduated at about the middle of his class, which numbered 39. He asked to be assigned to cavalry duty, but was brevetted second lieutenant of the 4th infantry, and ordered to Jefferson Barracks, near St. Louis. Here he remained till the spring of 1844, when his regiment was ordered to a point on the southwestern frontier, near the present town of Natchitoches, La. Here he remained till May 1845, when the Mexican War opened, and for the next three years he served with his regiment in every battle except Buena Vista. He was twice promoted for gallant conduct, and demonstrated his great coolness, resource, and bravery under the hottest fire. He was regimental quartermaster much of the time, and might honorably have kept out of battle, but contrived to be in the forefront with his command.

He was regimental quartermaster at Fort Vancouver, near Portland, Oregon, for one year. In 1853 he was promoted to a captaincy and ordered to Fort Humboldt, near Eureka in California. In 1854, becoming disheartened by the never-ending vista of barrack life, and despairing of being able to have his wife and children with him, he sent in his resignation, to take effect 31 July 1854 and returned to St. Louis.

His father-in-law, Frederick Dent, who lived about 10 miles out of St. Louis, set aside some 60 or 80 acres of land for his use, and thereon he built with his own hands a log cabin, which he called "Hardscrabble." For nearly four years he lived the life of a farmer. He plowed, hoed, cleared the land, hauled wood and props to the mines, and endured all the hardships and privations of a small farmer.

In the spring of 1860, despairing of getting a foothold in St. Louis, he removed to Galena, Ill., where his father had established a leather store, a branch of his tannery in Covington, Ky. When Galena held a war meeting to raise a company, Capt. Grant, because of his military experience, was made president of the meeting, and afterward was offered the captaincy of the company, which he refused, saying: "I have been a captain in the regular army. I am fitted to command a regiment."

He wrote at once a patriotic letter to his father-in-law, wherein he said: "I foresee the doom of slavery." He accompanied the company to Springfield, where his military experience was needed. He mustered in several regiments, among them the 7th Congressional Regiment at Mattoon. He made such an impression on this regiment that they named their camp in his honor, and about the middle of June sent a delegation of officers to ask that he be made colonel. Col. Grant marched his men overland, being the first commander of the State to decline railway transportation. His efficiency soon appeared, and he was given the command of all the troops in and about Mexico, Mo. At this point he received a despatch from E. B. Washburne, congressman for his district, that President Lincoln had made him brigadier-general.

In February 1862, with an army of 20,000 men and accompanied by Commander Foote's flotilla, he took Fort Henry and marched on Fort Donelson. On the 16th of the same month he had invested Donelson and had beaten the enemy within their works. Gen. Simon Buckner, his old classmate and comrade, was in command. He wrote to Grant, asking for commissioners to agree upon terms. Grant replied: "No terms except an unconditional and immediate surrender can be accepted. I propose to move immediately upon your works." Buckner surrendered, and Grant's sturdy words flamed over the land, making him "Unconditional Surrender Grant." On 6 April the Federals at Shiloh or Pittsburg Landing were attacked by a large Confederate force commanded by Gen. A. S. Johnston, and beaten back to the Tennessee with heavy loss. Grant, having reformed his lines and been reinforced by Buell, renewed the battle on the 7th, and the Confederates, who, Johnston having been killed, were commanded

ULYSSES SIMPSON GRANT,

EIGHTEENTH PRESIDENT OF THE UNITED STATES.

by Beauregard, were driven from the field. In January 1863 Grant began to assemble his troops to attack Vicksburg, but high water kept him inactive till the following April. Corinth was occupied on 30 May and on 3 July Pemberton at Vicksburg surrendered the largest body of troops ever captured on this continent up to that time, and Grant became the "man of destiny" of the army.

He was made commander of all the armies of the Mississippi, and proceeded to Chattanooga to rescue Rosecrans and his beleaguered army. In a series of swift and dramatic battles he captured Lookout Mountain and Missionary Ridge. The victory at Chattanooga opened the way for Sherman's march into Georgia, and practically closed the war so far as the West was concerned. In February 1864 Congress created and conferred upon Gen. Grant the rank of lieutenant-general, and the following month he assumed command of the armies of the United States, and immediately put himself in position against the army of northern Virginia commanded by Gen. Robert E. Lee. In the bloody campaign that followed (See WILDERNESS, THE BATTLE OF THE) slowly and inexorably Grant forced Lee and his army back upon Richmond. Petersburg fell on 2 April, and Richmond on 3 April; on 9 April 1865 Lee surrendered at Appomattox, and, Sherman having consummated his victorious march to the sea, the war was ended. Grant's terms with the captured general and the Southern army were so generous as to win the respect and admiration of the Southern people. Grant now returned to Washington. In 1866 he was promoted to the rank of general and every honor possible was bestowed upon him. In August 1867, Gen. Grant consented to fill the office of secretary of war *ad interim*, but, the Senate having refused to approve the suspension, January 1868 he surrendered the office to Mr. Stanton.

He was the chief citizen of the Republic at the close of the war, and when Lincoln was assassinated he was the mainstay of the Republic. He became inevitably a candidate for President, and was elected with great enthusiasm in 1868. In 1872 he was re-elected, and during his two terms his one great purpose was to reconstruct the nation. In 1878, two years after his second term had ended, he went on a trip around the world, visiting all the great courts and kings of the leading nations.

In 1880 he was defeated as candidate for nomination for a third term. Shortly after this he moved to New York, and became a nominal partner in the firm of Grant & Ward. His name was used in the business; he had little connection with it, for he was growing old and failing in health. In May 1884, through the rascality of his partner, Ferdinand Ward, the firm failed, and Gen. Grant lost every dollar he owned.

Now came the most heroic year of his life. Suffering almost ceaseless pain, with the death shadow on him, he sat down to write his autobiography for the benefit of his wife. He complained not at all, and allowed nothing to stand in the way of his work. He wrote on steadily, up to the very day of his death, long after the power of speech was gone, revising his proofs, correcting his judgments of commanders as new evidence arose, and in the end producing a book which was a marvel of simple sincerity and modesty of statement and of transparent clarity of style. It took rank at once as one of the great martial biographies of the world.

At his grave the North and South stood side by side in friendship, and the great captains of opposing armies walked shoulder to shoulder, bearing his body to its final rest on the bank of the Hudson River. The world knew his faults, his mistakes, and his weaknesses; but they were all forgotten in the memory of his great deeds as a warrior, and of his gentleness, modesty, candor, and purity as a man. Since then it becomes increasingly more evident that he is to take his place as one of three or four figures of the first class in our national history. He was a man of action, and his deeds were of the kind which mark epochs in history.

Grant University, a coeducational institution in Chattanooga, Tenn., with departments in Athens, Tenn., founded in 1867, under the auspices of the Methodist Episcopal Church; reported at the close of 1900: Professors and instructors, 65; students, 781; volumes in the library, 6,000.

Grants Pass, Ore., city, county-seat of Josephine County; on the Rogue River and on the Southern P. R.R.; in the southeastern part of the State, about 60 miles from the Pacific. It is the commercial centre of an agricultural, lumbering, and mining region; and its chief manufactures are lumber, flour, wood products, machinery for the farms, mines, and for lumbering, and bricks. It has large railroad repair shops. Pop. (1900) 2,290.

Granula'tion Tissue, the tissue formed in wounds to repair loss of substance. Through the clot in a fresh wound certain cells of the blood wander and begin to form new tissue. Blood vessels in tiny loops pass out from the sides of the wound. On the surface these loops form small rounded elevations, spoken of as "granulations." As the process goes on, the new tissue contracts, drawing in the sides of the wound; the skin grows out in delicate points from the margins of the cut. If the granulations pass beyond the surface-line because of irritation, they are spoken of as "superfluous" granulations or "proud flesh."

Gran'ville, Granville George Leveson-Gower, 2D EARL, English statesman: b. London 11 May 1815; d. there 31 March 1891. He was educated at Eton and Oxford; entered Parliament in 1836 for Morpeth, afterward for Lichfield, both in the Liberal interest. In 1855 he became president of the council, and ministerial leader of the House of Lords (1855-8). From 1859 to 1866 he was again president of the council, having previously failed to form a ministry under himself as premier. In 1868 he was colonial secretary under Gladstone, and in 1870 succeeded to the secretaryship for foreign affairs, which he held until 1874. During this period he negotiated the Treaty of 1870, guaranteeing the independence of Belgium, and "protested" against the Russian repudiation of the Black Sea clause of the Treaty of Paris. On the return of Gladstone to office in 1880 he was foreign secretary until 1885.

Granville, N. Y., village, in Washington County; on the Delaware & H. R.R.; about 37 miles northeast of Saratoga Springs and 57 miles northeast of Troy. The village is in an agricultural section, but nearby are valuable slate and building-stone quarries. The slate is used for mantels, roofing, and marbleized slating. The trade of the town is in stone and slate from the quarries, butter, cheese, hay, and vegetables. Population of the township of Granville, which includes several small villages, (1900), 5,217; of the village of Granville (1900), 2,700.

Granville, Ohio, a village in Licking County, on Raccoon Creek, and on the Toledo & O. C. R.R., about 25 miles northeast of Columbus. It has agricultural and manufacturing interests, but is chiefly noted for its educational institutions, which include Denison University (Baptist), and the Shepardson College for Women. Pop. (1900) 1,425.

Grape Culture. The grape is believed to be the oldest of our cultivated fruits. Although some 1,500 varieties of grapes are cultivated in Europe, they are practically all from a single species of the vine, known as the *Vitis vinifera.* It is supposed to have been indigenous to Asia, where it was widely planted by different peoples centuries before it was introduced into Europe. The Phœnicians have the credit of introducing the culture of the vine into Europe, first into the islands of the Grecian Archipelago and thence into Greece and Italy. The Romans carried vine culture, as a part of their civilization, wherever they settled. Thus, the vine had become well rooted in the south of France, in the neighborhood of Marseilles, at the beginning of the present era. Its culture during the next 200 years spread northward.

The native grapes of America are of entirely different types from the European kinds. The reason is that they come from different species of vines. So that in America, we cultivate two distinct types of grapes: (1) the native varieties, which are indigenous to the country; and (2) the vinifera, or European kinds, which have been transplanted here, and thrive out-doors only on the Pacific coast.

The vine and its cultivation engaged the attention of early colonists, who were encouraged by the authorities and by the lawmakers. The Virginia Assembly passed an act awarding premiums to successful grape growers. When the second charter was granted to Rhode Island by Charles II. in 1663 it contained an inducement to anyone who would plant a vineyard. Queen Christina in her instructions to John Printz, governor of New Sweden, urged that vine growing be encouraged, and she instructed the governor to give the matter his personal attention.

Many of the immigrants to the different colonies came from noted vineyard districts of the Old World. It was only natural that they should try to introduce here the cultivation of those European vines with which they were most familiar. Thus, most of the early attempts to establish vineyards for profit were by foreign, or foreign-born settlers. In 1792 or 1793 Pierre Legaux, a Frenchman, interested a number of Philadelphia gentlemen in his enterprise, and a company was incorporated for the purpose of planting vines. A vineyard was set out at Springmill, near Philadelphia, on the Schuylkill River. Foreign varieties of grapes were tried, but the experiment proved a failure.

About the same period (1790–3) a colony of Swiss grape growers from about Lake Geneva raised a fund of $10,000 and vineyards were planted in Jessamine County, Ky. Foreign varieties of grapes were tried, as had been done previously, but they all ran out and perished. Some years later, or about 1802, certain members of the Swiss colony removed to a place which they called New Switzerland (now Vevay, Indiana), on the Ohio River, 45 miles below Cincinnati. After failing with the best grapes imported from Switzerland, they tried a native variety called the "Cape," or the "Alexander" grape, and they then met with some success. This was largely due to the skill and experience of one member, John James Dufour, who joined the colony about 1805. He was an intelligent and observing vine-dresser, and afterward wrote a small treatise on grape culture and wine making — one of the first books on the subject published in this country. Dufour produced wine, which had a fair sale in the West, but by 1835 or 1840 the wines of Vevay were little heard of, and a few years later the vineyards had nearly disappeared.

Such, in brief, were the leading attempts to introduce the cultivation of European grapes into the Eastern States, beginning in 1620; not one lasting success is recorded.

However, in 1851 the European grape was being grown with success about the different missions. The popular variety was a kind now known as the "Mission grape," which is extensively cultivated in Southern California to this day. Other and better of almost all the leading varieties of European vines have been planted in that State, and their cultivation was a success from the beginning. Our native grapes grow there also, but they are not cultivated to any extent west of the Rocky Mountains. Therefore, grape culture, especially in California, constitutes a separate chapter in American viticulture.

The Cultivation of American Grapes.— After experience had shown that European varieties of grapes would not thrive, practical horticulturists began to turn their attention to the native vines found growing wild, or partially cultivated. They saw that success lay in that direction. But the trouble was to obtain a native grape of superior quality for the table and for wine.

In 1819 Maj. John Adlum noticed a vine growing in a garden at Georgetown, D. C. The grape struck him as having many excellent qualities. He first supposed it to be a European variety, but the grape was really a native of North Carolina, where it was discovered in 1802, and it took its name from the Catawba River. Maj. Adlum was enthusiastic in his estimate of the value of the Catawba grape. In a letter, written shortly before his death to the Hon. Nicholas Longworth of Cincinnati, Ohio, he says: "I have done my country a greater benefit in introducing this grape than I would have done if I had paid the national debt."

There is no doubt that the Catawba grape has played an important part in the grape and wine industry of the United States. This was largely due to the heroic efforts of Nicholas Longworth, who is called "the father of American grape culture." He spent 40 years or more of his life and $200,000 in establishing vineyards in the Ohio Valley, and his wine cellars at Cincinnati, Ohio. His persistent effort to make the industry a success is a fine example of American energy and enterprise. Longworth obtained thousands of vines from Bordeaux and Burgundy, from the Rhine district of Germany, from Madeira (6,000 vines), and from the Jura (7,000 vines) in hopes of finding grapes which would thrive in his Ohio vineyards. He also tried native grapes, but most of these were given up for the Catawba, which he first received from Maj. Adlum in 1825.

Not only as a pioneer, but as a leader in grape and wine growing, Longworth exercised great influence on the industry. Many able and practical men in Cincinnati became interested in grape culture and, in 1848, the Cincinnati Horticultural Society estimated that within 20 miles of the city more than 1,200 acres were planted in vineyards. During the next three or four years, some six or eight wine cellars were established at Cincinnati. Longworth had two. At his cellars dry and sweet wines were made, and "sparkling Catawba"— the latter produced by fermentation in the bottle after the method of French champagne. It was after a visit to Mr. Longworth that the poet Longfellow wrote his celebrated poem on 'Catawba Wine.'

In 1858, Erskine made a report to the British government on the extent and condition of viticulture in the United States. He gave the vineyard area of the several States, as follows: 3,000 acres in Ohio; 1,000 in Indiana; 500 in Kentucky; 500 each in Missouri and Illinois; 300 in South Carolina; 200 in North Carolina; 100 in Georgia — a total of 5,600 acres of vineyard in the United States. Even at this time grape culture in the Ohio Valley was on the decline. The vines there were being steadily destroyed by mildew and rot. By 1865, these vineyards, which promised so much pleasure and profit, and on which so much labor and money had been expended, were disappearing, and a few years later the grape and wine industry of the Ohio Valley became a thing of the past.

At that time the methods of successfully treating the two principal fungus diseases of the native vine — mildew and black rot — were not known to our viticulturists. Later on the discovery was made that black rot may be kept almost under control by a preparation of sulphate of copper, called the "Bordeaux mixture"— the cheapest and best fungicide ever introduced. As black rot prevailed from an early date in all the vineyards east of the Rocky Mountains, it was only after an efficient remedy was found that grape culture could become commercially profitable in the various eastern States. In California, on the other hand, the vineyards were rather free from fungus diseases, but there, as in France, the phylloxera began its ravages about in 1875, and has been the worst scourge of the vineyards on the Pacific coast since then.

The Growth of Grape Culture in the Eastern States.— About 1865 the grape-growing industry became rooted in the Hudson River Valley, the lake regions of central and western New York, and in northern Ohio, and on the islands in Lake Erie. New York, Ohio, and Missouri are the leading States in the order named. Then come Virginia, North Carolina, Indiana, Illinois, and Kansas. There are small vineyard districts comprising from 500 to 1,500 acres in Georgia, Florida, New Jersey, Michigan, Kansas, Tennessee, and many other States.

The grape industry of the Hudson River Valley was fairly established in the early sixties. Here, the Isabella grape was the leading variety. Like the Catawba, the Isabella is regarded as a native of North Carolina. About 1810 a vine was sent from the South to Col. George Gibbs, who planted it in his garden at Brooklyn, N. Y. A few years later, one of the successful pioneer viticulturists of this country, William Prince, of Long Island, N. Y., introduced this variety to growers, and he named it the "Isabella" in honor of Mrs. Isabella Gibbs. For a long time the Isabella was the standard grape in the New York vineyards, but of late years it has given place to other varieties.

Several varieties of grapes of good quality originated in the Hudson River district. Perhaps the most desirable kinds were the Iona, and the Eumelan. The former was originated by Dr. C. W. Grant, of Iona Island, N. Y. With the Delaware it is considered one of the finest flavored grapes of American origin. The Eumelan is more for wine making than for eating. The vineyards of the Hudson River district in 1890 comprised about 13,000 acres. Since then the industry has gone backward, and at the present time the vineyard area is estimated at from 8,000 to 9,000 acres. There are one or two wine cellars in this district, but about 80 or 90 per cent of the grapes raised along the Hudson River are sold for table purposes.

The Lake Keuka District.— Small plantings of vines were made at Hammondsport, N. Y., at the head of Lake Keuka, from 1850 to 1860. But it was not until after 1865 that the grape industry there began to assume some commercial importance. In 1890, when the statistics of viticulture were gathered for the first time in the United States, there were more than 12,000 acres of bearing vines in the Lake Keuka district, and the growers shipped 20,000 tons, or 40,000,000 pounds, of table grapes to market annually. In addition to that amount, some 5,000 tons of grapes were sold to the local wine cellars. The vineyard acreage in this section did not continue to increase so fast, and in 1903 there were in the district 15,000 acres of vines.

The vintage begins usually the first week in September, when the early varieties (such as the Concords and Delawares) ripen. It lasts until the middle of October, when the last of the Catawbas are gathered. The crop is picked in boxes, which hold from 35 to 40 pounds. The clusters of fruit are cut from the vines by grape shears. When the boxes are filled they are carried to the end of the rows, where they are gathered two or three times a day and taken to the packing-house. Here the grapes are sorted, and packed in 5- and 10-pound baskets. This work is done mostly by women and girls.

The bulk of the grape crop is shipped by fast freight to the large city markets — to New York, Boston, Philadelphia. Within the past few years new markets have been opened in the Far West, and now it is common to find New York State grapes for sale in Denver, Omaha, Kansas City, and even in Manitoba. The experiment was tried of shipping grapes to England, but while the fruit arrived there in fair condition, the cost and prices received did not warrant making further efforts.

The Lake Keuka grape growers now have a long range of season — that is, they can supply table grapes from early in September till the following March and April. The early varieties cannot be held very long, but the Catawba, for example, which ripens late, is a "good keeper." The grapes are stored in crates or trays in a cool building or cellar, and by proper ventilation and by maintaining an even temperature they can be kept fresh and fair till spring. Some years ago the only grapes in market in mid-winter were hothouse grapes, which cost from 50 cents to $1.50 a pound. Now these outdoor-grown grapes can readily be bought in January or February at 5 and 10 cents a pound.

The wine industry has also made striking progress in the Lake Keuka district. From the 2 or 3 cellars the number has increased to 12 at or near Hammondsport, N. Y. This section of New York State is often called "the American champagne district," as it produces about two thirds of all the champagne made in the United States.

There are two important areas of vineyards adjoining the Keuka district, namely, the Seneca Lake district of about 5,000 acres of vines in Seneca and Schuyler counties; the Canandaigua district of about 3,000 acres of vineyard bordering on Canandaigua Lake.

The Chautauqua Grape Belt.— This is the greatest single strip of vineyard in the United States. It stretches from the hills surrounding Chautauqua Lake in western New York, along the shore of Lake Erie for some 50 miles. There are about 25,000 acres of vineyard in this belt. The growth of grape culture in the Chautauqua district was remarkably rapid. The industry began about 1860. It grew and prospered, and in 1900 the Chautauqua grape belt contained about 25,000 acres of vines. The annual yield of this district is about 4,000 carloads of grapes. Each car holds from 2,300 to 2,500 baskets. In addition, probably one third, or more, of this amount is used to make wine. The making of unfermented grape juice has become quite a large and growing industry in the Chautauqua district.

The bulk of the crop (about 80 per cent) is handled by an association of growers. The grapes are graded according to their quality, and the returns from the shipments are "pooled." Each grower gets his pro rata share, after deducting expenses. About 85 per cent of the grapes grown in the Chautauqua belt are of the Concord variety.

The Northern Ohio Vineyards.— Soon after the decay of grape culture in the Ohio River Valley, about Cincinnati, the industry became established in northern Ohio along Lake Erie. Here, the Catawba grape, which was destroyed by fungus diseases in the former locality, survived and soon became the leading variety. There are large stretches of vineyards all along the Lake Erie shore from Ashtabula to Sandusky. There are also several islands in Lake Erie covered with vines; of which Kelley's Island and Middle Bass Island are the best known. The total area of these vineyards in northern Ohio is estimated at from 8,000 to 10,000 acres. From several towns in the northern tier of counties in Ohio, large quantities of table grapes are shipped, principally to western markets. The average crop from the Euclid or Cleveland district has been about 1,500 carloads. The yield about Sandusky and on the Lake Erie islands is mostly taken by the wine cellars.

Summary.— In the districts above described, the growing of grapes (both for the table and for wine making) is regarded as the chief industry. There are considerable vineyard areas in several of the southern and of the western States, and these may become important in the near future. New sections are being planted to vines from time to time; for example, of late years there has been quite an increase of vineyards in southern Michigan, and in the Ozark Mountain region of Arkansas and of southwestern Missouri.

Of American grape culture east of the Rocky Mountains two things may here be noted: First, although some 800 varieties are grown and flourish, yet the bulk of the crop in the leading districts consists of only two or three varieties, namely — the Concord, Catawba, and Delaware; secondly, two thirds of the grapes raised in the East are sold and used for table purposes, while only one third of the crop is made into wine. It is just the reverse in California, for there two thirds of the grape crop is turned into wine, the balance being used for raisins and the table. Therefore, not only in the fact that practically all of the grapes are foreign or European varieties, but in making wine the leading product of the vineyard crop in California is sharply defined from the industry east of the Rocky Mountains.

Grape Culture on the Pacific Coast.— Mention has already been made of the Spanish Fathers, who planted small patches of vineyards about their missions in southern California as early as 1770. The first plantings were at the mission of San Gabriel, and in the course of the next 75 years there were vineyards of from 5 to 25 acres extending from San Diego north as far as Sonoma County. The missions were abolished and their property confiscated in 1845.

The early settlers who began pouring into California in 1849 were more interested in gold than in grapes, and it was not until the year 1858 that a genuine and widespread interest in grape growing arose in the new State. During the next three or four years many vineyards were planted, and the industry began to attract considerable attention, so much so that, in 1861, Gov. Downey was authorized by the legislature to appoint three commissioners "to report upon the best means and ways to promote the improvement and culture of the grape vine in California." One of the commissioners appointed was Col. Agoston Haraszthy, who, by his writings and his efforts, was largely responsible for this renewed interest in grape culture. He went to Europe, visited the leading vineyard districts there, and secured 100,000 vines embracing 1,400 varieties. These vines and cuttings were distributed from time to time in small lots to growers in different parts of California, and they formed a basis for the viticultural industry in that State.

The first, or experimental, era of the young industry may be said to go from 1861 to 1871. During this period the most popular grape was the old "Mission." It was hardy, vigorous, and a good bearer. The "Mission" yielded a dry wine of rather inferior quality, which for some years prejudiced dealers and buyers against the Californian product. It will, however, produce a sweet wine, of the sherry type, of good quality.

After a while it was demonstrated that the fine wine grapes of Europe would succeed and flourish in different parts of California. And then French, German, and Italian vintners turned their attention to the vines they knew or had grown in the Old Country.

After 1871 grape growing in the State began to go backward, and this continued till 1879, when there came a "turn" in the industry. There was a short crop that year; the prices for grapes and wine went up, and soon there was renewed interest in viticulture. In response to a demand, a State Board of Viticulture was created in 1880. The board was composed of able and practical growers from the leading districts of the State, and their work resulted in a revival of the industry.

According to the census of 1890, there were then in California 155,272 acres of bearing vines; the output of wine that year amounted to 14,626,000 gallons. The wine crop reached its height in 1897, when it was 34,000 gallons. The dry and sweet wine production of California for 1902 is put at 28,000,000 gallons. The assessors' returns for the present year (1903) show a total area of vines in California of 230,675 acres, of which 118,209 acres are in wine grapes, and 89,792 acres in raisin grapes, and the balance table grapes. See Raisin Industry, American.

The shipping of California table grapes to the eastern markets now amounts to about 1,200 carloads. The California shippers of table grapes labor under the difficulty of long distance from their markets. They have fine, beautiful varieties of grapes, but many of them will not stand the journey to the eastern markets.

The leading varieties of California table grapes are: Flame Tokay, Emperor, Cornichon, Black Malvoisie, Rose of Peru, Muscats, Thompson's Seedless, the Chasselas varieties.

Practical Side of Grape Culture.— The practical part of vine-growing can not be learned from books, but is the result of hard work and years of experience. However, some of the more important features of vine cultivation may be mentioned. Of course, climate, location, and soil play an important part in the yield and in the quality of the fruit. From early times the vine was generally set out on the hills with southern or eastern exposure. It is another curious fact that the leading grape districts of Europe and of the United States are located near a body of water. It is so in the great Medoc district of France, situated between the rivers Garonne and Gironde, and in Germany along the river Rhine. In the eastern States we have the leading districts along the Hudson River, on the banks of Lake Keuka in central New York, and along the shores of Lake Erie in northern Ohio. Such large bodies of water keep the vines from late spring or early fall frosts, and from heavy dews and fogs.

Propagation.— The propagation of the vine may be accomplished by seeds, cuttings, layers, and grafts. The wild grape grows from, and multiplies by, the seed only. It reproduces itself, and its seedlings differ seldom from the parent vine. But, if we take the seed of the cultivated vine, the seedlings show a wide variation, and that is seldom wanted, unless as an experiment to obtain new varieties. The usual method of vine propagation is by cuttings, which are made in the winter from the trimming of the vines. The cuttings are planted early in the spring, after the ground is thoroughly well prepared. It is usual to let the plants grow one or two years. The methods of transplanting these vines are various, due to the nature of the vines and to the methods followed in the various districts. Thus, in California rooted vines of one year are preferred; in the eastern States growers prefer two-year-old transplanted vines.

Grafting.— The grafting of the vine, as with other woody plants, is quite easy, although it may be done in a number of ways. The time to graft is early in the spring before the sap starts. Fully a dozen methods have been named and described. The two kinds in most common use are the ordinary cleft or shoulder-graft, and the English or whip-graft. An ordinary graft is simply done by cutting the vine off three or four inches below the surface of the ground, then split with a grafting chisel, and held open with a wedge until the scion is fitted exactly into place. The cleft may be tied with a string, or covered with clay or grafting wax, and then the earth is heaped about the graft, leaving one bud of the scion above the surface. Grafting is of great importance to every vine grower in Europe and in California. For it is by grafting European vines on American stock that they can be protected from that dread scourge, phylloxera.

Pruning and Training.— The value of removing a portion of the vine, and other woody plants, was recognized at a very early date. Most of our native grapes are more vigorous growers and show a greater tendency to climb and spread than do the European vines. Pruning relates to the removal of such parts of the vine as ensures better fruit and larger yield. The general principles of pruning are practically the same for all vines, and these principles as given by Prof. L. H. Bailey are: (1) Fruit is borne on wood of the present season, which arises from wood of the previous season; (2) a vine should bear only a limited number of clusters, and (3) the bearing wood should be kept near the original trunk or head of the vine. Thus, the wood is constantly renewed, and new shoots which give wood, or canes, for the following year, are called "renewals."

Training relates to the form and disposition of the different parts of the vine. It is not necessary to describe the different methods of training. Each large vineyard district has its own system.

Brief mention may be made of the three well-known ways of training the native vine outside of California: (1) The so-called "Kniffin system" first obtained in the Hudson River district. The vine is allowed to grow at will the first season after planting; the second year it is cut back two or three buds from the ground, and from the stub only one shoot is allowed to grow. This is tied to a stake, at intervals, as it grows, to keep it straight to the height of the trellis. In the third year posts are set about 16 feet apart between every two vines. Two wires are then stretched along the posts, the upper wire about five and a half feet above the ground, and the lower one about half way between the upper wire and the ground. The vine is now tied to each wire, and cut off even with the upper one. The next year all the buds on the vine are rubbed off, except four — two for each wire. The two arms on the top wire are often bent down to the second wire, thus forming a droop, and the system is known as the "drooping system" of training.

(2) The Chautauqua system of vine training, as it may be called, is largely used in the vineyards of that district. In the first year the vine is cut back to three or four buds. The second year it is cut back to five or six buds, and three of the strongest shoots are left to grow the fruit-bearing arms for the third year. The trellis consists of three wires. Each year three or four of the strongest new canes are trained upon the trellis spread out in a fan shape.

(3) The Munson system of vine training is named after T. V. Munson, of Texas, a prominent viticulturist and is adapted to the native vines of the southern States. The trellis used is little different from that of the other systems. Thus, the posts are set about 24 feet apart, and carry two lines of wire. The vine is pruned back in the first year, and the next year the two arms may be allowed to bear a few clusters, if the vine is strong. The "bearing arms" are then cut back to 1 or 2 eyes each; the other arms to 8 or 10 eyes. These arms bear the next year, and are pruned for the third year quite short, while the bearing arms for the next year are pruned long. By this system of training there is a shifting of the bearing canes from one side of the vine to the other; all of which, it is claimed, gives vigor to the vine and a good distribution of the fruit.

Diseases of the Vine.— These are caused by animal and vegetable parasites. Of the former the worst and best known is the phylloxera. An American entomologist, the late Prof. C. V. Riley, discovered that some of our native American vines, were infested by phylloxera, but they successfully resisted its attacks. He therefore recommended to the French and other growers of European grapes, that they graft their vines on American stocks. This proved to be the solution of the problem, and practically all of the millions of vines planted in France during the past 25 years, are on "resistant stocks," or American species of vines. It is the same in California, where the vineyards destroyed by phylloxera, have been and are being replaced by vines grafted on American stocks. The main thing now is to get the right "resistant vines" for different soils and different climates. The other insect pests are the grape leaf-hopper, the root-worm, the flea-beetle, thrips, rose-bug, etc.

The leaf- or vine-hopper often does considerable damages in the vineyards of the East as well as in California. The best remedy so far recommended is a solution of whale-oil soap applied in a spray. The root-worm is at present working in the vineyards of Chautauqua and in northern Ohio. Two or three sprayings of arsenate of lead during the season is recommended, but thorough cultivation is regarded as the best check to the root-worm. See INSECTICIDES.

The leading vegetable diseases of the vine are mildew, black rot, oidium, anthracnose, anaheim, etc. The effects of mildew are seen on the leaves, stem, and the fruit. This disease is indigenous in this country, and first appeared in 1878 in Europe, where it spread over the vineyard districts, France, Germany, Italy, and Spain, doing great damage.

Black rot was also introduced into Europe from the United States, but there it was not as serious as with us. The rot first affects the leaves and then passes to the fruit. The condition most favorable for the spread of both mildew and black rot is warm, moist weather. See FUNGI and FUNGICIDES.

The Evolution of American Grapes.—It should be noted, in conclusion, that the development of American grape culture has been a process of evolution with a survival of the fittest. Thus, the improvement in the quality of our native grapes has been something remarkable. It represents the difference between the wild grape — coarse, harsh, and often disagreeable in taste and smell — and the cultivated grape — tender, luscious, and sweet and delicate in flavor.

The botanists have described and put American grape vines into some 12 or 13 groups or classes. Only 4 American species of vines have been cultivated and developed to any extent, as follows: (1) *Vitis Labrusca;* (2) *V. Estivalis;* (3) *V. Riparia;* (4) *V. Rupestris.*

The *V. Labrusca* is generally known as the "fox grape," and is a native of the Atlantic slope from New England to South Carolina. The largest number of varieties of grapes in all the Eastern States now cultivated spring from this species, which includes the Concord, the Catawba, etc.

The *V. Estivalis* is the "summer grape" of the Middle and Southern States. Several varieties (such as the Lenoir or Jacquez, Herbemont, Cunningham, etc.) have been much used in France and in California as a grafting stock.

The *V. Riparia* is the grape vine of the river banks, and is found growing wild from Canada to the lower Mississippi Valley. This species is very highly regarded in France and California as a stock on which vinifera vines have been grafted with success.

The *V. Rupestris* is native of the country west of the Mississippi River from Missouri to Texas. The varieties of this species have not been much cultivated, but are used, almost exclusively, as resistant stocks in France and in California.

Thus far, the efforts of our horticulturists to develop and improve many new varieties of American grapes has been confined to a few species. In 1830 William Prince enumerated but 88 varieties of native grapes; to-day there are more than 800 kinds. Already they have accomplished splendid results by cultivation, and by hybridizing our vines with the best foreign kinds. We may look in the near future for the production of many choice grapes which will combine all the vigor, beauty of foliage, and resistance to disease of the Labrusca and other American families with the delicate and fine qualities of the vinifera, or European varieties.

Bibliography.— The most complete books on grape culture have been written by the French experts, but their writings do not apply to American grape culture. Among the best books on the subject in French we may name the following: Guyot's 'Etude des Vignobles de France,' 3 vols., Paris 1876; Foex's 'Cours complet Viticulture,' Paris 1875, and Coste-Floret's 'Les Travaux du Vignoble,' Paris 1898. The leading journal is the 'Revue de Viticulture,' published at Paris.

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Grape Ferns. See FERNS AND FERN ALLIES, *Ophioglossales.*

Grape, or Globe, Hyacinth. See HYACINTH.

Grape Insect-pests. More than 200 species of insects have been observed preying on the grape-vine in America. The principal pest is the phylloxera (*Ph. vastatrix*), which first attracted attention by its ravages in the vineyards of France about 1865. It now occurs in vine-growing countries all over the world, and is the worst of the very few insect-pests that have emigrated from America. It caused the destruction of 2,500,000 acres of vineyards in the United States in 1884. The phylloxera is a minute brownish plant-louse of the aphid family. (See APHIS.) The winged females appear in Europe from August to October. Each lays about four parthenogenetic ova on the under surface of the vine-leaves. These ova develop in late autumn into males and females — wingless and without the characteristic piercing and sucking mouth-organs — which migrate to the stem of the vine. There each female lays a single egg under the bark. This egg lies dormant throughout the winter, and develops in April or May into a wingless but voracious "vine-louse." This form may pass to the leaves, on which it lays parthenogenetic eggs, and forms galls; but in Europe it attacks the roots, and lays its eggs there. From these in about 8 days young develop, which become mature females in about 20 days, and lay more eggs in the roots. Half a dozen or more of these parthenogenetic generations follow in rapid succession throughout the summer. The roots become knotted and deformed; the whole plant suffers, and, though it may survive for several seasons, eventually dies. In midsummer, among the subterranean forms, a generation is born whose members, after four, instead of the usual three, moltings associated with adolescence, become the larger winged females with which we commenced.

The destruction of this scourge of the grape-vine, without also injuring or destroying the plants, has proved exceedingly difficult when attempted upon a large scale, where the expense prevents the use of chemicals or methods effective in a small garden. Water, wherever it can be applied to the soil so as to saturate and keep it saturated for a time, has proved a safe and effectual destroyer, because the insect cannot live in a medium saturated with water for long. Chemical remedies, such as bisulphide of carbon, have succeeded, when injected into the soil about the roots. In some of the French vineyards grafting the cultivated vines on certain of the native vines of America has been tried with some success. Although the insect seems to feed on the roots of these vines, the greater vigor of the American stocks appears to enable them to resist the injuries inflicted on them.

An important vine-pest in certain parts of the United States is the grape root-worm (*Fidia viticida*). Injury is chiefly due to the work of the larvæ or "root-worms," but the beetles also injure the plants by gnawing many holes in their surfaces. The larvæ may be destroyed with bisulphid of carbon injections in the soil about the roots; or better by saturating the soil with kerosene emulsion, 10 times diluted, and systematic spraying. One of the most troublesome enemies of the vine is the rosechafer (*Macrodactylus subspinosus*), which is best kept in subjection by planting trap-crops of plants bearing white flowers which blossom at an earlier date than the grape, such as white rose, blackberry, spiræa, and deutzia. The grape-vine flea-beetle (*Haltica chalybea*) does considerable damage at times to grape leaves, but can readily be destroyed with an arsenical spray, and may also be caught in the same manner as the plum curculio, by jarring the insects on to collecting frames saturated with kerosene. Nearly everywhere leaves will be seen drawn together and slowly assuming a brownish hue, and when these are opened a small caterpillar will be found actively wriggling about. This is the grape leaf-folder (*Desmia funeralis*). When vines are sprayed for leaf-feeding insects some of these leaf-folders will be destroyed, but picking and burning the affected leaves is more effective, taking care that the larvæ do not escape to the earth during the process. Leaf-hoppers do much injury in some localities, particularly on the Pacific coast, and several other important enemies of the grape are known, including cutworms, which climb and defoliate vines at night, the grape-berry moth, which destroys the berry, and the grape curculio, which has the same habit. Consult: Cornu, 'Etudes sur le Phylloxera vastatrix' (1879); Lichtenstein, 'Histoire du Phylloxera' (1878); Riley, 'Sixth Annual Report of the State Entomologist of Missouri' (1874); Saunders, 'Insects Injurious to Fruits' (1883); Marlatt, 'Farmers' Bulletin, No. 70,' issued by the United States Department of Agriculture; Bruner, 'Report of the Nebraska State Horticultural Society' for 1895, which gives an extensive bibliography; Riley, 'Third Report State Entomologist of Missouri' (1871).

Grape-shot is a combination of small cannon balls put into a thick canvas bag, and corded strongly together, or fixed in a cylindrical frame, the diameter of which is equal to that of the ball adapted to the cannon. The number of shot in grape varies according to the service or size of the guns, usually, however, a round of grape-shot consists of nine balls in tiers of three.

Grape-sugar. See GLUCOSE.

Grapefruit, Pomelo, Pomelos, Pumelo, Shaddock, Forbidden Fruit, Fruit of Paradise, a tree (*Citrus Decumana*) of the natural order *Rutaceæ,* native of southeastern Asia, from whence it has been introduced in many warm countries. It is widely cultivated in the West Indies, California and somewhat in southern Florida. The lemon-colored fruit, which is as large as a large orange, is highly prized for its usually pale yellow or greenish-white subacid lemon-like pulp. Propagation and cultivation are practically the same as for the lemon and orange (qq.v.).

Graphic Method, a pictorial method of representing forces, motions, etc., by lines. Similarly, any other physical quantity, such as temperature, atmospheric pressure, or barometric height, electric potential, etc., may be represented by straight lines. Graphic methods are largely employed in physical investigations as aids to calculation, and for the purpose of exhibiting the nature of the law according to which some phenomena vary. The principal use of this method is to show the mutual variations of two quantities. This we will illustrate by a particular example. Suppose a table is drawn up, in one column of which are the months of the year, and in the other the corresponding average temperatures of the air, at some particular place, during these months (the average temperature for each month being the mean of the daily temperatures). Let two lines, OX and OY, be drawn from O, one horizontally, the other vertically; let the successive months of the year be represented on any convenient scale along OX, and let temperature be measured along OY, also on a convenient scale. Corresponding to each month in the year there will be a length along OX, and to each temperature there will correspond a point on OY. At the middle point corresponding to each month draw perpendicular to OX a line representing the temperature on the scale of OY. A series of lines will thus be obtained, through the upper ends of which there may be drawn, freehand, a smooth curve. The points on the curve in the figure represent the upper ends of these lines. A general glance at such a curve will reveal certain features regarding the temperature of the whole year; at what dates maxima and minima occurred; when the temperature rose or fell quickest, and so on.

Graphite. Graphite is manufactured in large quantities at Niagara Falls from the ordinary forms of amorphous carbon, large quantities of anthracite coal being converted into this product. The present artificial production of graphite amounts to no less than 1,250 tons per annum. The art of converting the various forms of amorphous carbon into graphite was discovered and developed by Mr. E. G. Acheson, to whom the art of producing carborundum is also due.

E. G. Acheson.

Graph'ophone. An apparatus similar in principle to the Edison phonograph (q.v.), and designed to reproduce human speech and other sounds. It was invented conjointly by Messrs. C. A. Bell and Charles S. Tainter, and differs from the phonograph merely in its mechanical details of construction, and in the employment of a wax-coated cylinder of pasteboard instead of a solid wax cylinder.

Graph'otype, a process of engraving discovered in 1860 by De Witt Clinton Hitchcock, by which the valuable improvement is effected of enabling the artist to be his own engraver. The discovery is utilized in the following manner: French chalk is by a careful process ground to the finest powder, which is repeatedly passed through a wire-cloth with 10,000 holes to the square inch. It is then laid between a smooth plate of zinc and a smooth plate of steel, and submitted to intense hydraulic pressure, after which it is sized to prepare it for the artist. The pencils used by the artist are of sable-hair, and the ink is composed of lamp-black and glue. The drawing, when finished, is gently rubbed with silk velvet or fitch-hair brushes until the chalk between the ink lines is entirely removed to the depth of one eighth inch. The block is then hardened by steeping it in an alkaline silicate, by which the whole of the chalk is converted into stone. Molds are then taken of it, from which stereotype plates are cast for printing. See Zincotype.

Graptolites, grăp'tō-līts, a name given to fossils, characteristic of the Upper Cambrian, Ordovician, and Silurian strata, now regarded as belonging to the Cœlenterata, and to that class under which the sea-firs (*Sertularia*, etc.) are arranged. They consist of a rod or axis, which appears solid, but may have been hollow during life, and of cells disposed on both sides of this rod. These cells open one above another in the same vertical plane, while, by the other end, they open into a cavity which is common to all the cells on one side of the axis, this common cavity being characteristic of the Hydrozoa. These fossils seem to have been of horny consistence during life, for they are, with few exceptions, found flattened on the surface of shales and never calcareous. They live rooted in the mud; not attached to any object, but simply anchored by their base, like the living sea-pens.

Gras, Felix, fā-lěks, Provençal writer: b. Malemont, near Avignon, 3 May 1844; d. Avignon 4 March 1901. His education ceased at 17, when he returned to his father's farm, from which he was sent, in 1864, to Avignon and articled to Jules Giéia, a man of letters as well as a lawyer, and a member of Félibrige, a Provençal literary club of which Frederic Mistral (q.v.) was a member. Amid such surroundings he accepted law as his profession but resolved on literature as his vocation. In 1876 he published his first important work, an epic poem in 12 cantos, 'Li Carbounié,' which won for him the first place among Provençal writers of the younger generation. 'Toloza,' an epic recounting the crusade of Simon de Montfort against the Albigenses, followed in 1882. He proved himself second only to Mistral among Meridionals by a collection of his shorter poems to which he gave the title 'Lou Roumanceers Prouvençal' (1887). In his collections of prose stories, 'La Papalmo' (1891), he fancifully describes, in vivid, racy style, the loves and hates, sensuality and "superstition" of the papal court at Avignon. His greatest popular success, 'Li Rouge dóu Miejour' (1896), was published in a translation, 'The Reds of the Midi,' before it saw the light in France, where it is not so popular as among those who read it in the English version alone. A more recent work, which has been translated in the United States under the title 'The White Terror,' describes the retaliatory violence of the Royalists in the south, when the storm of the Revolution had swept by. For 10 years previous to his death he had been Capoulié, or president of the Félibrige.

Grasmere, grăs'mēr, England, village, in Westmoreland County; on the lake of the same name. It has been made famous by the "Lake School of Poets," Wordsworth, Southey, and Coleridge. Many places in Grasmere and the surrounding lake country have been mentioned in the poems of the authors who frequented this section, especially by Wordsworth. The graves of Wordsworth and Hartley Coleridge are in Grasmere.

Grass. See GRASSES IN THE UNITED STATES.

Grass, Straw, or Pampas Cat, a wildcat (*Felis pajeros*) of southern South America, common on the grassy plains. It is described by Hudson ('A Naturalist in La Plata,' 1892) as not unlike the European wildcat in its robust form and dark color, "but a longer, more powerful animal, inexpressibly savage in disposition."

Grass-bass, the calico-bass (q.v.).

Grass, China. See RAMIE.

Grass-finch. See VESPER SPARROW.

Grass-pink, or Calopogon, a showy orchid (*Limodorum tuberosum*), with a small bulbous root, large ovate leaves, sheathed at the base, and flowers growing in a loose spike upon a slender stem 12 to 18 inches high; they are butterfly-shaped, fragrant and magenta pink; and the lip, which is exquisitely bearded with gay colors, remains on the upper side of the flower, giving the blossom an upside-down appearance. It is common in boggy places from Florida to Newfoundland. Several other species of the genus occur in the South, one of which (*L. multiflorum*) bears many more flowers than does the grass-pink.

Grass-snake. In the United States a greenish unstriped variety of the garter-snake (q.v.). In Great Britain the European water-snake (*Tropidonotus natrix*), which closely resembles our American water-snake (q.v.), but is rather more terrestrial and even arboreal in its habits. It is the only serpent in England except the viper, and does not occur in Ireland or Scotland, but is common all over southern and central Europe, in Algeria, Asia Minor, and eastward to India.

Grass-snipe, a gunner's name for the jack-snipe (q.v.), and some other shore-birds of similar habits.

Grass-tree, the popular name for certain tree-like Australian sedges (*Juncaceæ*). Their large stems are crowned by thick tufts of narrow, pendulous foliage which in turn display cylindrical flower-spikes like exaggerated cattails. The plant contains an aromatic resin (Botany-bay gum or gum acaroides) employed in pharmacy, and also used by the natives for a variety of purposes, such as calking canoes, and as a cement or glue. These plants are also called 'black-boys' from the appearance of the stems when charred by fire, and from the fact that the black-skinned natives often use them as a means of concealment, or even imitate the appearance of a charred stem by crouching into a similar attitude, and so escape the eyes of enemies.

Grass Valley, Cal., city, in Nevada County; on the Nevada County Narrow Gauge R.R.; about 3 miles northeast of Marysville. It was one of the first settlements made after gold had been discovered in the State. It is in a rich gold quartz mining region, and the chief occupations are connected with mining. It has granite and marble works, a distillery, and large wineries. Pop. 4,825.

Grass Worm, the caterpillar of a noctuid moth (*Laphygma frugiperda*), which often does great damage to grasses and cereals in the Southern States, and to a great variety of crop plants, as in 1899, when a serious outbreak of this species extended from Mexico to Chicago. In the North it is known as the fall army-worm, from the fact that it appears and travels in greatest numbers in the autumn, devouring nearly every form of vegetation encountered in its line of march.

Grass-wrack, a maritime grass. See EEL-GRASS.

Grasse, François Joseph Paul, frăṅ swä zhō-zĕf pōl gräs, COUNT DE, French admiral: b. Valettes, Provence, 1723; d. Paris 11 Jan. 1788. He first entered the navy of the Knights of Malta, and served against the Turks; in 1749 entered the French navy, became captain in 1762, and rear admiral in 1778, and was appointed to command a squadron sent to the West Indies. In 1781 he was given the rank of admiral and sent with a fleet to coöperate with the land forces in the American colonies. He first assisted at the taking of Tobago, in the West Indies, then sailed to the mouth of the Chesapeake, where he repulsed the attack of the British fleet under the command of Graves, prevented aid from reaching Cornwallis at Yorktown, and cut off his retreat, thus materially assisting the decisive American victory there; for these services he received the thanks of Congress. He then went to the West Indies, where for a time he was successful against the British, capturing the island of St. Christopher; but on 12 April 1782 was surprised by the English fleet under Rodney, and after a hard fight defeated, and taken prisoner. He was accused of carelessness and even treachery, but was exonerated by an official investigation, and at the time of his death held the rank of lieutenant-general of the naval forces of France.

Grasserie, a disease of silkworms (q.v.).

Grasses in the United States. The term "grass" is popularly applied to the green herbage on which cattle and other beasts feed, and thus includes many plants which are not botanically related to the true grasses, such as the clovers, alfalfa, sanfoin, vetches, spurry, etc., frequently referred to as "artificial grasses," while it excludes some of the most important of the true grasses, namely, the cereals. The true grasses constitute the botanical family *Gramineæ*. They are distinguished from related groups of plants in that the leaves are arranged in two opposite rows on the stem, with a single leaf at each joint. The stems (culms) are usually hollow except at the joints, and the base of the leaf forms a sheath which surrounds the stem above the joints. The sheath is usually extended a short distance above the base of the blade of the leaf, in a delicate, whitish structure closely surrounding the stem, called the ligule, the office of which seems to be to prevent rain-water from percolating between the sheath and the stem. The grass flower usually consists of the following parts: flowering glume, palet, lodicule, one to six stamens (usually three), and a one-celled ovary usually with two styles tipped with plumose stigmas. The flowers are usually arranged in two rows on opposite sides of the rachilla, constituting a spikelet. At the base of the spikelet are usually two empty glumes. The empty glumes, flowering glumes, and palet constitute the "chaff." The spikelet may contain one to many flowers. The lodicule, which stands in front of the flowering glume, is very small, usually not noticeable except on close examination. At flowering time, the lodicule becomes greatly swollen, and by this means spreads the flower open. In spikelets that contain several flowers, the palet, or inner chaff, rests with its back against the rachilla, and is concave on the back, with a nerve or keel on either side. The edges of the palet are overlapped by the edges of the flowering glume, or outer chaff. The spikelets are arranged either in spikes, as in wheat, or in panicles, as in oats. Popularly, these are referred to as the "seed-head," and this term will be frequently used in this sense in this article. The fruit of the grasses is a seed-like grain, either adherent to the chaff, as in barley, or free from it, as in wheat.

This is one of the largest and most widely disseminated families of plants, and by far the most important to mankind. It includes the cereals, wheat, oats, barley, rye, rice, millets, and corn, sugarcane, sorghum, the cane of the southern canebrakes and the bamboo of the Old World, in addition to the common grasses of the fields and prairies. It furnishes the principal food of both man and beast, and some of the most beautiful ornamental plants (reed, Ravenna grass, plume-grass, ribbon-grass, etc.). The grasses are the foundation of agriculture. Their principal development is in the temperate zones, though grasses are found wherever vegetation flourishes. Singularly enough, the most important grasses, the cereal grains, are not known in the wild state, and their cultivation extends so far back into antiquity that even their places of origin are unknown. Either their wild counterparts have become extinct, or the cereals have been so changed by cultivation that their wild forms are no longer recognizable. There are in all about 4,000 distinct species of grasses known. The species of only two natural orders of flowering plants exceed this number, namely, the *Compositæ* and the *Leguminosæ,* though in the number of individual plants the grasses far surpass all others. The total number of grass species growing in the United States is about 1,400; in the limits of the State of Washington about 275 species are found. Originally, nearly half the area of this country consisted of prairies, the principal herbage of which was grasses. The existence of these vast stretches of grass-land has never been fully accounted for. It is not due simply to climatic and soil conditions, for many species of trees readily grow on the prairies when placed there by man. In recent years, vast areas that were formerly occupied by grasses have been invaded by various shrubs and trees, particularly the mesquite tree of the Southwest. This has occurred simultaneously with the destruction of the grasses by stock, indicating that the presence of the grasses is inimical to forest growth. It is well known that grasses thrive best on the more compact soils. On such soils, the abundant growth of grass, with the fires that have swept over these regions in dry seasons from time immemorial, has kept in check those classes of vegetation which could not quickly recuperate after the destruction by fire of their aërial portions. On the coarser types of soil, the sparse growth of grass, and the consequent lack of fuel to feed the fires, has enabled forest trees to become established. These facts, while they do not entirely account for the existence of prairies, are undoubtedly an important element. The prairies are particularly developed in the arid and semi-arid regions where frequent drouth has augmented the destruction occasioned by fires, and particularly on the heavier soils of that region which retain sufficient moisture to enable the grasses to form a complete covering over the soil.

Of the many grasses (popularly known as such) native to this country, or of the introduced grasses that have become established here, comparatively few are of economic importance. Their principal use is as food for live stock. Most of them grow too sparsely to be important for this purpose, and many of them are not nutritious enough to make them valuable as food. A considerable number, however, are both nutritious and palatable to stock. Yet the number of these which are propagated artificially is exceedingly small when compared with the total number of species. This is partly accounted for by the fact that a few species are surpassingly useful by reason of abundant growth, ease of propagation, nutritive value, and palatability. When such a grass becomes established in a region to which it is adapted, the effort to find other valuable sorts in a measure ceases. But there are vast sections of country, particularly in the cotton-producing States and the arid and semi-arid West, where good grasses, adapted to local soil and climatic conditions, have not yet become established as field crops. Not that there are no good grasses known in these regions, for there are many of them; but it happens that these grasses are not easily propagated or have some characteristic which renders them undesirable. The well-known and valuable buffalo grass (*Bulbilis dactyloides*) of the West and Southwest is an example in point. It is one of the most nutritious and palatable of all the grasses, and produces abundant feed; but it produces very little seed, and that only on trailing vine-like stems, from which it is impractical to harvest it. Many of the grasses which formerly constituted important factors on the ranges of the West, and which are eminently adapted to the climatic and soil conditions there, are rendered useless on cultivated lands by reason of their poor seed habits. What the breeder's art may accomplish in rendering these now useless grasses useful, by improving their seed habits, remains to be seen. The leading tame grasses of the country are as follows:

Timothy (*Phleum pratense*).— The acreage of this grass in the United States is twice as great as that of all other cultivated grasses put together. It may be said to be the hay grass of the country. Its supremacy is due first of all to its excellent seed habits. The seed from an acre of it will seed a larger acreage than is the case with any other grass. The seed is easily harvested, and retains its vitality for several years. It also produces relatively large yields of hay, which, although not so nutritious as the hay from some other grasses, is eaten readily by all kinds of stock. It is particularly valuable for horses, because of its favorable physiological effect on the digestive apparatus. Owners of livery stables, whose horses are liable to be subjected to hard driving after heavy feeding, will feed no other hay when timothy is available. Timothy is usually sown with wheat, in fall, at the rate of about eight pounds of seed per acre, the seed being cast on the bare ground behind the drill-plows. Clover is then frequently added, at the same rate, in early spring, though farmers who raise much hay for sale prefer to omit the clover, as the pure timothy is preferred by horsemen. After the wheat crop is harvested, the grass is ordinarily used for pasture in the fall. The next season a large yield of hay is obtained (one to three or more tons per acre, according to the fertility of the soil), but the yield decreases thereafter to such an extent that the best farmers do not attempt to maintain a timothy meadow for more than two seasons, though such fields are frequently used for pasture for two or three years longer, before breaking them up for corn. In the latter case, bluegrass seed (*Poa pratensis*) is frequently scattered on the timothy sod, so that the pasture consists largely of bluegrass. The production of timothy hay is confined largely to the region north of and including the eastern third of Kansas and Nebraska, and to certain restricted localities in the Rocky Mountains and Pacific coast States; but timothy hay is used almost exclusively by horsemen in the large cities of all sections of the country.

Kentucky Bluegrass, June Grass, or Bluegrass (*Poa pratensis*).— Next to timothy this is the most important grass in this country, though it seldom grows large enough to cut for hay. It is undoubtedly the leading pasture grass in America. Its distribution is nearly identical with that of timothy. It does not extend south of the Ohio River except in a circular area about 100 miles in diameter in Kentucky, with a point 25 miles north of Lexington as a centre; and in certain portions of Tennessee and the mountainous portions of the southern States. In Kentucky and Tennessee its distribution is closely confined to the Cambrian rocks, which are rich in both lime and magnesia. Perhaps no other grass is so acceptable to stock as bluegrass. It is one of the most nutritious of grasses, and it is a notable fact that stock raising has never become a prominent feature of farming anywhere in the United States outside of the bluegrass region, except of course in the range country of the West, where ranching rather than farming is the prevailing form of agriculture. The best bluegrass pastures are those which are kept free from weeds and bushes, not cropped too closely and constantly, and upon which fattening stock are fed grain and mill products. Such pastures last indefinitely, but are hardly productive enough to justify their maintenance except on rough lands not well adapted to the cultivation of ordinary crops. So highly prized are the bluegrass pastures in many sections that they are seldom broken up; for it is a difficult matter to establish a good bluegrass pasture, a process requiring several years.

Millet.— The term millet is applied to three more or less distinct groups of grasses. The more common millets in this country are the foxtail millets (*Chætochloa italica*). They include the well-known foxtail, a common weed springing up in grain fields after harvest, and the hay-producing varieties, Hungarian grass, German millet, golden millet, and a few others, all annuals which produce an abundant crop of coarse hay of rather inferior quality. They are grown mostly as catch crops, being sown in late spring and early summer on fields where other crops have failed because of drouth. They are hence confined largely to the semi-humid region extending from North Dakota to Texas. Millet hay, when fed to horses that have no other roughness, has the peculiar property of producing acute rheumatic affections of the joints; but when fed with other hay, the damage from this source is very slight. Another group of millets, frequently called broomcorn millets, are varieties of the species *Panicum miliaceum*. These are little known in this country, though they constitute important bread-producing crops in central Asia. A third kind of millet, usually known as Japanese millet, is a variety of the common barnyard grass, *Panicum crus-galli*. Some forms of this grass are common weeds all over this country. Some of the varieties produce large crops of coarse but palatable hay, particularly on wet lands in the southern States. The seed of one variety is used for food by certain Indian tribes of the Southwest. Other varieties are similarly used in the Old World. This group of millets probably deserves more attention that it has yet received in this country.

Redtop (*Agrostis alba*).— This grass and its variety *vulgaris* are widely distributed in this country, occupying the whole of the timothy and bluegrass region, and extending considerably farther south; but the only section in which it may be said to hold first place is in a limited area in southeastern Illinois and adjacent parts of Kentucky. In this section, practically all of the redtop seed of the country is produced. It is rather distinctly a wet-land grass, and is usually a valuable constituent of meadows and pastures on moist lands in all parts of the country except the extreme south. In yield of hay it is distinctly inferior to timothy, but it withstands cropping and trampling by stock much better. Although quite nutritious, it is not nearly so well relished by stock as timothy or bluegrass.

Orchard Grass (*Dactylis glomerata*).— In its distribution in this country, this grass is identical with redtop, but it is adapted to drier soils. Particularly in the southern portion of its area, orchard grass flourishes in the shade of trees, hence its popular name. It may be said to be important as a hay grass only in that part of its range which extends beyond the limits of the timothy region. It is particularly important in the clay soils around the base of the Appalachian range from Virginia southward, though it thrives equally well throughout the timothy region. This grass produces a large yield of rather coarse hay, which, however, is of excellent quality if cut by the time the blossoming period is over. If allowed to stand longer, the quality of the hay deteriorates rapidly because of the formation of woody tissue in the stems. A rather serious objection to it is that it is inclined to grow in bunches, making a rough and uneven surface difficult to mow; yet it is undoubtedly the best of the hay grasses in those portions of its region where timothy does not succeed. It is also an excellent pasture grass, withstanding much hard usage, and furnishing large quantities of herbage. In New Zealand, where this grass is very popular, and in England, it is known as cock's-foot, from the fancied resemblance of its branching seed-head to a chicken's foot.

Bermuda (*Cynodon dactylon*).— With some reservations, it may be stated that what bluegrass is to the North, Bermuda is to the South. The differences are: Bermuda revels in the heat of summer, while bluegrass makes little growth in hot, dry weather. It stands drouth much better than bluegrass. On good land, Bermuda furnishes good crops of hay, which bluegrass does not. Bermuda stands trampling even better than bluegrass, and yields more pasture. On the other hand, Bermuda furnishes pasture only during the warm season; and while it furnishes larger amounts of feed than bluegrass, stock do not relish it quite so well. The seed of Bermuda is also quite unreliable and very high-priced, so that, to insure getting a stand of it, it is the usual custom to plant small pieces of sod, which soon spread over the ground and form a complete covering. One of the most characteristic features of Bermuda is its habit of sending out long runners which run along the surface of the ground, taking root at the joints. This renders it a matter of considerable difficulty to eradicate the grass when it is once established. But this may be done by growing densely shading crops, such as oats in winter, followed by cowpeas or velvet beans in summer, for one or two seasons. A single season of clean culture, such as cotton receives, will then completely destroy the Bermuda. *St. Lucie Grass* is a variety of Bermuda which is found in Florida and near the Gulf coast. It grows considerably larger than the species, and is said to remain green longer in the fall.

Johnson Grass or Means Grass (*Sorghum halapensis*).— This grass was introduced into South Carolina from Turkey near the middle of the last century. In that State it is generally known as Means grass, from Gov. Means, who did much to popularize it. It was later taken to Mississippi by a Mr. Johnson, where it became widely known under his name. The most prominent characteristic of Johnson grass is its habit of producing an enormous growth of underground stems (rootstocks, or rhizomes), from each joint of which a new plant may be produced. It is therefore a matter of extreme difficulty to get rid of the grass when it is once established. It is now very generally distributed over the cotton-producing States, and is the most formidable weed found in the South. It is generally believed that it cannot be exterminated by any practicable means. This, however, is not the case. If the land is thoroughly plowed in autumn, with a disk plow or a good turning plow, the rootstocks dragged from the ground with a good harrow, or better, a root-digger; plowed again in midwinter; then plowed and thoroughly harrowed again in late spring, again removing all the roots possible, a crop of cotton may be grown the following summer nearly free from grass. If then the grass be persistently pulled or cut during the summer, never allowing it to reach a height of four inches, it can be completely eradicated. It is practicable to do this, for very little grass will appear in the cotton, and what does appear will be attached to loose roots easily pulled from the ground. While Johnson grass produces rootstocks in abundance, it spreads very slowly by this means, but spreads rapidly by seed. These are produced in great quantity, are readily eaten by stock, and are thus carried over all parts of a farm on which it has once gained a foothold. Johnson grass usually gives three cuttings of hay in a season, of about a ton each on good land. The hay is of excellent quality, particularly for cattle and for all horses except livery horses liable to be subjected to hard driving after a full feed. In such cases its laxative and diuretic effect becomes objectionable. As a pasture grass it can not be compared with Bermuda, though it is greatly relished by all kinds of stock. It is soon killed down completely when heavily pastured, but when the land is plowed it springs up again.

Brome Grass (*Bromus inermis*).— This is a recent introduction from east central Europe, and on the prairie soils of the Northwest and the Pacific Northwest, it occupies the place that bluegrass holds on the glacial drift of the more humid climate to the East. It is much larger than bluegrass, and hence furnishes more feed. It is much relished by all classes of stock. Stock eat with great avidity the straw from which seed is harvested, and the hay, cut just after the blossoms fall, is of excellent quality. Brome grass forms an excellent sod.

Italian Rye Grass (*Lolium italicum*).— This is perhaps the most important of all the meadow grasses in England and on the continent of Europe. It is relished by stock better perhaps than any other of the cultivated grasses; yet, for some reason not entirely clear, it is almost unknown in America. The only section of the country in which it has gained favor is in northwestern California, western Oregon, and western Washington. It is adapted to a very wide range of soils. It thrives remarkably on land reclaimed from salt marshes by dyking, and it is also a valuable grass on upland soils that are inclined to be dry. Practically speaking, it is an annual, but if properly managed it reseeds itself in such a manner as to be practically a perennial. It is a valuable constituent of all pasture mixtures, and is a hay grass of much value. It is not well adapted to single culture, being rather too weak of stem to stand alone.

English Rye Grass (*Lolium perenne*).— This differs from the last in no essential respect except that it does not grow quite so tall, and is slightly more inclined to a perennial habit. It is an important European grass practically unknown in America.

Tall Fescue and Meadow Fescue (*Festuca elatior*, and variety *pratensis*).— These two grasses differ in no essential particular (from the agriculturist's standpoint) except that the first is taller and more leafy than the second, and therefore more valuable as a forage plant. The smaller form is frequently known as English bluegrass, a name which has led to much confusion, and which should be abandoned. It is not closely related to our Kentucky bluegrass, nor to Canadian bluegrass (*Poa compressa*). Tall fescue is much confused with meadow fescue by seedsmen, and it not infrequently occurs that seed of the latter is sold under the name of tall fescue. This fact has hindered the recognition of the decided merits of tall fescue. Next to Italian and English rye grass, these two grasses are the most important cultivated grasses in Europe. But like the rye grasses, they have never been recognized as valuable grasses in this country except in a few restricted localities.

Tall Oat Grass (*Arrhenatherum avenaceum*).— This grass is found occasionally in all parts of the country, but is nowhere an important crop. Stock do not eat it readily at first, but soon become accustomed to it, and then eat it freely. It has considerable value both for hay and for pasture.

Cheat, or Chess (*Bromus secalinus*).— In the central and eastern States, cheat is a pernicious weed in wheat fields, and it is popularly believed that, under certain unknown conditions, wheat turns into cheat, and it avails nothing that the fallacy of this notion has been demonstrated time and time again. In some parts of the South, and in the Willamette Valley in Oregon, cheat is sometimes grown for hay. It produces a large yield of rather poor hay. Being an annual, it is of little value for pasture.

Velvet Grass (*Holcus lanatus*).— This grass is common in the Pacific coast region along roadsides and in waste places. On sandy soils along the coast and on peaty soils that dry out in summer, velvet grass is perhaps the most profitable hay and pasture grass, because the better grasses do not succeed. Stock usually refuse to eat it until driven by hunger, but they will soon acquire a taste for it, and it is exceedingly nutritious. Its worst faults are its low yield and lack of palatability.

Canadian Bluegrass (*Poa compressa*).— A grass of small economic value, found quite generally over the northern States and in Canada. It is of some value as a sand binder, and, when kept closely mowed, it forms a smooth, even sod in lawns.

Crab Grass (*Panicum sanguinale*).— This is not, strictly speaking, a cultivated grass. It springs up in cornfields in late summer, and frequently furnishes a considerable crop of hay, which is of fair quality. It is universal in the South and extends northward to the Missouri and Ohio rivers.

Fodder Grasses.— Under this term we may include the coarse-growing grasses such as the sorghums, Kafir corn, Milo maize, teosinte, etc. On account of their large size, they require to be handled in a different manner from the common hay grasses. They are usually cut and shocked after the manner of fodder corn, though most of them may be handled by haying machinery if they are sown quite thick.

The sorghums (saccharine sorghums) were introduced into this country about the middle of the last century, and were extensively grown for syrup making before the now universal adulteration of this class of food materials destroyed the market for all farm-made syrups. At present little sorghum syrup is produced, but the sorghum plant is much grown for fodder. Its most valuable characteristic is its ability to withstand protracted drouth. It is therefore especially adapted to the western edge of the humid region, where it is exceedingly popular. Sorghum is also very generally grown in all the southern States, where the fodder is particularly valuable as a feed for the plantation mules. In all the cotton-growing States, as well as along the edge of the great plains, sorghum is a much more certain crop than corn (maize). Kansas is the leading State in the production of this crop. Some varieties are grown as far north as Minnesota and North Dakota. In the South two or three cuttings may be made in a season.

Several varieties of Kafir corn (non-saccharine sorghums) have become established in this country in recent years. The plant resembles a low-growing, branching, very leafy sorghum. It is cultivated either for fodder or for grain, of which latter it yields abundant crops. The grain is inferior to corn, but its more certain yield in dry seasons renders it a valuable crop in the same sections where sorghum is grown. It is rather more distinctly a southern crop than sorghum, being grown most largely in Kansas, Oklahoma, Texas, and New Mexico. Milo maize is not very widely known in this country, but it is gaining a foothold in parts of Texas, where it is grown after the manner of sorghum and is said to furnish large crops of valuable fodder or hay. Teosinte (*Euchlenea mexicana*) is a tropical plant somewhat resembling sorghum, but in reality more closely related to corn (maize). It does not produce seed in this country, but on rich alluvial soils in the southern States it produces enormous yields of green fodder much relished by cattle. It is of no account on poor thin soils. Near the cities, where dairying is an important industry, this crop is of great value in the South. It may be cut several times in a season, and there is no waste in feeding it, as the stalks are readily eaten.

Pearl millet may be classed with the sorghums on account of its manner of growth, but botanically it is quite different from them. It is a native of Africa, and was introduced in this country about 30 years ago. It has been tried very generally over the country, but has never gained favor. The seed is frequently unreliable, and the stems are inclined to be woody when approaching maturity.

A large number of our wild grasses have more or less economic importance. In fact, a majority of them furnish food for domesticated animals, while some are important for other reasons, as will appear in the discussion below. Only a few, however, are of sufficient importance to warrant their mention here. It is somewhat remarkable that none of our wild grasses have been domesticated during the past hundred years. This is perhaps due to the fact that the best of them were brought into cultivation very early in the history of the country. The more important genera of our wild grasses are:

Andropogon.— This genus is particularly well developed along the eastern edge of the western plains, where several species form important constituents of the immense acreage of wild hay cut in that region; also in the southern States, where it constitutes the major part of the growth of grasses in open woods and abandoned fields. *A. virginicus* is one of the most abundant grasses from Maryland southward. These grasses are large and coarse, and are not much relished by stock except in the early stage of their growth, whence the common practice of burning over the prairies to start a new growth of tender grass.

Agropyron.— This genus is particularly characteristic of the northern Rocky Mountain States, where several species are valuable for forage. They are, as a rule, better relished by stock than the preceding, and some of them furnish hay of excellent quality. *A. occidentale* is the well-known blue-stem of the mountain regions and the western margin of the plains. It has strongly creeping rootstocks, and is perhaps the best hay grass among the wild species in the region where it grows. There is reason to believe that it will in time constitute an important crop on cultivated lands, particularly in the moister valleys of the northern portion of the arid region. *A. divergens* is the common bunch grass of eastern Washington and Oregon and northern Idaho. It is valuable on the ranges, and furnishes very good hay where the rainfall is 20 inches or more. *A. repens* is the well-known quack grass of our northern States. On account of its great development of rootstocks it is a very pernicious weed. Yet it furnishes fairly good forage, and is recommended by some for cultivation in the semi-arid region. It also has some value as a sand binder. *A. tenerum,* the slender wheat-grass of the northwestern prairies, is a good hay grass, seed of which may now be had on the markets.

Ammophila.— A genus of one species, known as beach grass; in Australia and South Africa called "marram." This is as yet the only species of grass that has been used successfully in northern latitudes as a sand-binding grass on dunes near the coast. For this purpose it is invaluable. Extensive plantations of it have been made on both the Atlantic and Pacific coasts; also on dunes near the Great Lakes. It is propagated by digging up bunches of the grass, separating each one into several small bunches, and then resetting them in the sand.

Arundinaria.— The cane of the southern cane-brakes, a relative of the Oriental bamboos. It is much utilized as winter forage for cattle, which frequently winter in good condition in the brakes. There are two closely related species, the larger one furnishing the common cane fishing rods.

Avena.— *A. fatua,* the wild oats of the spring-wheat producing States, is a weed in wheat fields. In several States the common hay is cut from patches in wheat fields taken by wild oats. If cut early enough the hay is of fair quality. Wild oats form an important constituent of the forage on the ranges of portions of the State of California.

Bouteloua.— This is one of the most characteristic genera of the arid regions of America, particularly in the Southwest. Side oats grama (*B. curtipendula*) is a handsome and valuable grass on the plains, where it furnishes much valuable feed. Blue grama (*B. oligostachya*) is the buffalo grass of the plains of eastern Montana, and is also a valuable forage plant.

Bulbilis.— Buffalo grass (*B. dactyloides*) is probably the most valuable wild grass of the plains region, extending from the Dakotas and Montana to southern Texas and New Mexico. It is one of the most nutritious grasses, rivaling Kentucky bluegrass in this respect, but is less productive than the latter. In Texas and elsewhere there were formerly vast areas of buffalo grass forming a compact sod; but owing to overstocking, and the depredations of prairie dogs, the grass is now much less in evidence. It is not well adapted to use on cultivated land because of its poor seed habits.

Calamagrostis.— An important genus along the northern border of the United States. Bluejoint (*C. canadensis*) is an important constituent of swamp hay, of which a large acreage is cut in Minnesota, Iowa, and adjacent States.

Cenchrus.— Two species of *Cenchrus* are found in sandy soils in the South and West. They are noted for the hard spiny "burs" in which the seed are found. They are known as "sand burs," and are pernicious weeds in sandy soils.

Setaria (*Chætochloa*).— The foxtail grasses. Two species, the yellow foxtail and green foxtail, are useless weeds which spring up in wheat fields after harvest.

Distichlis.— Salt grass (*D. spicata*) is common in salt water marshes on the coasts, and on alkali soils in the arid regions. It has some value as a forage plant.

Elymus.— This is a large and important genus. Several representatives are widely distributed, and some possess considerable value as forage plants. *E. condensatus* (giant rye grass) is a very characteristic grass in lowlands in the arid regions, where it grows in large clumps, attaining a height of 6 or 7 feet. While not greatly relished by stock, it frequently suffices to sustain life during periods when other grasses are covered by snow. It has been sown on cultivated land in some irrigated lands of the West, particularly where alkali has begun to appear, and it furnishes large crops of hay. This hay is rather too laxative for horses, but is said to make good feed for cattle. *E. triticoides* (wild wheat) is found in great abundance on wet meadows in eastern Oregon and adjacent regions, where it is frequently cut for hay. The forage is said to be excellent. *E. canadensis* is a very variable species, common throughout the central and northern States. Some forms of it are characterized by strongly developed rootstocks, and thrive in the sandiest soils. It probably has considerable value for holding embankments in places where the soil is sandy. It is also a good forage grass, and is worth more attention than it has yet received for this purpose in the semi-arid region.

Festuca.— One of the characteristic genera of the western States. *F. ovina* (sheep's fescue) is one of the most abundant and most valuable grasses of the ranges in the mountain regions.

Hordeum.— Squirrel-tail grass (*H. jubatum*) is common on the plains of the West, particularly in the north. When young and tender it is eaten by stock. When mature, its rough beards are often injurious to stock; they penetrate into wounds in the mucous membrane of the mouth and into crevices in broken teeth, and often cause the death of horses and cattle. *H. murinum,* a species found on the Pacific coast, has barbed beards which penetrate the skin of young animals. It is a most pernicious pest.

Muhlenbergia.— A genus particularly well developed in the South, where several species of it are usually found in moist or shady places. Nimble Will (*M. diffusa*) is one of the commonest species. A genus of no particular value.

Panicularia.— Four species of *Panicularia* are common swamp grasses of the northern States. They are all excellent forage grasses, but are little utilized, since they seldom grow in situations that permit them to be harvested.

Panicum.— One of the largest and most important genera of grasses in the United States, particularly prominent in the southern States.

Several species have already been noticed in the list of tame grasses above. These are crab grass, Colorado grass, Japanese millet, and the broom-corn millets. The most prominent remaining species are: *P. amarum,* a grass with long creeping stems, common on sands near the coast from Connecticut to Florida and along the Gulf coast. This species is of considerable value for holding drifting sands. *P. capillare,* Old Witch grass, tickle grass, an annual with widely branching panicles, common and sometimes troublesome as a weed in cultivated ground. *P. maximum,* Guinea grass, introduced into Florida from the tropics. A valuable fodder plant, furnishing several cuttings in a season, sometimes confused with Johnson grass, but much less hardy. *P. proliferum,* sprouting crab grass, growing in much the same region as crab grass, but extending farther northward. It springs up in cultivated fields in late summer, and is occasionally utilized as pasture or hay. *P. virgatum,* switch grass, ranging from Maine to the Gulf and westward to the Rocky Mountains. It is a perennial, 3 to 5 feet high, and, if cut very early, furnishes a large yield of fairly good hay. It deserves attention as a hay and pasture grass in semi-arid regions.

Paspalum.— Another large and important genus. Seeds usually in digitate spikes resembling those of crab grass. Carpet grass (*P. compressum*) is a valuable pasture grass near the Gulf coast, particularly on sandy soils. On such soils it will even drive out Bermuda when closely pastured. Its spreading stems form a dense carpet-like growth which gives it its popular name of "carpet grass." Water grass (*P. dilatatum*) is another common grass in all the southern States, frequently found in wet lands. Its seed has recently been placed on the market, and it is used to some extent as a hay and pasture grass. Knot grass (*P. distichum*), with creeping stems, is also common in the South, where it is frequently mistaken for Bermuda, which it closely resembles. Said to be valuable on wet lands as pasture.

Phalaris.— One of the species of this genus (*P. arundinacea*), known as "reed canary" grass, is one of the most thoroughly cosmopolitan species in this country. It is found all over the country, usually on wet or overflowed land, but frequently on uplands as well. It is a perennial with creeping rootstocks (underground stems) growing 4 to 6 feet high. Few grasses are better relished by stock, either as hay or as pasture; and, were it not for its habit of shedding its seeds the moment they are mature, it would undoubtedly have become an important cultivated grass long ago. *P. canariensis* is the well-known canary grass, seed of which is commonly used as food for canary birds.

Poa.— This is one of the most characteristic genera of this country, some representatives of it being well-nigh universal, except in the far South. Kentucky bluegrass, the June grass of the northern States, one of the most important grasses in America, has been fully discussed under the tame grasses above. Many varieties of this species are found in the wild state in the Northwest, where it is of great importance as a range grass. Even in the region of its greatest importance it is a semi-wild plant, springing up everywhere from seed scattered by the wind or by stock. It is the finest pasture grass in the world, but not the most productive. *P. annua* is another representative of the genus found all over the country. It is particularly common in the South and on the Pacific coast, where it remains green during the entire winter. This species is not native here, but is fast becoming one of our commonest grasses. It is frequently found in lawns, and in cultivated grounds. It seldom attains a height of more than a few inches. Texas bluegrass (*P. arachnifera*) is noted for the cottony appearance of its seed. It is also a valuable grass for winter pasture in the South, but is somewhat difficult to establish in a pasture. Like Bermuda, it is usually propagated by setting small pieces of the sod a foot or two apart each way. It is a native of Texas, but is nowhere very abundant. Many species of Poa are found in the far Northwest, where they are important range grasses. *P. laevigata* is frequently cut for hay on wet meadows in the mountain regions of Oregon and Washington.

Savastana.— Vanilla grass (*S. odorata*), commonly called "sweet grass" in the Northwest, is found from New England to Oregon and Washington. It is noted for its strong vanilla-like odor, resembling the odor of sweet vernal grass. The dried leaves are used by the Indians in weaving small mats and boxes, in which condition they retain their characteristic odor.

Spartina.— Cord grass (*S. cynosuroides*) is an important constituent of the swamp hay of which large quantities are cut in Minnesota, Wisconsin, and Iowa. It is frequently found in large areas growing alone, as if it had been sown there by hand. The hay is of fair quality, and the yield large.

Sporobolus.— Another characteristic genus of the West and Southwest, where several species are important on the ranges. Saccaton (*S. wrightii*) is common in Arizona and New Mexico, where it grows in large clumps, and is frequently cut for hay. Although decidedly coarse, the hay is valued as forage. Dropseed (*S. cryptandrus*), common on the western plains and in the Rocky Mountains, is much relished by stock.

Stenotaphrum.— A single species, *S. dimidiatum,* is of importance. It is frequently used as a lawn grass from Charleston, S. C., southward. Sometimes called Charleston lawn grass and Mission grass. This is the pimento grass of Jamaica. In New South Wales it is called buffalo grass. It grows on all kinds of soils, from heavy clay to almost pure sand, but is seldom found far from the seashore.

Stipa.— A large and important genus in our western flora. Several species are remarkably long-awned on the flowering glumes, giving them the popular designation of needle grasses. Some of them have the lower end of the seed produced into a hard, sharp joint which frequently penetrates the skin of animals, rendering these species somewhat of a nuisance to stockmen. Many of them, however, make excellent hay on the great plains. *S. leucotricha* is the bearded mesquite of central and southern Texas, a valuable wild hay grass. *S. vaseyi,* found in the Rocky Mountains at altitudes of 5,000 to 6,000 feet, has the peculiar property of inducing sleep in stock that eat it, for which reason it is known as "sleepy grass." No harm, further than a desire to sleep, seems to follow a feast on this grass; the effects wear off gradually in a day or two.

Uniola.— One species (*U. latifolia*) has large panicles of broad, drooping spikelets, rendering it exceedingly graceful. It is used as an ornamental, and is indeed one of the most beautiful of the grasses. It is found from Pennsylvania westward to Illinois and southward. *U. paniculata*, seaside oats, grows abundantly on the sands of our southern Atlantic coast, and on the Gulf coast, where it serves as a sand binder.

Zizania.— Wild rice; Tuscarora rice. Wild rice (*Z. aquatica*) is one of the most striking in appearance of any of the American grasses. It occurs on mud flats almost all over the country. It is very abundant on the tide flats of the Delaware and Potomac rivers, as well as in many other places both in the United States and Canada. A field of it in bloom presents a very pleasing appearance with its large, graceful panicles, yellow below with a great wealth of staminate flowers in drooping branches of the panicle, the upper, pistillate branches rising gracefully at various angles. When found in situations that permit it to be harvested, Indian rice is cut for forage, yielding enormous quantities of succulent feed much relished by stock. The seed is gathered in quantity for food by Indians in the northern States and in Canada. It is frequently planted in mud or shallow water for its seed, of which fish and birds are exceedingly fond. The seed is gathered in boats, into which it is threshed from the tall stems growing in water. The seed keeps best under water.

Ornamental Grasses.— A number of valuable ornamental grasses have been mentioned above. A few others deserve notice. Reed (*Arundo donax*) is found in door yards in nearly all parts of the country, particularly in the South, though it thrives quite well at the North. It frequently attains a height of 15 feet or more. It resembles sorghum, but is more leafy and more graceful in appearance. It is a perennial, springing up in early spring from the roots. As a background for smaller ornamental plants it is invaluable. Many of the bamboos are exceedingly useful as ornamental plants. Only a few species are adapted to northern latitudes. A garden variety of *Phalaris arundinacea* is common in this country under the name of ribbon grass. Its leaves are striped with white. There is also a similar striped variety of reed. *Coix lachryma-jobi*, Job's tears, is a small to medium-sized grass frequently found in gardens and door yards; it is noted for the indurated, tear-shaped covering of the seed. *Eulalia japonica* of the Orient, *Erianthus ravennæ* (Ravenna grass) of Italy, and *Gynerium argenteum* (Pampas grass) of the Argentine pampas are other well-known and deservedly popular ornamental grasses.

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Grass'hopper-frog, or Cricket-frog, a small agile, noisy frog (*Acris gryllus*), common throughout the warmer half of the United States, whose spring cry is like the rattling produced by striking rapidly together two resonant pebbles. It is about an inch long, brown with a blackish triangular patch on the back of the head and a dorsal stripe. Its eggs are attached in little masses to a blade of marsh-grass.

Grasshoppers and Locust-plagues, insects of comparatively large size of the orthopterous families *Acridiidæ* and *Locustidæ*, or short-horned and long-horned grasshoppers respectively. In Great Britain and her colonies the former are the "locusts" of popular speech, and only the *Locustidæ* are called "grasshoppers." For the allied family of crickets, see Gryllidæ. The *Acridiidæ* have the antennæ shorter than the body and blunt, the ovipositor short and its parts divergent at the tip, and the sound-producing organs (see Orthoptera), on the hind thighs and outer edge of the forewings. In the *Locustidæ* the antennæ are long and tapering, the ovipositor long and sword-like, and the sound-organs are at the inner base of the forewings. This latter family embraces the katydids, tree-crickets, green meadow-grasshoppers, and certain western species erroniously called "crickets," and the group is more particularly treated under Katydid. In both families the hinder legs are greatly enlarged, enabling the insects to make the long leaps so characteristic of them; their wings are also capable of carrying them in some cases many hundreds of miles.

The short-horned grasshoppers are those of greatest interest economically, and those responsible for the "locust" plagues of Africa, Arabia, and southern Asia, as also in our West. From time to time vast bodies of certain species sweep from one region to another in swarms many square miles in area and so dense as to darken the sun, feeding on grasses and herbage, and consuming not only crops and pasturage as if by fire, but stripping bushes and trees of foliage and even of the bark. In the ancient world such visitations, which frequently extended into central Europe, caused extensive local famines, sometimes resulting in the loss of hundreds of thousands of human beings and vast numbers of grazing animals. Such "plagues" lasted for two or three years, the hosts breeding numerously at first, but gradually dying out and ceasing to reproduce outside the limits of their permanent breeding-grounds. The reproduction of grasshoppers consists in the deposit in autumn of eggs laid in bunches, covered with a secretion which hardens into a case or "pod," beneath the surface of the ground, into which the ovipositor is deeply thrust, and where the eggs remain to be hatched the following spring; in warm countries, however, two generations may take place annually. The locusts referred to in Scripture belonged probably to the species now named *Schistocerca peregrina*, of North Africa and Arabia. The swarms which from time to time appear in South Africa are of *Pachytylus migratoroides*; while *P. migratorius* is the best-known one of southern Europe and Asia. Similar species inhabit the open interior regions of both North and South America, a species of *Acridium* afflicting Argentina.

Of the many species in the United States those of the genus *Melanoplus* are of greatest interest because frequently destructive of crops. The most conspicuous is *M. spretus*, the Rocky Mountain locust, which has been a scourge of agriculture west of the Mississippi River ever since settlements began there. Among the more recent great plagues were those of 1856 and 1874, the latter enduring three years and causing widespread ruin throughout the whole region between the Mississippi River and the Rocky Mountains. The federal government appointed a commission of entomologists to investigate the habits of the insect, and its three 'Reports'

(1877, 1879, and 1882) are exhaustive essays on the subject. It was found that these and other destructive locusts bred throughout the whole plains region in the river bottoms and sunny depressions, and that little could be hoped for in defence except the gradual effect of cultivation in destroying the eggs and young by late and early plowing. This effect has been gained with unexpected celerity; and troublesome grasshoppers now breed in considerable numbers only in northern Idaho and central British Columbia. Swarms occasionally migrate and do damage, but the extensive plagues of the past will probably not recur. Nevertheless, grasshoppers are likely often to be locally harmful in the West, and must be combatted intelligently. The most valuable preventives are the burning over or deep plowing of breeding grounds, so as to turn the eggs out and kill them in the fall or before they can hatch in the spring. The grasshoppers themselves may be captured by means of "hopper-dozers" or kerosene pans. A cheap destroyer consisting of one part of Paris green thoroughly mixed in 60 parts of fresh horse-dung, two pounds of salt to half a barrel of the mixture being added, after being dissolved in water. This mixture is scattered broadcast along the edges of crops where infestation is feared, and the locusts, liking and eating the poison, die a few days later. The ordinary bran-arsenic mixture for cut-worms may also be used, and in some regions wheat fields are protected by a trap-crop of rye sown in a strip around the fields and poisoned by spraying with Paris green.

Consult: Sharp, 'Insects' (Vol. VI., Cambridge Natural History 1900); Howard, 'The Insect Book' (1901); and publications of the United States Department of Argiculture, especially Bulletin 25, Division of Entomology.

Grass'quits, a group of interesting little seed-eating finches of the West Indies, belonging mainly to the genus *Sporophila,* and flocking in grassy lands and pasturage.

Gra'tian, or **Gratianus Franciscus,** Benedictine writer of the 12th century. He was a native of Chiusi, and is considered the founder of the science of canon law. He was the author of a famous work, entitled 'Decretum; or, Concordia discordantium Canonum,' in which he endeavors to reconcile those canons that seem to contradict each other. It is a rich storehouse of the canon law of the Middle Ages. The best edition of the text is found in the 'Corpus Juris Canonici' of Richter (1833–9).

Gratian, or **Gratianus,** grā-shĭ-ā'nŭs, Roman emperor; eldest son of the Emperor Valentinian: b. Sirmium, Pannonia, 359 A.D.; d. Lyons 383. When only eight he was raised by his father to the rank of Augustus. On the death of Valentinian in 375 the eastern part of the empire still remained subject to Valens, and Gratian was obliged to share the western part with a half-brother, a child of four years, associated with him under the title of Valentinian II. In the early part of his reign the Goths and Alemanni made incursions into the Danubian provinces and into Gaul. They were repeatedly defeated by Gratian and his generals, but they also advanced into the eastern empire, and defeated and killed Valens in 378. Gratian then bestowed the eastern empire upon Theodosius, one of his generals.

Gratiola, grā-tī'ō-la, a genus of scrophulariaceous plants with many species widely distributed in temperate regions. A notable representative is the European hedge-hyssop (*Gratiola officinalis,* which is extremely bitter, acts violently as a purgative, diuretic, and emetic, and in overdoses is an acrid poison. It was formerly highly esteemed as a medicine, and its virtues were supposed to depend on a bitter resinous principle called "gratiolin."

Grattan, grăt'an, **Henry,** Irish orator and statesman: b. Dublin 3 July 1746; d. London 4 June 1820. He was called to the Irish bar in 1772, and in 1775 was elected member for Charlemont in the Parliament of Ireland. He immediately became distinguished in the opposition, and infused that spirit into the country which produced in 1782 a repeal of the statute of 6th George I., which had enacted that the crown of Ireland was inseparably connected with that of Great Britain; that Ireland was bound by British acts of Parliament when named therein; that the Irish House of Lords had no jurisdiction in matters of repeal; and that the last resort in all cases of law and equity was the British House of Lords. For his share in the acquirement of this concession the Irish Parliament voted him £50,000 and a house and lands for him and his heirs forever. He became the leader of the country party in the House of Commons, and the head of the Irish Whigs. Disgusted by the Irish rebellion and its manifold horrors, he temporarily seceded from Parliament, but the project of a union being brought forward by Pitt, he once more obtained a seat in Parliament for the purpose of opposing it. When it was carried, however, he did not refuse a seat in the United House of Commons, being returned in 1805 for Malton in Yorkshire, and in the following year for Dublin. His later years were chiefly occupied in a warm and energetic support of Catholic emancipation. Grattan was the zealous friend of Ireland from first to last. As a public speaker he had to contend with a defective voice; but his eloquence was bold and commanding, combining strength with beauty, and energy and elevation with elegance. The best collection of Grattan's parliamentary speeches is that edited in 1822 by his son Henry, who also wrote an account of his 'Life and Times' (1839–46). See Lecky, 'Leaders of Public Opinion in Ireland' (1871); Dunlop, 'Henry Grattan' (1889).

Gratz, Rebecca, American educator: b. Philadelphia 4 March 1782; d. Philadelphia 27 Aug. 1869. Of a family noted for wealth and culture, she showed her bent of mind by founding in 1838 in Philadelphia the Hebrew Sunday-school, the oldest society of its kind in America, and for 32 years she was at its head. Apart from her labors in behalf of the Jewish poor and needy, she was quick to respond to the claims of charity without regard for creed, and she was long regarded as Philadelphia's representative Jewess for her simple piety, personal charm, and social standing. Her name will always be associated with Scott's 'Ivanhoe,' for once when Washington Irving was visiting Sir Walter Scott and learned that a Jewess was to be introduced in the latter's novel, then in course of preparation, the American described Rebecca Gratz with so much warmth — she was a dear friend of his betrothed, Miss Hoffman, whose early death produced such poignant grief — that Scott was deeply impressed. When 'Ivanhoe' was finished he sent the first copy to Irving, with the inquiry whether the "Rebecca" of romance compared favorably with the "Rebecca" of reality. Miss Gratz's portrait is preserved, after a painting by Thomas Sully, in John Sartain's 'Reminiscences of a very Old Man' (D. Appleton & Company 1900).

Grau, Maurice, b. Brunn, Austria, 1849; d. Paris, France, 14 March 1907. He came to the U. S. with his parents in 1854; was graduated from the New York College in 1867 and from Columbia Law School. From 1872 until 1903 he was the most prominent operatic manager in America, securing a long line of singers, musicians, and actors, including names so diverse as Aimée, Rubinstein, Salvini, Sarah Bernhardt, Patti, Irving, Coquelin, Jane Hading, Mounet-Sully, Mme. Rejane. As director of the Maurice Grau Opera Company, he brought some of the most famous singers of the day to America.

Grau, Miguel, mē-gĕl' grow, Spanish-American admiral: b. Piura, Peru, 1834; d. 1879. After studying in the naval school at Callao he entered the Peruvian navy as a midshipman in 1852. In 1871 he was put in command of the turret ship Huascar and in the Chilean war of 1879 was killed by the explosion of a shell while engaged with two ironclads of the enemy.

Graubünden. See GRISONS.

Gravatt, William Loyall, American Protestant Episcopal bishop: b Port Royal, Va., 15 Dec. 1858. He was educated at Virginia State College and Virginia Theological Seminary. Deacon's orders were conferred upon him in 1884 and he was advanced to the priesthood in 1885. In 1899 he was consecrated bishop of western Virginia.

Gravel. See CALCULUS.

Gravel-root. See EUPATORIUM.

Gravelotte, gräv'lŏt, **Battle of**, one of the most severely contested and most important conflicts of the Franco-German war (q.v.). It is named after a village of Lorraine, seven miles west of Metz, but is also called by the French the battle of ST. PRIVAT, and of GRAVELOTTE and REZONVILLE. After the disastrous defeats at Wörth and at Forbach on 6 Aug. 1870 the French in two armies, one under MacMahon and one under Bazaine, retreated along the line of the Moselle, their object being to join forces at Châlons. To prevent this the first German army under Prince Frederick Charles intercepted Bazaine by a circuitous march, forced upon him the battle of Courcelles and Mars-la-Tour, and compelled him to keep within touch of Metz. On 18 August the armies of Prince Frederick Charles and Steinmetz, numbering about 211,000 troops under the command of King William, attacked the position. Bazaine had taken position with about 111,000 men around Gravelotte to the west of Metz. By a flanking movement the Germans captured St. Privat and defeated the French attempt to break through at Gravelotte. After nine hours' desperate fighting, in which the Germans lost over 28,000 men and the French over 12,000, the latter were forced to retreat into Metz, which was immediately invested by Prince Frederick Charles, and capitulated two months later on 27 October.

Graves, Anson Rogers, American Protestant Episcopal bishop: b. Wells, Rutland County, Vt., 13 April 1842. After being graduated at Hobart College, he took a course at the General Theological Seminary 1870. When the missionary district of Platte (now designated the missionary district of Laramie) was constituted in 1889, he was consecrated first bishop 1 Jan. 1890.

Graves, Frederick Rogers, American Protestant Episcopal bishop: b. Auburn, N. Y., 1858. He was graduated at Hobart College (1878), and the General Theological Seminary (1881). His ministry has been devoted to work in China, he having been ordained for the foreign missionary field, deacon in 1881 and priest in 1882. His consecration as bishop of Shanghai took place in 1893. He has published several works in Chinese.

Graves, John Temple, American journalist and orator: b. Wellington Church, Abbeville District, S. C., 9 Nov. 1856. He was graduated at the University of Georgia in 1875. He is generally classed with Henry Grady as an orator and leader of patriotic sentiment in the South. He has been on the staff of the Atlanta *Journal* since 1892, and is an advocate by pen as well as by voice of a separation between the white and colored races in the United States.

Gravitation. The law of gravitation is the law discovered by Newton, according to which every portion of matter attracts every other portion with a force directly proportional to the product of the two masses, and inversely proportional to the square of the distance between them. The motion of the planets round the sun in ellipses, each marking out the area of its orbit at a constant rate, and each having a year proportional to the square root of the cube of its mean distance from the sun, implies that there is such a force on each planet exactly proportioned to its mass, directed toward, and inversely as the square of its distance from the sun. The lines of force radiate out from the sun on all sides equally, and always grasp any matter with a force proportional to its mass, whatever planet that matter belongs to. Since the force is always proportional to the mass acted on, and produces the same change of velocity whatever that mass may be, the change of velocity tells us nothing about the mass in which it takes place, but only about the mass which is pulling. If, however, we compare the accelerations due to different pulling bodies, as for instance that of the sun pulling the earth with that of the earth pulling the moon, or if we compare changes in motion due to the different planets pulling each other, then we can compare their masses and weigh them one against another and each against the sun.

All this was clearly seen by Newton, and was set forth in his 'System of the World' (3d ed., p. 41). Kepler (q.v.) had indeed given the laws, deduced from observation, according to which the planets describe their orbits. From these Newton deduced the laws of the force in the case of the planets; and subsequently he generalized the statement of them, by showing the identity of the nature of the force that retains the moon in her orbit, and that which attracts matter near to the surface of the earth. Kepler's laws state, first, that every planet revolves round the sun in an ellipse, of which the sun occupies one focus: second, that the velocity of any planet at different parts of its orbit is such that the radius vector from the sun to the planet sweeps over equal areas in equal times; and third, that the distances of the various planets are so related to the periods of their revolution that the squares of the periodic times are proportional to the cubes of the mean distances from the sun. From these laws Newton made the following deductions: He inferred from the second law that the planet is acted on by a central force that is always directed toward the sun. From Kepler's first law he deduced the law of variation of the force for any one planet, and found that the force varies inversely as the square of the distance of the planet from the sun. Lastly, he concluded from Kepler's third law a relation between the forces on the various planets; namely, that the forces on equal masses of the different planets are inversely proportional to the squares of the distances of those planets from the sun. This law indicates the identity of the nature of the force that acts on the different planets. Newton next proceeded to consider the motions of the moon; and to ask the question, «Is not the force that causes the moon to fall toward the earth the same as that which influences falling bodies near to the earth's surface?» This question he attempted to put to the test of calculation. At first he was unsuccessful. The then received estimate of the dimensions of the earth were so far from correct that the comparison between the force of attraction in a stone and that in the moon at her distance from the earth did not exactly agree with his theory, and he was obliged to give it up for nearly 20 years. It was not till 1684, when he heard a paper of Picard read at the Royal Society of London, on new geodetical measurements of the earth, that he obtained accurate data to work with; and, returning home, he set to work to examine the question afresh.

Newton saw that a mountain mass might be used, and weighed against the earth by finding how much it deflected the plumb-line at its base. The density of the mountain could be found from specimens of the rocks composing it, and the distance of its parts from the plumb-line by a survey. The deflection of the vertical would then give the mass of the earth. Not long after Newton's death the mountain experiment was actually tried. The honor of making the first experiments on gravitation belongs to Pierre Bouguer (q.v.), whose splendid work does not appear to have received the credit due it.

Having established the law of gravitation throughout the solar system, it was natural to infer the universality of its action. We know on the one hand, by observing the motion of the planets and satellites, the asteroids, and the comets, that the law holds with great exactness for all these bodies; on the other hand, experiments of Cavendish with balls of lead, and of others, verify its exactness down to very short measurable distances: and though we are unable with our present appliances to determine the orbits of double stars and of other stellar systems, still we seem to be fully justified in assuming that in these cases also the law stated above holds, at least, very approximately.

The track was first laid down by Newton, based on astronomical observations, and only made firmer and broader by every later observation. Important work in Europe has recently been done in gravitational experiments by the late Prof. U. Jolly, and by Profs. Braun, Boys, and Poynting, who, with others, have advanced beyond the results of Henry Cavendish (q.v.), whose device, known as the Cavendish experiment, for determining the density of the earth, has so long interested scientists. The latest research has verified Newton's celebrated guess that "the quantity of the whole matter of the earth may be five or six times greater than if it consisted all of water."

No inquiry on gravitation has showed that it is related to anything but the masses of the attracting and the attracted bodies. It appears to have no relation to physical or chemical condition of the acting masses or to the intervening medium. This independence of gravitation of any quality but mass, bars the way to any explanation of its nature or source.

There is a point respecting the law which is almost universally passed over without notice, although it is one of the most important questions with respect to the construction of any theory to account for gravitation; namely, the exact proportionality of the gravitating forces of any two bodies to their masses. The most delicate experiments show no deviation from the exactness of this law; nor has the most accurate observation of planetary bodies sufficed to detect any such deviation. This is the fact proved by the well-known guinea-and-feather experiment, in which it is shown that though a mass of gold and a feather do not fall equally fast under ordinary circumstances, because of the unequal resistance of the air in the two cases, yet that, the air being removed by means of the air-pump, they fall with equal velocity. The experiment proves that the force of gravity in the two cases is exactly proportional to the mass of the guinea and of the feather. Newton showed the same thing himself with far greater minuteness by vibrating balls of various materials similarly suspended. In this, which is known as Newton's pendulum experiment, it is shown that pendulums of equal length vibrate in equal times whatever be the material and the masses of which the bobs of the pendulum are made. By this experiment, when performed with all the nicety at command, it is probable that any deviation amounting to a ten-thousandth or a hundred-thousandth part of the whole amount considered could be detected. Planetary motions prove the law to even a greater degree of accuracy. It is curious that this portion of the law, though it is only proved by experiment and observation, is hardly ever, if ever, referred to by popular writers. It is either assumed without pretense of proof, or is passed over without remark.

Notwithstanding the vast interest and importance of the study which this subject presents, and all the labors of eminent scientists in endeavors to solve its complex problems, it still remains to be said that the world is yet without any theory which can really be considered as explaining gravitation. Consult Mackenzie, 'The Laws of Gravitation' (1900).

Revised by Simon Newcomb.

Gravity, in physics, the terrestrial gravitation, the operation of the law of gravitation on the earth, specially in making heavy bodies fall in all parts of the planet in the direction of its centre. Newton (q.v.) and Bessel have shown that in a vacuum a sovereign and a feather will fall with equal speed, though the rate will be different in the atmospheric air. The attraction of the whole earth, considered as a sphere, on a body at its surface, is the same as if the whole matter of the earth were collected at its centre. The attraction of the earth on a body within its surface is the same as if the spherical shell situated between the body and the earth's surface was removed; or is the same as if all the matter situated nearer to the earth's surface than the body was collected at the centre, and all the matter situated at a greater distance was removed. The weight of a body is proportioned to the attraction which it exerts, hence gravity in many cases means simply weight (q.v.).

Gravity, Specific. See SPECIFIC GRAVITY.

Gray, Asa, American botanist: b. Paris, Oneida County, N. Y., 18 Nov. 1810; d. Cambridge, Mass., 30 Jan. 1888. He was graduated at the Fairfield Medical College in 1831; but had already acquired a taste for natural science which led him to abandon the practice of medicine for the study of botany. The flora of the United States was by no means well known and classified at that period, and many botanical problems were to be solved by the attainment of new data in his chosen science. He had attracted notice so early as 1834 and was appointed botanist to the Wilkes Exploring Expedition, which was so dilatory in starting that he resigned the position in 1837, and in 1842 was elected Fisher professor of natural history at Harvard University. Between the resignation of his post as botanist to the Wilkes Expedition and his acceptance of the chair at Harvard, he took the opportunity of traveling over Europe, where he made many social and scientific friends and in England met Dean Church of St. Paul's, London, then Fellow of Oriel College, Oxford, with whom he kept up a correspondence of the most intimate friendship until his death. Both were many-sided men of keen intellect and reverent minds. From 1842 to 1873, when he retired from his professorate at Cambridge, the life of Gray is to be read in his published works. He gradually developed the reputation of a botanist of the first rank, one of the greatest of his century, and certainly the greatest his country had ever produced. His lot was cast at a point in the history of science when the artificial system of botany was to pass away, and the new and natural method was to undergo development. There were vast masses of new material constantly pouring in from the newly explored middle western Territories, together with the rich spoils that government expeditions were bringing by sea from the Pacific coast. Prof. Gray, with the assistance of Dr. John Torrey (see TORREY, JOHN), set about to arrange these multitudinous specimens in accordance with the newest methods; to identify, name and classify them. His work was to be called the 'Flora of North America,' and was to be a comprehensive history of the botany of the country upon a classification basis of natural affinity. This work was not completed beyond the order of *Compositæ*, as the constant accessions of new specimens rendered the portions already published out of date, and proved that the attempt at so colossal an undertaking would be premature before all the material was in, and every specimen had been deliberately examined and classified. Yet Gray's pen could not be idle, and he published volume after volume in which he showed he was as clear and concise as an exponent of botany in its elementary principles, as he was skilful and bold in wide generalizations and profound analysis. His scientific position was that of a theistic evolutionist. He dissented from Darwin's opinion that variation was the result of fortuitous contingencies. He was a teleologist and believed that species were differentiated according to a preordained plan in the mind of a creator, and he was of the spirit that could subscribe to evolution and yet repeat the Catholic creed. His principal writings are as follows: 'Elements of Botany' (1836); 'Structural and Systematical Botany' (1879); 'Manual of Botany for the Northern United States' (1848); 'Genera Boreali-Americana Illustrata' (1849); 'Botany of the United States Exploring Expedition under Captain Wilkes' (1854); 'Plantæ Wrightianæ Texano-Neomexicanæ' (1853); 'Darwiniana, Essays and Reviews Pertaining to Darwinism' (1876); 'Synoptical Flora of North America' (1884); 'Natural Science and Religion' (1880); published posthumously, 'Scientific Papers of Asa Gray' (1889); and 'Letters of Asa Gray' (1894).

Gray, Barry. See COFFIN, ROBERT BARRY.

Gray, David, American journalist: b. Buffalo, N. Y., 8 Aug. 1870. He was graduated from Harvard in 1892, entered journalism in 1893 as a reporter and editorial writer for the Rochester *Union and Advertiser*, became managing editor of the Buffalo *Courier* in 1897, and after a course in law was admitted to the bar in 1899. He has published 'Gallops,' a collection of fox-hunting sketches reprinted from the 'Century.'

Gray, Elisha, American inventor: b. Barnesville, Ohio, 2 Aug. 1835; d. Newtonville, Mass., 21 Jan. 1901. During his attendance at Oberlin College his skill in handicraft enabled him to support himself by carpentry. He left college to apply himself to the improvement of electrical apparatus; and in 1867 received his first patent for a self-adjusting telegraph relay. He subsequently invented the telegraphic switch and annunciator for hotels, the telegraphic repeater, the private telegraph line printer, etc. The litigation between him and Alexander Graham Bell, both of whom claimed to be inventors of the telephone, resulted in a verdict in favor of the latter, whose rights were sustained by the Supreme Court. The telautograph, by which written messages were to be sent over the telephone or telegraph, was patented by him in 1893. For many years he was engaged practically in the manufacture of electrical apparatus in Chicago and Cleveland and founded the Gray Electric Company in Highland Park, Ill. The Congress of Electricians at the World's Columbian Exposition was organized by him in 1893, and he was elected to preside at its sittings. Among his writings the most notable are: 'Experimental Researches in Electro-Harmonic Telegraphy and Telephony' (1878); and 'Elementary Talks on Science.'

Gray, Henry Peters, American painter: b. New York, 23 June 1819; d. there 12 Nov. 1877. He was a pupil of Daniel Huntington in 1838, and after several years abroad he established himself in New York, and was president of the National Academy 1869-71. Among the most important of his works are: 'Wages of War,' now in the Metropolitan Museum; 'The Judgment of Paris'; 'Cupid Begging his Arrows'; 'Apple of Discord'; 'Blessed are the Pure in Heart,' an illustration of Irving's 'Pride of the Village'; 'Hagar and the Angel.'

Gray, Horace, American jurist: b. Boston 24 March 1828; d. Nahant, Mass., 15 Sept. 1902. He was graduated from Harvard in 1845. from the Harvard Law School in 1849; studied law also in the office of Judge Lowell; was admitted to the bar in 1851, and in 1854-61 was reporter of the Massachusetts supreme court. At the same time he became a leader of the Massachusetts bar, in 1864 was appointed an associate justice of the State supreme court, and in 1873-81 was chief justice. In 1881 he was appointed to the Supreme Court of the United States, and this post he held until his resignation in 1902.

Gray, John Purdue, American alienist: b. Half Moon, Pa., 1825; d. Utica, N. Y., 29 Nov. 1886. He was graduated from Dickinson College in 1846 and took a medical degree at the University of Pennsylvania in 1848. He was successively assistant physician and medical superintendent of the New York State Asylum at Utica. He introduced many improvements into the treatment of the insane, and was for many years editor of the 'American Journal of Insanity.'

Gray, Maxwell. See TUTTIET.

Gray, Robert, American discoverer: b. Tiverton, R. I., May 1755; d. Charleston, S. C., 1806. In 1787 he was appointed to the command of the sloop Washington, equipped by Boston merchants for trade with the Indians of the Pacific coast. He returned in the Columbia in 1790. and, proceeding by way of Canton, was the first to carry the United States flag around the earth. During a second voyage he discovered the Columbia River, which he named from his ship. He was subsequently in command of trading vessels.

Gray, William Crane, American Protestant Episcopal bishop: b. Lambertville. N. J., 6 Sept. 1835. He was graduated at Kenyon College (1859): ordained deacon in 1859 and priest in 1860. He was consecrated bishop of southern Florida in 1892.

Gray, Thomas, English poet and scholar: b. Cornhill, London, 26 Dec. 1716; d. Cambridge 30 July 1771. He was the fifth child and only survivor of 12 infants born to Philip Gray, a money-scrivener, and Dorothy Antrobus, a one-time milliner. The father was brutal and maltreated his wife, who had to support herself and her son. When Gray was 11 he was sent to Eton, where his uncle William Antrobus was one of the masters. Here he formed a close intimacy with a few boys of quiet tastes—notably with Horace Walpole (q.v.) and Richard West, upon whose death in 1742 he wrote one of the few sonnets to be found in the literature of the early 18th century. Seven years later (1734), Gray became a pensioner at Peterhouse, Cambridge, Walpole coming up the next year, but to another college. Gray found the courses at Cambridge unsatisfactory, his tastes being at that time literary rather than scientific and philosophical, and he was not sociable or inclined to sports. He left in 1738 without taking a degree, and lived a few months in London before he accepted Horace Walpole's invitation to become his companion on a "grand tour" of the Continent. They left England late in March 1739, spent some months in France and Switzerland, crossed into Italy in November, visited Florence, Rome, and other cities, returned to Florence in July 1740 and passed some time with Horace Mann, the English minister, afterwards Walpole's correspondent, and in April 1741 started for Venice but parted at Reggio in consequence of a quarrel as famous as it is mysterious in its details. It seems quite certain that Walpole's confession to William Mason (q.v.), the poet and biographer of Gray, that he treated his sensitive companion superciliously and so caused the rupture, is in essentials the true explanation; it seems also certain that their friendship would never have been renewed if anything very disgraceful had occurred; but it is equally likely that something happened about which it was desirable to keep silence. Gray went on to Venice by himself, returned through Verona, Milan, and other places, paid a second visit to the Grande Chartreuse, where he wrote in the album the famous 'Alcaic Ode' (August 1741—the original was destroyed by a mob in the French Revolution), and reached home 1 Sept. 1741. Two months later, his father, with whom Gray seems to have been on better terms than the parent's brutality warranted, died of gout after having squandered a fairly considerable fortune.

Gray and his mother remained in London for some time, the former, suffering from a naturally morbid temperament and the loss of his friend West, making but slight efforts to enter the profession he was dallying with, the law. In October 1742 Mrs. Gray went to live with her two sisters in the house of one of them at Stoke Poges in Buckinghamshire, and Gray betook himself to Cambridge in order to study the civil law. He was made LL.B. in 1743, but really spent most of his time reading Greek and annotating what he read with the care he had displayed in noting down what interested him during his tour.

Cambridge, though he disliked the place and had few congenial friends there, became practically Gray's residence for the rest of his life, since he could live comfortably on his small income and could have access to books. Among his few friends, who did not, however, remain in Cambridge permanently, were his correspondents Dr. Thomas Wharton and the Rev. William Mason, the latter a rather servile literary follower. In 1744 the friendship with Walpole was renewed and Gray became a visitor to Strawberry Hill. He also went every summer to Stoke Poges to see his mother, who died there in 1753. But he could never be drawn out by others, and he never "spoke out." A small literary controversy has arisen over the reasons of his sterility as a writer, some attributing it mainly to his retiring character and his constitutional melancholy and delicate health (*cf.* D. C. Tovey, 'Gray and his Friends' (1890); and

W. L. Phelps, 'Selections from Gray's Poems' (1894); others, of whom Matthew Arnold is the main exponent, emphasizing the blighting influence exercised upon Gray's essentially romantic genius by the dominance of the pseudo-classical school of Pope (*cf.* Arnold's essay on Gray in Ward's Poets, Vol. III.). There is probably something in both views. Gray was shrinking and fastidious in temperament, and he was also depressed by the standards of his age in respect to poetry; for, if he was not, he presents, as Arnold claimed, the extraordinary phenomenon of a poet whose achievements show the powers of a master producing far less than equally fastidious and delicate masters who have had the good fortune to write in epochs more propitious to their genius.

Meanwhile, Gray, indolent and irresolute though he was, had slowly laid the basis of his fame as a poet. In 1742 he wrote the sonnet to West, and the pensive and beautiful 'Ode on a Distant Prospect of Eton College' (published anonymously, 1747). In 1743 he began, but soon discontinued, his ably sententious poem on "The Alliance of Education and Government" —forestalled by the appearance of Montesquieu's 'Esprit des Lois,' but an interesting proof that Gray tried to get himself somewhat in touch with his contemporaries. Five years later the 'Ode to Spring' and the stanzas on the drowning of Walpole's cat appeared, and in 1749 he took up again the most famous of all his poems, the 'Elegy Written in a Country Churchyard,' which had been begun in 1742. It was finished at Stoke Poges in June 1750, and attracted so much attention in manuscript that a pirate announced his intention of printing it. This caused Gray to authorize Dodsley, to whom he rather loftily yielded all the profits, to print an edition in February 1751. It attained at once the popularity it has never lost, and was much imitated and parodied throughout the western world. In August 1750 that admirable piece of *vers de société*, 'A Long Story,' was written, and in 1753 his six best poems, including a 'Hymn to Adversity,' were published with designs by Richard Bentley. The next four years saw the writing and printing (at Strawberry Hill) of the two Pindaric odes, 'The Progress of Poesy' and 'The Bard'—not the earliest but among the best of their kind in English and exhibiting, as Gray and Arnold thought, the highest reaches of Gray's poetic genius. Curiously enough many people found them obscure, but they had warm admirers from the beginning, one of whom secured for Gray, late in 1757, the offer of the Laureateship, which he declined.

The rest of Gray's life is summed up in his friendships, his studies, and his travels. In 1756 he changed his quarters from Peterhouse to Pembroke because some undergraduates, hearing that his fear of fire had caused him to buy a rope ladder, induced him by their cries to use it and in consequence to land himself in a tub of water. The rude prank was not followed by the proper punishment, and Gray was very indignant. He found consolation, however, in making young friends like Norton Nicholls, in studying (1759-61) in the newly opened British Museum, and in taking tours through regions marked by romantic scenery, to the beauties of which he was one of the first Englishmen to open his eyes appreciatively in a modern fashion. In 1764 and 1765 he visited Scotland (making friends with a fellow Romanticist, James Beattie—q.v.), and in 1769 he paid the famous visit to the English Lakes described in his journal. In connection with his love of romantic scenery and with the morbid temperament, which gave him his post of eminence among the "Churchyard Poets," should be mentioned his enthusiasm for the buildings and the writings of the "Gothic" past—another characteristic feature of the new school of revolt from classicism. Gray was delighted with Macpherson's 'Ossian' and wrote in imitation of the Norse and Welsh his 'Fatal Sisters'; 'Descent of Odin'; and 'Triumphs of Owen' (published 1768). In 1762 he had applied for the regius professorship of history and modern languages at Cambridge but had failed to secure it; six years later, his successful competitor having died from an accident when drunk, the post with its good salary and nominal duties was given to Gray. He did not wish to seem ungrateful and so, in return for the Duke of Grafton's kindness, he wrote an ode for the installation of that worthy as chancellor of Cambridge (1 July 1769). The next year he visited London with his young friend, the Swiss naturalist Bonstetten, but in 1771 he was forced to deny himself the pleasure of going to see this friend in his foreign home. He was taken violently ill with gout of the stomach and died on July 30. He was buried a week later in a vault with his mother at Stoke Poges.

Despite the paucity of his poetry, Gray's position as a classic has long been secure. He is the chief English elegist and eminent as a master of the elaborate, not the simple and singing lyric. His letters are among the most charming of his period, and his notes on classical and mediæval authors, on genealogy, heraldry, painting, architecture, ornithology, and botany show the extraordinary range of his accomplishments. His knowledge of Norse has been greatly exaggerated (*cf.* G. L. Kittredge in Phelps), but in certain senses Leslie Stephen did not exaggerate when he wrote in the 'Dictionary of National Biography,' apropos of a man who could admire almost equally Shakespeare and Racine, that Gray, "the most learned of all our poets . . . was naturally an eclectic."

Bibliography.—For Gray's life see the biography by Mason (1774)—not that by Johnson, which is one of the worst of the 'Lives,'—and also the letters given in the editions of Mitford and Gosse. The latter (4 Vols., 1884) is the fullest. There are numerous editions of the poems, *e.g.*, the new 'Aldine' by John Bradshaw (1891); and there is a fair amount of criticism to be found in the books previously named and in Gosse's biography in the 'English Men of Letters' (1882). Add the works of Phelps and Beers on English Romanticism in the 18th century and the histories of English literature, as well as a good essay by Lowell. Tovey's 'Gray and His Friends' contains a considerable amount of previously unpublished material.

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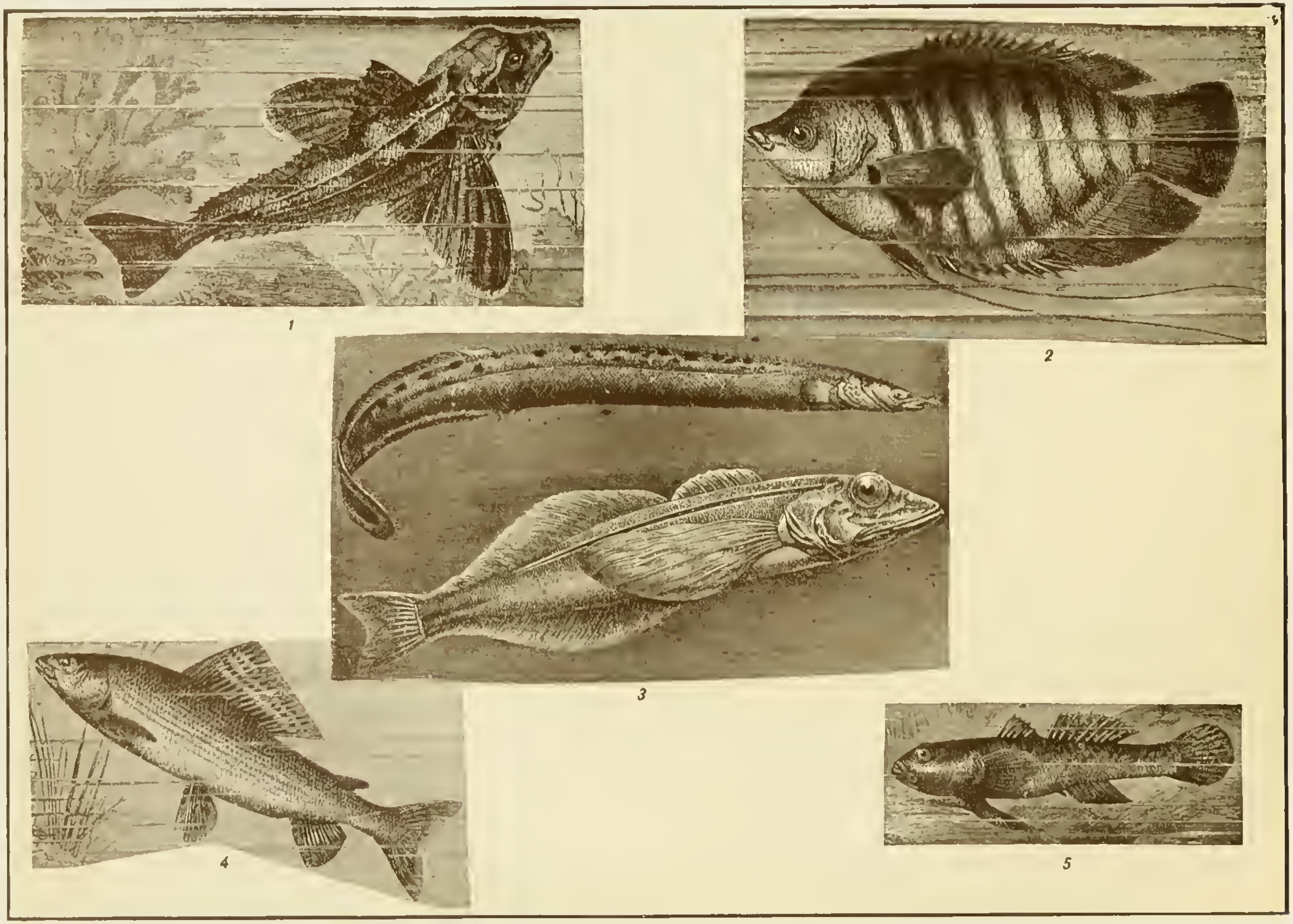
Gray Duck, the gadwall (q.v.).

Gray Whale (of California). See Rorqual.

Grayback, the name, in popular speech, of several animals strikingly gray in color, as the



1. Gurnard (Trigla hirundo). 2. Gourami (Osphromenus olfax).
3. Indian Spring Eel (Mastacembelus armatus), above; and Golomynka or Oilfish of Lake Bailkal (Comephorus baikalensis), below.
4. Grayling (Thymallus thymallus). 5. European Goby (Gobius fluviatilis).

gray whale (see Rorqual); the knot (q.v.) and certain other shorebirds; or a body-louse. See Louse.

Graybeard Moss. See Usnea.

Graydon, James Weir, American inventor: b. 18 Jan. 1848. He was graduated at the United States Naval Academy; served during the Civil War period in the Federal army under Sherman and Grant; was later promoted lieutenant in the navy, and resigned. His inventions include a dynamite gun; the Graydon gigantic wheels; an aërial torpedo; a cable system of torpedoes, and a railway carriage heater, all bearing his name.

Grayhen. Feminine of Blackcock (q.v.).

Graylag Goose. See Geese.

Grayling, A fish of the family *Thymallidæ*, much resembling a slender salmon, 15 to 18 inches long, and formerly included in the salmon family. Some five species of the single genus *Thymallus* are known, all inhabitants of northern regions, in rapid streams where the water is clear and cool, and the bottom sandy or pebbly. Its habits are similar to those of trout, except that it spawns in the spring. Its flesh is excellent, with an odor and flavor, when fresh, of wild thyme. It is caught by fly-fishing as for trout, and is a favorite with anglers. Two species are known in North America, each with so limited and scattered a distribution that they are regarded as modified relics of a preglacial circumpolar species. The Arctic grayling, or «poisson bleu» (*T. signifer*) of the fur-hunters, inhabits only the Mackenzie basin and rivers in Alaska. The more southerly and familiar grayling (*T. tricolor*) is restricted to certain streams in northern Michigan, where it is almost extinct, and seems incapable of recovery by fish-cultural methods; and to Montana. These fish are distinguished from trout or salmon by the large size of the dorsal fin and by their grayish hue, with half-a-dozen deep blue spots on the fore part of the abdomen. Consult: Pritt's ‹Book of the Grayling› (London 1888); and Jordan & Evermann's ‹American Food and Game Fishes› (New York 1902).

Gray's Inn, one of the four Inns of Court, in London, situated on the north side of Holborn and to the west of Gray's Inn Lane. It contains a hall of the period of 1560. It derives its name from the noble family of Gray of Wilton, whose residence it originally was.

Gray's Peak, a peak in the Colorado range, in Colorado, and one of the highest in the Rocky Mountains. Its height is 14,341 feet. It was named in honor of Asa Gray, the botanist.

Gray'weather, or **Graywether,** a sandstone of the Tertiary strata scattered over the surface of the ground in Dorsetshire and Wiltshire, England. It was from these stones that the famous druidical circles were built.

Grease-bug, or **Overflow-bug,** a ground-beetle (*Platynus maculicollis*), common in California, and occasionally a pest in houses because of its disagreeable odor when crushed, and because it nibbles bread and meats.

Greasewood, a small, very thorny, almost leafless shrub (*Sarcobatus vermiculatus*) of the goosefoot family (q.v.), which abounds among the sage-brush on the arid plains of the western United States, especially where the soil is saline. The wood, which is yellow and very hard and tough, frequently supplies the only fuel available there, and burns with a bright hot crackling blaze suggesting grease.

Great Auk. See Garefowl.

Great Awakening, the popular name of a great and tenacious «revival» in New England, 1740–5, under the influence of Jonathan Edwards and George Whitefield. Edwards had created a similar excitement in Northampton five years before, the embers of which were still glowing, but on Whitefield's visiting him in the fall of 1740, and preaching his thrilling sermons in addition to Edwards', the wave spread all through New England, involving over 150 towns, and rising almost to frenzy. It was marked by the extremest accompaniments of bodily seizures, convulsions, hysteria, etc., and aimed especially to bring young children under its control. Edwards was rightly considered its author, and was fiercely denounced for its irrationality and evil effects on public worship, as well as the temporary ruin of calm and fruitful work; he defended it for some time, but its results at last came to be deplored even by its champions, and by 1742 it was threatening not only the peace but the life of the churches. So bad were its effects that to the reaction has been attributed the religious deadness of the country for the next 60 or 70 years. The separation of the «converted» into an arrogant clique who often seceded in separate churches, the upspringing of a horde of ignorant lay preachers making physical effects the touchstone of religion, the indecent rivalry in «manifestations,» the denunciation of all the trained ministry as lacking divine grace, were only a part of its demoralizing outcomes. The faculties of Yale and Harvard colleges pronounced against it, as did the leading divines; the Massachusetts General Convention of 1743 added its testimony, and in Connecticut an effort was made to enforce the Saybrook Platform against the independence of congregations.

Great Barrington, Mass., town in Berkshire County, on the New York, N. H. & H. R.R.; 40 miles west of Holyoke. In the town are three villages: Great Barrington, Housatonic and Van Deusen. It was settled in 1725, but formed a part of Sheffield until 1761. William Cullen Bryant was town clerk for several years, and the thoughts in many of his poems were suggested by the beautiful Berkshire scenery. The town has a good public library, the Hopkins Memorial Manse, the Sedgwick Institute, and a number of good elementary schools. The manufactures are cotton goods, electrical apparatus, and paper. Pop. 5,872. Consult: Taylor, ‹History of Great Barrington.›

Great Basin, a vast region of interior drainage, a triangular plateau of North America, occupying the western part of Utah, and nearly the whole of Nevada, parts of Oregon and California, and extending at its northeast angle into Idaho. It is bounded on the west by the Sierra Nevada and on the east by the Wasatch Mountains. The base of the triangle at the north is 500 miles from east to west, and the extent from north to south is 800 miles. The area is about 210,000 square miles, a little larger than France. It is traversed by numerous mountain ranges, irregular in arrangement; the valleys are mostly sinks, the chief drainage centre being Great Salt Lake (q.v.). The areas of greatest depression are to be found near the borders, and the greatest elevation near the central part. The highest range is the East Humboldt, one peak of which, Mount Bonpland, is 11,321 feet in height. Volcanic masses form or conceal the original rocks of many of these ranges. The slopes and the geological markings show that the lakes and rivers which once existed within this region have become smaller and some have disappeared. The greater portion of this section was once in the basin of the Columbia River. The Great Basin contains many streams and lakes (the latter for the most part salt) whose waters never reach the ocean, but are either taken up by evaporation or their waters sink in the desert sands. The mean annual rainfall ranges in different localities from 4 to 15 inches. The plateau is nearly destitute of trees, and in general only the upper parts of the valleys are clothed with desert shrubs, their lower portions often being covered with muddy water or with several inches of alkaline salts left by evaporation. The chief arid places are the Great Salt Lake Desert, the Mohave Desert, and the Carson Desert. This Basin is rich in mineral wealth; gold, silver, iron ore, and copper exist here in large quantities.

The Great Basin is among the large interior drainage sections of the world; but the interior drainage basin of Asia is 23 times as great, and the Sahara 16 times as great.

Great Bear Lake. See Bear Lake, Great.

Great Bend, Kan., city, county-seat of Barton County; on the Arkansas River, the Missouri P. and the A., T. & S. F. R.R.'s; about 92 miles northwest of Wichita. The Central Normal College is located here. It is a trade centre for the surrounding agricultural region, and contains flour mills and iron works. Pop. 2,500.

Great Bridge, Va., Battle at, 9 Dec. 1775. Lord Dunmore, royal governor of Virginia, hearing that a patriot force from North Carolina was on the way to occupy Norfolk, the largest town in Virginia and its chief port, built a rough fort at Great Bridge, over the Elizabeth River, commanding the southern approach. The Virginia patriots raised a band of sharpshooters, including John Marshall, afterward Chief Justice of the United States Supreme Court, took possession of the opposite bank, and in a 15-minute fight, which cost Dunmore 61 regulars and the militia none, forced him to abandon the fort. A few days later the Virginians occupied Norfolk, which the spiteful governor set on fire before taking refuge in a war-ship in the harbor. The town was reduced to ashes.

CONTENTS OF THE DEPARTMENT OF GREAT BRITAIN

GREAT BRITAIN:

HISTORY AND MODERN DEVELOPMENT.

INTRODUCTORY.

The following series of articles, dealing with various aspects of the life of the United Kingdom, is intended to present a coherent account of present British conditions and activities, and of the historical circumstances which have led up to them. On a balance of considerations the usual encyclopædic arrangement in alphabetical order has been abandoned. Encyclopædias are used by two classes of people — for reference by those who have access to other books, for reading by those who must live in the main removed from books. For purposes of reference there is no doubt much to be said for the alphabetical order of arrangement. But knowledge is organic; no fact can be understood in isolation, or fully understood apart from the general scheme and atmosphere of the department of knowledge to which it belongs. Even for reference it is therefore likely that matter grouped according to some natural order, if supplemented by an alphabetical index, will convey the truer impression. For continuous reading there can of course be no question of the superiority of such an order.

The characteristic of British Institutions is that it is impossible to understand them apart from their history. They rarely have logical consistency, for the English suspect ideas, notwithstanding the fact that in certain departments the world owes great ideas to some Englishmen. The typical Englishman suspects an idea because he is impressed with the complexity of experience. He is a creature of habit, not so much from inertia as from caution. His political wisdom does not express itself in such phrases as "Liberty, Equality, and Fraternity," but in practical and limited expressions such as "Freedom of Speech," or "Freedom from Arrest," and in such working laws as that "the remedy of grievances must precede supply." He is willing to change his habits, but only when they have become inconvenient to him because of changed conditions.

The British constitution has never been reduced to writing. It is matter of habit, and throughout history has been in a state of flux. Thus the English manage to combine a curious conservatism with a way of advancing in some matters ahead of the rest of mankind. They have little feeling for symmetry, and are not hurt by anomalies, hence their practical sense of compromise, and their trust in the curative power of time. Though the least consciously historical of all the great races, their institutions are only explicable with the aid of history. Therefore the aim set before the contributors to the British section of this Encyclopædia has been to sketch the leading characteristics of the British nation, and so to sketch them that they are seen to be the natural outcome of history.

The fifty-five articles which follow fall into eight groups. First we have a group concerned with the Making of England, the senior and predominant partner in the United Kingdom. Here the history of Britain, and especially of England, is told with a definite object. There are some episodes and some aspects of history which have chiefly an archæological value. Their results no less than their causes are past. But there are others whose results have endured, and are embodied in the features of to-day. Bagehot somewhere compared the different standpoints in history to the different grouping of the monuments of the same city when seen from two different towers. The perspective of these articles is that of the social and economic observer of to-day, who seeks to explain the present in the light of the past rather than the past in the light of the present. We have nine articles in the first group, viz.:—

A.— THE MAKING OF ENGLAND.

2. Geographical Environment The Editor.
3. The Conquests............Dr. Thomas Hodgkin.
4. Mediaeval England........Prof. T. F. Tout.
5. The Reformation.........Prof. A. F. Pollard.
6. The XVIIth Century......Dr. William A. Shaw.
7. The XVIIIth Century:
   (a) Political Sketch.....Dr. Lilian Knowles.
   (b) The French Wars... Dr. J. Holland Rose.
8. The XIXth Century:
   (a) Political Sketch.....Dr. J. Holland Rose.
   (b) Political Parties.....Sir Thomas Raleigh.

In the second group we have a description of the Mechanism of British Government, both Central and Local. Historical considerations have not been, and indeed could not be wholly excluded, but the aim of the articles in this group is to explain the system, so far as there is a system, and the habits of British Government. The point which will probably strike an American as characteristic of the whole machine is its centralization. The sharp distinction and counterbalance of legislative, executive, and judicial functions, and of local and central powers, are unknown. So far as natural laws and the prejudices begotten of history permit, Parliament is omnipotent. Within Parliament the House of Commons, and within the Commons the Cabinet, and within the Cabinet the Prime Minister count for more than any other force.* It is within the power of no court of law to declare that Parliament has acted *ultra vires*, and the local authorities have no rights which cannot be overridden by Act of Parliament. In this second group we have five articles:

* This statement is not invalidated by the fact that some members of the Cabinet, and sometimes even the Prime Minister, are chosen from the House of Lords.

B.— THE MECHANISM OF GOVERNMENT.

9. PARLIAMENT......... SIR COURTENAY ILBERT.
10. CROWN AND CABINET. PROF. EDWARD JENKS.
11. THE JUDICIAL SYSTEM DR. WM. BLAKE ODGERS, K. C.
12. LOCAL GOVERNMENT.. SIDNEY AND BEATRICE WEBB.
13. THE CIVIL SERVICE.. MR. GRAHAM WALLAS.

Then there follows a small group of articles dealing with the peculiarities of the three Junior Partners in the United Kingdom. Scotland was a Centralized Monarchy, long allied with France in hostility to England. She retains her own law and churches, but similarity of race and of resources have permitted of her blending with England into a single economic organism. Ireland has never been a single independent state, yet geographical, religious, and economic causes have always held her apart from England, notwithstanding the strategical necessity which has prevented and prevents her separation. Wales has had even less of national history than Ireland, yet the Welsh race has maintained a separate vitality, although expressed rather in literary than political institutions. There is perhaps no greater political anomaly in the world than the peculiarly illogical — characteristically British — relations of the four nationalities which form the United Kingdom. The articles of this third group are as follows:

C.— THE JUNIOR PARTNERS.

14. SCOTLAND................ PROF. P. HUME BROWN.
15. IRELAND................. THE REV. T. A. FINLAY.
16. WALES................... PROF. EDWARD ANWYL.

From political government we turn in the next group of articles to the Control and Movement of the National Wealth. The banker and the merchant, the ship-owner and the railway chairman compete in these days with the political statesman for the control of humanity. In this department also of the national life of Britain centralization is characteristic. English banking and railway management are centralized in London, and in a less degree the same is true also of British shipping and commerce. Though some banks and railways and many shipping companies have their head offices outside the Metropolis, yet the banking and railway clearing houses, and Lloyds, the chief seat of shipping insurance, are within it. Even the Scottish and Irish banks depend ultimately on the gold reserve of the Bank of England. Britain, in other words, is a single compact organism with a metropolitan nucleus containing one-sixth of its population. No other important centre is at a greater distance than can be traversed by an express train between the morning and the evening meal. Thus it comes about that a relatively small group of leaders, known either directly or indirectly to one another, go near to controlling all departments of the national life. In other words, Britain is essentially an oligarchy limited by democracy. This fourth group consists of seven articles:

D.— THE CONTROL AND MOVEMENT OF WEALTH.

17. NATIONAL FINANCE....... DR. EDWIN CANNAN.
18. BANKING AND CURRENCY .. SIR FELIX SCHUSTER AND MR. ERNEST SYKES.
19. COMMERCE:
   (a) XVIIIth CENTURY.. DR. LILIAN KNOWLES.
   (b) PRESENT DAY....... MR. A. J. SARGENT.
20. SHIPPING:
   (a) NAVIGATION ACTS... DR. LILIAN KNOWLES.
   (b) PRESENT DAY....... MR. RUSSELL REA, M. P.
21. RAILWAYS................ MR. W. M. ACWORTH.

We then turn to the fifth group which deals with the Production of British Wealth. Here necessarily there is greater decentralization for we come closer to the soil, the mines, and the coasts. The great staple industries of Britain are away from the Metropolis, and in the industrial districts we find a new social and intellectual atmosphere. The three minor nationalities and the Industrial North of England are the democratic forces which compete with the agricultural, commercial, and administrative oligarchy in London. The articles of this group are:

E.— THE PRODUCTION OF WEALTH.

22. AGRICULTURE:
   (a) THE LAND LAWS...... MR. J. FISCHER WILLIAMS.
   (b) XVIIIth CENTURY..... DR. LILIAN KNOWLES.
   (c) XIXth CENTURY...... MR. A. D. HALL.
23. FISHERIES.................. SIR HERBERT MAXWELL.
24. MINING..................... PROF. R. A. S. REDMAYNE.
25. INDUSTRIES:
   (a) INDUSTRIAL REVOLUTION DR. LILIAN KNOWLES.
   (b) EXISTING INDUSTRIES.. MR. W. A. S. HEWINS.

The institutions discussed in the next, the sixth group, are chiefly products of northern industrial thought. The trade unions and the industrial co-operative societies have originated in the north, and have there reached their most efficient and general development. From that region, also, has come the stimulus for factory legislation. The articles in the sixth group are as follows:

F.— INDUSTRIAL RE-ORGANIZATION.

26. TRADE UNIONISM..... SIDNEY and BEATRICE WEBB.
27. THE LABOR POLITICAL MOVEMENT......... MR. E. R. PEASE.
28. CO-OPERATION.......... MR. H. W. MACROSTY.
29. FACTORY LEGISLATION. SIDNEY and BEATRICE WEBB.

The articles in these six groups have dealt with political and economic power. In the seventh group we turn to what may be described as the ideal life of the nation — its religion, its education, and its amusements. But even here one cannot help being struck by the essential unity of English life. The churches and society are intimately concerned with politics. No large interest in Britain holds aloof from government. The typical English education aims at the shaping of character for political and commercial activities rather than at intellectual training for the achievements of scholarship. The articles of the seventh group are:

G.— THE IDEAL LIFE OF THE NATION.

30. RELIGION:
   (a) THE CHURCH OF ENGLAND........ DR. A. C. HEADLAM.
   (b) NONCONFORMITY.... THE REV. DR. JOHN BROWN.
   (c) ROMAN CATHOLICISM MONSIGNOR BERNARD WARD.
   (d) JUDAISM........... MR. ISRAEL ABRAHAMS.
31. EDUCATION:
   (a) GENERAL........... MR. GRAHAM BALFOUR.
   (b) MEDICAL........... DR. FRANCIS FREMANTLE.
   (c) ENGINEERING....... PROF. D. S. CAPPER.
32. SOCIETY.................. THE HON. MRS. ALFRED LYTTELTON.
33. SPORT.................... THE RIGHT HON. ALFRED LYTTELTON, K. C., M. P.
34. THE FINE ARTS......... MR. A. J. FINBERG.
35. NEWSPAPERS............. MR. J. A. SPENDER.
36. THE TREND OF THOUGHT AND LITERATURE IN THE XIXth CENTURY....... DR. SIDNEY LEE.

Finally, we have an eighth group of articles dealing with the external expression of British life. Here we find the same forces in action — the dominant imperialism of London, with its great tradition of statesmanship, limited by the partially antagonistic ideals of the industrial and democratic north. The eighth group of articles is as follows:

II.— EXTERNAL RELATIONS.

37. Navy.................... Lieut. Carlyon Bellairs, R. N., M. P.
38. Army.................... The Right Hon. H. O. Arnold-Forster, M. P.
39. Foreign Policy:
 (a) In Relation to Europe........... The Hon. George Peel.
 (b) In Relation to India............ Sir Walter Lawrence.
40. The Free Trade Movement.................... Mr. J. St. Joe Strachey
41. The Tariff Reform Movement.................... Mr. J. L. Garvin.
42. The Reaction of the Empire on the Mother Country.............. Mr. J. L. Garvin.

The writers of the articles in these eight groups are authorities on their respective subjects. They all speak either from long study or long practical experience, and I desire to thank them for the pains they have taken with the object of presenting as complete a picture of the political, social, and economic condition of the Old Country as space would permit of. The intention of each has been to convey the key ideas and not merely the statistics of the department entrusted to him. Bibliographies have been appended throughout, as a guide to readers who would pursue further particular studies in which they are interested. In these days when libraries are multiplying throughout the Anglo-Saxon world, the function of an Encyclopædia should not only be to reply to the questions which arise incidentally to study and business, but also to act as a guide to the leading sources of information which we may reasonably expect to find on the shelves of a good library.

H. J. Mackinder.

THE MAKING OF ENGLAND.

2. Great Britain — Geographical Environment. The Greeks could not have played their decisive rôle in history had they not dwelt in the centre of the lands, amid the islands and peninsulas between Europe and Asia. Nor is it likely that any race less happily endowed could have achieved what the Greeks achieved even in that favored environment. A like relation is true as between the British race and the British Isles.

The origins of the British race are recounted in the next article of this volume. It is the aim of the present article to analyse the geographical influences which have contributed to British history.

Popular philosophy, as embodied in Shakespearian phrases such as the "moat defensive" and the "silver streak," would dismiss the matter as almost too simple and obvious for set discussion. The insularity of Britain has no doubt counted for more than any other single geographical cause, but the British polity and character are in fact the product of a very singular combination of geographical no less than historical circumstances. For the purposes of this short summary the major geographical controls of British development may be grouped under the nine following heads:

1. Insularity.
2. Shallow surrounding seas.
3. Neighborhood to the continent.
4. Relation to the chief linguistic frontier of Europe.
5. Climate determined by oceanic winds.
6. Internal natural divisions.
7. Adequacy of economic bases.
8. Geographical momentum.
9. The consequences of sea power.

1. *Insularity.*— Britain has not been successfully invaded since the defeat at Hastings eight and a half centuries ago. The Englishman is ever conscious of this fact — it is a frequent argument in twentieth century political speeches. The victories over the Spanish Armada and at Trafalgar have served to increase the sense of security, and freedom at home and empire abroad are the twin results. At home there has been an ineradicable jealousy of a standing army, and there has therefore been freedom for the development of what Bagehot described as "government by talk." The navy on the other hand has at most times been viewed with favor, for it has screened the experiments and mistakes by which popular government has been slowly nurtured. These mistakes were often such as would have involved a continental nation in the consequences of a Jena or a Sedan.

Insularity has also permitted of a concentration of purpose upon the sea which was impossible for the other maritime states along the western seaboard of Europe. England succeeded where Portugal, Spain, France, and Holland failed, because, in the absence of a land frontier, her economic resources could be focussed on adventure beyond the seas. In this regard it must be borne in mind that sea-power does not rest on the navy alone, but on the co-operation of a mobile army with a dominant navy. An army limited to this subsidiary use has been possible for Britain because of her insularity. By her navy and amphibious army Britain won North America and the sovereignity of the Indies, while France and Holland were involved in continental wars. It was by the exhaustion of her enemies rather than by her victories that Britain achieved her empire. This is surely the truth which lies behind Seeley's famous utterance "that Britain made an empire in a fit of absence of mind." Behind her girdle of seas she fought with a limited liability and was immune at home though often defeated abroad.

John Bull's insularity of character is the natural result of his strong frontier. Elsewhere the types of humanity merge gradually where political frontiers are crossed. In some respects this contrast between the British and the continental peoples was in the past even more obvious than to-day. Not only, on the one hand, is the traffic over the seas more frequent now, and Britain's isolation in time of peace less marked, but on the other hand, the change at the conventional continental frontier has been emphasized owing to the centralized character of the modern great state. It is the stalwart Prussian Protestant who does duty now-a-days on the frontier of Alsace-Lorraine, not the Swabian, shorter, darker, and Catholic neighbor of the Frenchman across the line. Ever since the days of the first Edward, the Englishman has felt himself a foreigner from the moment that he landed at Calais or Boulogne.

2. *Shallow Surrounding Seas.*— The British Isles are the emergent portions of a great shoal known as the Continental Shelf, which stands out seaward from the mainland coast. Precisely as waves grow taller until they break on the foreshore, so the tides, which measure in mid-ocean only some two or three feet in amplitude, are magnified several fold as they pass on to the British shoal. Strong currents are thus generated as the wide British seas alternately deepen and drain low. Cæsar bore eloquent testimony to the influence of our tidal currents in the defeat of his strategy. The British tides, however, have had a uniting as well as a disuniting influence. Streams and streamlets whose mouths in other parts of the world would be mere creeks without fame, in these seas bear the historic names of Thames and Severn, Rhine and Seine. Even in the days of steam motive power, the flow and ebb of the Thames to and past London are worth much money annually — a fact which is one of the chief arguments against the scheme often proposed for erecting a dam below the metropolis and so keeping the water permanently high. What the tides were in the days before steam is evident from the position, many miles from the open sea, of such ports as London, Antwerp, and Hamburg.

Nor must it be forgotten that the shallow seas around Britain are exceptionally productive of fish. The fishermen of Holland became the carriers from Lisbon to the Baltic, and when Lisbon fell temporarily under the power of Spain, these same Dutchmen extended their voyages to the Indies. To-day, however, the fishermen of England and Scotland are in a great majority on the international fishing grounds of the North Sea, and the powerful steam fishing vessels which are now being built extend their operations as far as Iceland on the one hand and the coast of Morocco on the other. It is an important fact for a state whose power is on the sea that there are no fewer than one hundred thousand English, Scotch, and Irish who earn their living wholly or in part by sea fishing.

3. *Neighborhood to the Continent.*— Britain would have had small significance in the world had her position been distant from the historic shores of Europe. It is of course true that the ancient writers from Virgil to Shakespeare are full of the remoteness of Britain at the end of the known world. It is true also that until a relatively late period in history Britain did not count among the powers which shaped the destiny of mankind. These very facts however have enabled Britain to play a part in the last two or three centuries which is comparable to that played by the Greeks on the smaller stage of the earlier time. Because of her neighborhood to Europe, Britain was deeply and repeatedly influenced from several distinct quarters, yet because of her insularity was never permanently attached to any one centre of European culture. It has been Britain's function to amalgamate the several elements of European civilization, and then to spread Europe to all the shores of the world. At least four streams of blood — Neolithic, Celtic, Roman, and Teutonic — and four linguistic influences, all drawn from across the narrow seas, have gone to the making of modern Britain. Yet the Englishman of to-day differs generically from all the species of continental European. Britain has been and is *of* Europe yet not *in* Europe.

From this point of view it is important also to notice that the hilly parts of the British Isles are in the north and the west — toward the ocean that is to say, not toward the continent. As a result, the agricultural England of the plain, the dominant partner in the United Kingdom, lies toward the channel, and London is close neighbor to Paris and the Netherlands. History would have been far other than it has been had the hills been in the south-east and the plains in the north and west.

4. *Relation to the Chief Linguistic Frontier of Europe.*— A glance at a map of Europe showing the areas occupied by the several languages would make it clear that the most important linguistic frontier, that between the Romance and Teutonic tongues, traverses Europe diagonally from the Alps, and comes down to the coast in the northern corner of France, within sight of Dover Castle. England has received from the Rhine, the Elbe, and the Norwegian fjords her Teutonic language and the rudiments of her free institutions, while she has taken from the Seine, and from the western Mediterranean beyond, her Christianity and her scholarship. Scandinavia on the one hand and Spain on the other possess a geographical separation almost as definitely secure as that of Britain, but Scandinavia is Teutonic and Spain is Romance. Britain has been cross-fertilized from both sources.

Moreover, Britain has re-acted upon the dual Europe with the power due to her position. If the adjoining continent, with its greater population and greater aggregate wealth, had been united politically, the independence of Britain would have been impossible. As Mr. Peel has shown in his article (see GREAT BRITAIN — FOREIGN POLICY IN RELATION TO EUROPE), we have at most times used our power to defeat every bid for general European dominion. Rome conquered a large part of Europe and she also subdued Britain. Napoleon's aim was to invade England, and England only defeated him by overthrowing his European Empire. The task of holding Europe disunited has been facilitated in every age by the fundamental antagonism of Roman and Teuton. Britain's immediate neighbors across the Channel, to-day, as in the time of Napoleon, of Louis XV., of Louis XIV., and of Charles V., are on the Rhine and also on the Seine. In the same connection let us note that in the year 1066, at Stamford

Bridge and at Hastings, England exchanged, as Dr. Hodgkin points out (The Conquests) in this volume, a period of Teutonic for a period of Romance influence.

5. *Climate Determined by Oceanic Winds.*— Britain lies further north than any other country of equally old civilization. Great Britain occupies almost precisely the same latitudes as Labrador. The prevalent westerly wind from the Atlantic, and the set of the Atlantic waters from the tropical southwest carry the warmth and moisture of lower latitudes into a great climatic bay over Britain, in which long frosts and long droughts are equally rare. Unlike either the south or the east of Europe, there is labor in the fields at all seasons, for Britain has neither a Mediterranean summer nor a Russian winter. May not the moral effect of this continuity of effort account for some of the so-called Anglo-Saxon characteristics? Yet the mists of the oceanic air and the long northern nights are often as unfavorable to repose in the open as the other conditions are favorable to work there. Hence a second Anglo-Saxon characteristic, the home round the fireside.

Nor, it must be remembered, is climatic control limited to agriculture and domestic conditions. There are splendid waterways in the wide plains of eastern Germany and Russia, but navigation is there intermittent owing to the long grip of the winter frosts. The rivers of Spain and Italy have abundant volume after the rains and the thaw in the mountains, but they are reduced in the summer to strips of pebble desert. The smaller waterways of England, closed neither in winter nor summer, were long ago made navigable by means of locks.

6. *Internal Natural Divisions.*— Britain is divided into the two islands of Great Britain and Ireland. The same causes which have separated British conditions as a whole from those of continental Europe have of course tended to separate Irish conditions from those of Great Britain, but they have acted with less effect, because Britain by her position has been driven to obtain sea power, and thus for many purposes to remove her frontiers from her own coast to the coasts across the water. Thus Ireland has been strategically enveloped by England, yet because adequate English man-power was lacking in the time of Henry II., Queen Elizabeth, and Cromwell, was never completely assimilated to England. Ireland conquered, and necessarily conquered, by England, is in the position that Britain would be in if there were a united Europe across the Channel. Had Ireland been an organized kingdom in the early Middle Ages, instead of a group of rival and hostile tribes, she would have supported Scotland against England, would have retained her independence longer, and when modern conditions rendered union inevitable, would have come into the sisterhood like Scotland as an organized force capable of holding her own.

What every map does not show, however, is the coherent area of bleak uplands occupying the centre of the length of Great Britain, and dividing the agricultural lowland of England from the smaller lowland of Scotland. This upland area has no single name, but is known in different parts as the Southern Uplands of Scotland, the Cheviot Hills, the Pennine Moors, and the Lake Mountains. Until a century and a half ago it had but a sparse population, and was in fact a broad natural frontier between the England of London and the Scotland of Edinburgh. This "border," utilized by a people of Teutonic tenacity, was the geographical position from which Scotland for six centuries held at bay the superior might of England. Not a little of the effect of modern British action in the world is due to the interaction of the two national characters thus evolved in antagonism.

The central uplands of Great Britain between England and Scotland are now the seat of great industries, and for most purposes the two countries form a single economic organism. But in the Highlands of Scotland on the one hand, and in the broad upland of Wales on the other, a remnant of Celtic speech still survives. In all parts of the world there is a marked contrast between the highlander and the lowlander, but this contrast is here increased by that between Celt and Teuton. Formerly marriage was between neighbors, and provincialisms were inbred. But modern facilities for communication lead to distant intermarriages, which are rapidly imparting a national solidarity of blood to states like Britain. This crossing of highlander and lowlander, Celt and Teuton, within Britain must be productive of a change in the race which may prove something far other than the mere striking of an average.

7. *Adequacy of Economic Bases.*— All the preceding advantages — insularity, shallow surrounding seas, continental neighborhood, linguistic division among rivals, soft climate, and internal stimulative contrasts — would, however, have been of little value unless Britain had had length and breadth enough to supply the economic bases for a people able to count among the Powers of Europe. It is therefore important to note on the map of Europe a certain rough equality as between the great natural regions — the Spanish, Italian, and Balkan Peninsulas; the plain of the Middle Danube; the French land between the Alps, the Pyrenees, the Bay, and the Channel; the north German plain; and the southern habitable portion of Scandinavia. Even the vast Russian plain, after all only partially European, must not deceive by the space which it occupies on the map. North and east of the great bend of the Volga at Kazan it contributes little to the strength of the Russian people. Many advantages and disadvantages, moreover, compensate for such differences of mere area in this bundle of natural regions which we call Europe. Thus there is a rough equality of resource among the tenant nations, and this has sufficed for a balance of power during several centuries.

Until within the last few generations agriculture was the chief economic base of these nations. For the reason given just now — the separation of their agricultural plains — England, Scotland, and Ireland were separate economic organisms. Relatively to her population, England was until lately so adequately endowed with land that in the Middle Ages she was the principal exporter of wool, and in the 18th century, of wheat, to the continent of Europe. The vast improvement of agriculture achieved by the English farmer in the 18th century was one of the chief causes — if not the chief — of the wealth which enabled England to defeat Napoleon. (See GREAT BRITAIN — AGRICULTURE IN THE 18TH CENTURY, by Dr. Knowles).

Though agriculture still remains the greatest single industry, yet by the aggregate of her industries Britain is now an industrial rather than an agricultural country. In other words, she rests on her output of coal rather than of wheat and meat. The change has, however, been fully accomplished only in the last two generations.

The new economic conditions have been variously influenced by geography. In the first place Scotland has been effectively united to England. The barren uplands in the north of England — in the isthmus, that is to say, connecting the two countries — are rich in coal, and a population has grown up in this part of the island drawn both from Scottish and English sources, and of an intermediate character. Moreover, Scotland, by virtue of her own coal, has been able to share in the advantages of the imperial and economic policies of England. At the time of the union of the two parliaments in 1707 Glasgow was only a village.

The dominance of the trader over the farmer led in the 19th century to a reversal of the long-settled British policy of protection. England and Scotland no longer rest economically on the resources of their own territories. They produce coal, and are the seat of labor and of capital, but four-fifths of their wheat they import, and one-fifth of their people are engaged on manufactures for export. Ireland, however, has very little coal, and must still depend on her agricultural products. Thus, while Scotland and England are now a single economic organism, Ireland — with the exception of Belfast — is another and separate organism. There is an antagonism of economic interest between Ireland and Great Britain which may be compared to the antagonism of interest between the Southern States and the Northern before the Civil War. If in her own interest Great Britain were to revert to her former economic policy, an incidental result in the long run might possibly be to reconcile Ireland to her.

8. *Geographical Momentum.*— We must not however seek to ascribe the present strategic and economic position of Britain in the world, in so far as it depends on geographical causes, wholly to the present action of those causes. There is such a thing as geographical momentum. The causes which originally led to the establishment of a market in a given place may have ceased to act, but the habit of the customers will long compel salesmen to resort to it. London at the present moment is the greatest general store in the world. It has no staple industry, but parcels of almost everything manufactured in other parts of Britain, and, indeed, in almost all parts of the world, are warehoused there. Except for large quantities of staple goods, many smaller communities find it convenient to give their orders and to make their payments in London. Formerly, no doubt, as Emerson has said, England as the great shop-keeping nation had a good stand in the world. Her chief customers were along the European coast opposite. But now part, at any rate, of her influence is due to momentum from the past, to the start given to her during the Napoleonic Wars, and by the fact that in the days before railroads she had coal near the waterways.

9. *The Consequences of Sea Power.*—Britain now lives in part on the products of her own land and seas, in part as a manufacturer for other countries, and in part as a market. But she also obtains profit from her position as the chief sea power. By this power she prevents her enemies from uniting, she retains certain open markets, and she protects her carrying trade. Sea power, however, is a condition of the existence not only of the British Empire, but also of the United Kingdom. This was early made evident. When Edward the First conquered the Principality of Wales, he moved the fleet of the Cinque ports, then the only fleet available for the English king, into the rear of his opponent. This he could not have done had not the Lord of the Isles been defeated shortly beforehand by the Scotch. For several previous centuries sea power along the oceanic borders of Britain had been in the possession of a Norse state established in the fringe of islands which extend round the west of Scotland from the Shetlands to the Isle of Man. Unless Britain has command of her seas the Shetlands and the Orkneys, and indeed Ireland itself, might be held by the foreigner against her, and the foreign invader might establish his bases even in the remoter peninsulas, say of Scotland or Wales. It was from such a peninsular base at Lisbon that Wellington conducted the war against France at the beginning of the 19th century.

The very need of sea power, or in other words, of the sea itself, renders it impossible to put territorial limits to naval action. Britain can command in the British seas only if she can also command in waters more remote. Her fleets are now concentrated in European waters because her possible naval opponents are there to be found, and for no other reason. It follows, however, that Malta and Gibraltar, the bases of the Mediterranean and Atlantic fleets, are in reality not merely milestones on the road to India, but also outposts for the defence of London. It is this characteristic of sea power, now familiar to all the world through the writings of Captain Mahan, which renders it necessary for modern Britain — faced by Powers that rest upon half continents — to extend her economic bases beyond her original insular territory. Whether this is to be done by the method of increasing the insular factories and holding open the over-seas markets, or by such a federation with her colonies as will in effect base her navy on the agriculture and factories of a wider land, is the present issue of British politics — the outcome of many centuries of history in an insular and yet European geographical environment.

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3. Great Britain—The Conquests. Two, at least, of the great inrolling waves of conquest, which have left their mark on the people and the institutions of Britain, had spent their force before any historian arose to record them, and are thus for us like the forgotten events of our unconscious childhood. As to these we can only speak darkly and doubtfully according to the scanty evidence furnished by excavations of the barrows in which the bones of Prehistoric Man are laid. Judging from these, we are able to say that in the dawn of the history of Britain, our island was inhabited by a race ignorant of the use of metals, of the manufacture of pottery, and of the art of weaving, but accustomed to the use of stone implements such as wedges, axes, and hammers, which they fashioned with considerable skill. This race is one of those called Neolithic, to distinguish them from the incalculably older races of Palæolithic Man, who also used stone implements, but who lived before that mighty parenthesis in human history which is called the Great Ice Age. What the Neolithic inhabitants of Britain may have called themselves we are utterly unable to say. For convenience they are generally spoken of as Iberian, in order to indicate a possible connection with the aboriginal inhabitants of Spain, now represented by the Basques; but this connection is only an ethnological guess and must not be taken as an established fact. The race in question buried their dead in long barrows, the excavation of which shows that they were of short stature, with skulls tending to the long rather than the broad shape (Dolicho-cephalic rather than Brachy-cephalic) and that they were probably black-haired and of dark complexion.

To these aborigines of Britain entered two tall and fair-haired races, both of them probably belonging to that great family of nations which we call Celtic. The first of these invading races wielded weapons of bronze; the second was acquainted with the use of iron, and this may account for their victory over their predecessors. At present the tendency of scholars is to identify the bronze-using people with the Gaels (or as they are now generally termed the Goidels), who have left their chief mark on the populations of the Scottish Highlands, of Ireland, and of Gaul. The wielders of iron would be the race (now called Brythonic) which gave its name to Britain; which occupied the greater part of the southern half of the island when Cæsar landed; which survives under the name of Cymri in the mountains and valleys of Wales; and whose language, once spoken in Cornwall and Cumberland, is the dearest possession of the eloquent Welsh and has a large currency among the peasants of Brittany. As to the date of these several movements accurate information entirely fails us, but it is probable that several centuries elapsed between the arrival of the two waves, the Goidelic and the Brythonic, and that all had been accomplished several generations before the birth of Christ.

It was in the year 55 B.C. that the Roman eagles were first seen on this side of the straits of Dover. Whether Julius Cæsar seriously contemplated the conquest of Britain, or whether his two expeditions in that and the following year were only theatrical performances meant to overawe the tribesmen of Gaul and to dazzle the populace of Rome, is a question not easily answered. It is certain that, if an abiding conquest was his aim, he had greatly underrated the difficulty of the task. His own narrative, much more candid than that of most generals who indite their own bulletins, shows clearly that neither expedition was really successful, that the Britons fought well, that the dense forests of their land, and the chopping tides of their seas powerfully aided their resistance, and that Cæsar himself, after the midsummer of 54 B.C., never desired any closer view of the white cliffs of Britain.

But though Cæsar was foiled, Rome remained and was still the world-conquering city. In the year 43 A.D. when Claudius was Emperor of Rome, an expedition was fitted out for the conquest of Britain. The commander was the high-born senator Aulus Plautius, and he had under his orders four legions with a proportionate number of cavalry and "allies." The latter were for the most part armed more lightly than the legionaries and were generally stationed in the wings, while the legionaries fought in the centre. The total number of Plautius' soldiers cannot have been less, and may have been considerably more, than 40,000. For 17 years no serious misadventure hindered the onward progress of the Roman arms, though the Silures of South Wales, under their king, Caratacus, kept the invaders at bay for many years. In the year 59, however, we find the Roman general Suetonius Paulinus crossing the Menai Straits and conquering Anglesey, and the Roman soldiers quartered at Chester and at Lincoln. Then came (60) a terrible reverse of fortune, the only serious set-back to the Roman career of conquest in these early centuries. Maddened by the tyranny of a grasping Roman official, Boadicea, queen of the Iceni (a tribe who inhabited what is now the county of Norfolk), called her countrymen to arms, sacked the Roman colony of Camulodunum (Colchester) and the cities of Verulamium and Londinium, and threatened to root the Romans out of the land. Suetonius, however, hastened back into the centre of the island and there, giving battle to the far more numerous forces of the barbarians, achieved a decisive victory.

After this the Roman frontier was pushed steadily forward, especially by the famous general Julius Agricola (78–84) till it nearly coincided with that which is now the northern boundary of England. About the year 120 the Emperor Hadrian is believed to have built that noble stone wall from the estuary of the Tyne to the Solway, of which important fragments still remain, forming one of the most interesting memorials of Roman domination north of the Alps. Another wall, of turf, was drawn by Hadrian's successor, Antoninus Pius, across the lowlands of Scotland from Forth to Clyde, but it was probably not maintained for long as a boundary of the empire, and the hold of the Roman legions on any part of Caledonia was always precarious. We cannot now do more than briefly allude to the expedition of the aged Emperor Severus, in which he is said to have reached the northern extremity of the island and carefully noted the duration of the long midsummer days.

Notwithstanding many incursions of the barbarians, and the obviously failing strength of the Empire, the 3d and 4th centuries were probably not on the whole calamitous times for the now reconciled and submissive inhabitants of Roman Britain. At last in 383 a general named Maximus rebelled against the Emperor Gratian, assumed the purple robe, and carried his legions into Gaul to enforce his claim. It may be doubted whether the wealthy and timid provincials ever slept soundly after that fatal departure. True, the rebellion was in course of time suppressed, and some portion of the legions struggled back to Britain, but more mutinies followed, Rome itself was in danger from Alaric and his Goths, and at last about 407, the last of the Roman legions quitted the island never to return.

Of the next act in the great drama, the conquest of England by the English, we have hardly any trustworthy information. The broad outlines of the conquest may be traced. Three tribes of the Low German stock from the shores of the Baltic and the North Sea certainly established themselves here in the course of the 5th century. The Jutes settled in Kent and the Isle of Wight, the South Saxons gave their name to Sussex, the East Saxons to Essex, the West Saxons established themselves in Hampshire and Wilts, the East Angles in Norfolk and Suffolk, the Middle Angles in the Midland counties where they founded the kingdom of Mercia. Deira and Bernicia, the two kingdoms which sometime coalesced into Northumbria, were also Anglian settlements: but how and when all these territorial changes took place we really cannot state with certainty. Even the 'Saxon Chronicle,' which professes to give dates for the foundation of the kingdoms of Kent, Sussex, and Wessex, tells us scarcely anything about Northumbria in these early years, and nothing at all about the other three kingdoms.

The ordinary story of the Saxon conquest is thus told. On the departure of the Roman legions the Britons, sore pressed by the incursions of the Northern and Irish barbarians, the Picts and Scots, called on "Aëtius, thrice consul," for aid which he was unable to give them. Thereupon they foolishly turned to the Saxon and kindred continental tribes for help. Hengist and Horsa, Jutish princes, came at the call, landed on the coast of Kent, repelled the Caledonians, but refused to quit the country after the work of liberation was accomplished. The infatuated passion of Vortigern, the elderly British king, for Rowena, daughter of Hengist, aided the designs of the invaders, who sent over to the continent for more and ever more of their countrymen till the conquest at least of the eastern half of the island was accomplished.

For the story thus told the evidence is not satisfactory. It chiefly consists of the narrative of a Welsh ecclesiastic named Gildas, who lived a century and a half after the legions quitted Britain, and who, though an earnest Christian patriot, was evidently but slenderly furnished with historical knowledge. Nor do the very meagre details of the conquest which are supplied by the 'Saxon Chronicle' carry us much further. That Chronicle was itself probably not compiled till three or four centuries after the invasion, though some of the material included in it may be of a much earlier date.

On the whole all that we can safely say appears to be that apparently throughout the 5th century a series of attacks on the Romano-British population was being made by the Germanic tribes which the Romans had known by the name of Saxons. These attacks had begun, even in the 4th century and, in order to guard against them, the emperors had created a high official who bore the name of "Count of the Saxon Shore." The invasion may possibly have culminated in the year 449, the year assigned by the 'Saxon Chronicle' to the landing of Hengist and Horsa, but there is some reason to think that even that specific event took place eight years earlier. The name of the first West Saxon chieftain, Cerdic, interests us because it is from him that the present royal house of Great Britain derives its origin. His career of conquest, which had been most successful, was possibly stayed about the year 516 by a great victory which Gildas reports the Britons to have won at "Mount Badon." In the present state of our historical knowledge no one can deny that this victory (about which the 'Saxon Chronicle' is silent) may have been won by a Romano-British hero named Arthur.

About 60 years later (577) the great victory of Deorham, won by Ceawlin, the grandson of Cerdic, once more carried forward the invading flood and finally separated the Britons of Wales from their kinsmen in the district which was then called West Wales, but which we now know as Cornwall.

The Saxon conquest was apparently never an easy one, and became harder and slower as time went on. By the middle of the 6th century, roughly speaking, the invaders occupied all of England that lies east of a line drawn from Berwick to Portland; but it had taken at least three generations to reach so far. Then came the above-mentioned victory of Deorham and the extension of the Saxon border far into Devonshire. In the North-west during the 7th and 8th centuries, the Northumbrian kings cut short the British kingdom of Strathclyde, and perhaps reduced it into a condition of something like vassalage. On the Welsh marches, Offa, the great king of Mercia, in the 8th century, carried the western border of England from the Severn to the Wye, and by a substantial earthwork, some vestiges of which still remain and are known as Offa's Dyke, fixed the dividing line between England and Wales almost in its present position. The actual conquest of Wales and its complete subjection to the English kings had to wait till the 13th century, when it was accomplished by Edward I.

The four centuries which intervened between the departure of the legions and the accession of Egbert are generally felt by the historical student as a wearisome interlude in which nothing is done toward the real business of the drama, the creation of an united England. In truth, no thought that such was the real action of the play probably visited the minds of the chief performers. The invaders belonged to various clans, tribes, and communities, and though they must have spoken the same or nearly the same language, they had only the feeblest conception of duty toward one common country. Even within the limits of the same race we look in vain for any active principle of brotherhood. Angle seems to war against Angle, and Saxon against Saxon, just as cheerfully as either would war against the other. It is true that the moral conquest which lies outside the scope of this paper, the conversion of the English to Christianity (600–686), did something toward quickening the sense of national unity; but notwithstanding the Church's influence, this was still weak when Egbert ascended the West Saxon throne, nor can he, notwithstanding the ascendency which he exercised over the other still subsisting kingdoms, be regarded as truly king over all England. It was the terrible Danish invasions and the fact that only one champion, the hero king of Wessex, was found able to resist them, which finally established the unity of Anglo-Saxon Britain under the rule of Alfred and his descendants. We call the new invaders, for convenience sake, Danes, but in truth they came not only from Denmark, but from Norway, perhaps from all the harbors of the Scandinavian seas. In 789 the Danish storm began to blow, and with one or two lulls, it blew for three centuries, till Harold Hardrada lay dead on the field of Stamford Bridge. In the year just mentioned (789) three Danish ships appeared off the coast of Devonshire. The mariners resisted the attempt of the king's steward to levy toll upon them, slew him, and sailed away. Four years afterward came another and more deadly invasion. "The heathen men," says the Chronicle, "miserably destroyed God's church at Lindisfarne, with rapine and slaughter." This ravage of one of the holiest places in Western Christendom showed the savage heathenism of the invaders and struck terror into the hearts of noble and peasant alike, who saw that no sanctuary could be of any avail when the terrible raven standard of the Danes was flapping in their harbors.

The usual course of one of the early Danish invasions was something like this. When spring days dawned a little fleet of ships, or rather long boats, undecked, with one mast in each, and seats for 60 rowers, would push off from the Danish or Norwegian coast and appear in English or French waters. (It must be remembered that France and Germany suffered almost as severely as England from the Danish ravages.) The mariners steered their barks into some estuary, such as that which then severed Thanet from the mainland, and leaving them there under a sufficient guard, spread themselves over the country in quest of horses. When they had thus mounted themselves at the expense of the victim country, they made rapid excursions far and wide over the land, burning towns, plundering monasteries and churches, fighting with and generally defeating the *caldorman* or lord-lieutenant of a county, who at the head of his rustic militia (*fyrd*) came forth to fight his brave but stupid battle of defense. Their enemies accuse them of inhuman crimes: the torture of prisoners, the violation of women, the mirthful slaughter of little children; but there is some doubt how far these atrocities can be fairly taken as typical of the general character of the Danish invasions. Of one feature of these invasions there can be no doubt: that is, of the special hostility which they displayed to the churches and monasteries of Western Europe. The historical literature of our country has probably to lament the loss of priceless manuscripts, especially in the convents of Northumbria and Mercia, caused by the ravages of the Danes.

When the summer was drawing to a close, and when the long boats were gorged with the plunder of half a dozen counties, the unwelcome intruders would return to their ships, glide away out of the channel in which they had cast anchor, and for that year the harried and wasted land would see them no more. This, at least, was the case in the first stage of the invasions, for about 60 years after the sack of Landisfarne. Then, in 851, as the Chronicles tell us, "the heathen men settled themselves over winter in Thanet." From that time the invasions of the Danes assumed a more and more permanent character: from mere freebooters they became conquerors: Northumbria and Mercia were bound to their chariot wheels, and the whole of England would have been subjugated by them but for the war of liberation which was successfully waged against them by Alfred the Great (871–900).

Though Alfred broke the Danish yoke, and although his son and grandson, Edward and Athelstan, triumphantly asserted the supremacy of the English crown over the Danish chieftains who were left in the land, the result of the warlike operations of the 9th and 10th centuries was to cause an immense infusion of Scandinavian blood into the population of England. The Danelaw, as it was called, included the greater part of the country northeast of the Watling Street, the old Roman road which ran from London to Chester; and in many parts of this region, notably in Lincolnshire and the East Riding of Yorkshire, the names of places still bear witness by their terminations to the existence there of a large number of Danish settlements. It cannot be doubted that this Scandinavian element when subjected, as it soon was, to the humanizing influence of Christianity, was a most valuable and virile ingredient in the population of England.

Through the greater part of the 10th century the Danish inhabitants of England were kept under by the strong hand of the English kings, and the Danish invasions nearly ceased. Near the end of that century they were resumed, and owing to the portentous weakness of Ethelred and his counsellors, they achieved a greater measure of success than ever before. An archbishop was martyred; six successive payments of tribute were paid in the vain hope of inducing the invaders to cease from ravage; and finally the descendants of Cerdic had to quit the realm, and Canute the Dane sat upon the throne of England. As king, however, the Scandinavian conqueror healed many of the wounds which his countrymen had inflicted as ravagers; and the long and prosperous reign of the Christian Canute marks practically the end of the period during which the Danish pirates were a source of terror to the Saxons. The reign of Canute, however, coincided with one event in the nature of a conquest, not favorable to England. In the year 1018 Malcolm, king of Scotland, won the battle of Carham over the men of Northumbria and thereby succeeded in forcing back the English frontier from the Firth of Forth to the line which it now occupies of the Cheviots and the Tweed. The rich country of the Lothians, which for near five centuries had formed part of the kingdom of Northumbria, was now permanently added to Scotland.

The line of Canute came to a speedy end in the persons of his worthless sons; and thereafter, during the central years of the 11th century, under the reign of Edward the Confessor, there was going forward a peaceful conquest of England by the Normans under favor of the Norman-minded king. In truth there was much to admire in this young Norman race, strong with Scandinavian energy, but refined and liberalized by the memories of Roman culture which still lingered in the shattered empire of Charlemagne. Hard and grasping as the Norman warrior might be — and William the Conqueror was a typical Norman in this respect — he was at this period generally chaste and temperate. His devotion to the Church was not a mere hypocritical pretense, nor was it only testified by the magnificent cathedrals which he erected. As statesman, as architect, and as warrior, it must be admitted that the Norman knight much outshone the Saxon *thegns* whom he supplanted.

The peaceful conquest of England by Norman influence which had been for a time arrested by the successful rebellion of the half-Danish family of Godwin was succeeded by the bloody conquest of 1066. Many causes concurred toward this event: the utter feebleness of the representatives of the line of Cerdic; an uneasy consciousness that Harold Godwineson, who had been raised to the throne on the death of Edward the Confessor, was no rightful wearer of the West Saxon crown; the long-lasting feud between his family and that of the sons of Leofric; but above all the grieviously ill-timed invasion of the Norwegian Harold Hardrada. It was on an ill day for Scandinavia as well as for himself that he landed with his ally, the traitor Tostig, on the coast of Yorkshire. Unable to conquer England himself, and winning nothing from her king but the seven feet of earth assigned for his grave at Stamford Bridge, he nevertheless left her panting and breathless for the encounter with a mightier and unwearied foe.

By the battle of Hastings, England, which had been for centuries closely linked with Scandinavian interests, was wrenched away from that connection, and was forced to revolve in the same orbit with the Latin-speaking races of western Europe. A revival of the empire of Canute, which had bound England, Norway, and Denmark together, was made forever impossible. The eyes of the English king turned henceforth toward Rouen, Paris, Angers, Bordeaux; the lands of the northeast on the far side of the German Ocean were to him a well-nigh forgotten world.

As a matter of tactics the victory of Hastings seems to have been due to William's skillful combination of archers and cavalry. The English forces, though much more imperfectly disciplined and less inured to war than the Normans, stood well at bay for many hours behind the shield-wall which they knew so well how to weave, but they were galled by the thick-flying arrows of the Normans, and were tempted, by the feigned flight of the enemy, to rush down the hill after them. Then did William's cavalry, galloping up, thrust themselves in between their broken ranks, and throw them into confusion from which they never recovered. Since the 14th of October 1066 no foreign conqueror has permanently established himself on English soil, and we may therefore here close our brief and rapid sketch of the Conquests of England.

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For later history it will be sufficient to refer to J. R. Green's ‹Making of England› and ‹The Conquest of England,› to E. A. Freeman's ‹Norman Conquest,› to Sir James Ramsay's ‹Foundations of England,› and to C. F. Keary's ‹Vikings in Western Christendom.› But for the whole subject of the bibliography of English history from the earliest times to the 15th century no better guide can be found than ‹Sources

and Literature of English History,' by Charles Gross, of Harvard University.

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4. Great Britain—Mediæval England. The foreign invader had finished his task when the last results of the Norman conquest of England were slowly worked out during the Norman and Angevin periods. For the future the development of the country was to depend upon resources supplied from within. The first stage in this new growth is marked by the reigns of Henry II. and his sons. From one point of view Henry II.'s work was but a continuation of that of his grandfather, Henry I. Recent investigation has shown that few of the characteristic features of Henry II.'s policy were specifically his own, and that he never departed far from the lines laid down by his grandfather. Yet the use Henry made of the materials thus provided for him constituted a new departure in our history. Dr. Stubbs' well-known description of Henry's reign as a "period of amalgamation" remains as true as ever. Before his days, the English and Norman peoples and English and Norman institutions remained separate, though side by side. It was the mission of the Angevin despotism to grind down both English and Norman into a common nation with a common set of institutions. At first the process was a mechanical one, for the combination was due exclusively to the will of an absolute monarch, working through the most effective administrative machinery which mediæval times had up to now witnessed. As long as the Angevin despotism remained intact, the English and Norman races and institutions continued to be kept together through this external pressure. But they became accustomed to the new conditions, and when the system of Henry II., which had survived the neglects of Richard I., broke down through the active tyranny of John, the union had become organic to such an extent that it continued, despite the relaxation of the severe pressure which had brought it about.

The most permanent feature of Henry II.'s work lay in the establishment of the unity of England, and the control of the country by a unified administration dependent upon the central power. Though the upper classes long continued to speak French and to bear French names, they became as English in spirit as their native-born tenants and vassals. Yet neither Henry nor his subjects had any consciousness of the results of his work. Henry selected England for more treatment than he devoted to the rest of his dominions, not because he was an English patriot, but because circumstances gave him greater control over his English kingdom than over any other part of his extensive territories. His own personal ambition was rather to build up a cosmopolitan Angevin empire, than a national English kingdom. This ideal could not be realized because it brought his house into direct conflict with the growing monarchy of France, whose kings were engaged in carrying out over their dominions similar work to that which Henry had accomplished for his island kingdom. With the falling away of Normandy, Anjou, and Poitou from John, and their absorption into the monarchy of Philip Augustus, the Angevin empire collapsed. Henry II.'s continental possessions had contributed next to nothing toward the development of England, but the work he had accomplished in unifying them had materially smoothed the path by which the French national state was to attain to greatness. The retention of Gascony in the hands of the English kings kept up the friction between the two nations and brought about that hereditary enmity of France and England, which was so characteristic a feature of all later mediæval history. Thus the failures as well as the success of the Angevin rulers had their permanent importance. This was even more notably the case with other aspects of Henry II.'s policy which may be described as premature rather than as impossible. Conspicuous among these were the efforts of Henry II. to enlarge the English kingdom into a monarchy over all the British islands. The conquest of the more fertile parts of Ireland by Anglo-Norman feudal adventurers set up in that island the uneasy dependence of a Celtic people on the English King's feudal vassals which had already been established in southern and eastern Wales since the days of Henry I. Side by side with this, something like a Norman conquest of Scotland was effected, not so much by the enforced recognition of English supremacy by unwilling Scottish kings, as by the gradual infiltration into the northern kingdom of the system and habit of thought which had gained the ascendancy in Henry's own realm. Even the least successful of Henry II.'s efforts was not without influence on the future. After the martyrdom of Saint Thomas of Canterbury, Henry II. renounced as hopeless any heroic attempt to limit the sphere of the jurisdiction and authority of the Church. Yet his watchfulness in controlling and regulating what he deemed the usurpations of the clerical power was renewed from time to time by the more strenuous of his successors, and finally attained a full triumph in the period of the Reformation. For all these reasons, the reign of Henry II. is among the most pregnant of future consequences in all British history.

The personal prowess and contemporary fame of Richard I. cannot blind us to the insignificance of his reign in results. His brother, John, was the worst and most unlucky of English kings, but the consequences of his failures and blunders determined the whole future course of English history. John's unsuccessful conflict with Innocent III. emphasized that triumph of the Church, which even his father had been unable to prevent. The break up of the Angevin empire, though precipitated by his caprice and neglect, was sooner or later inevitable. More important than either of these was the reaction against his domestic authority, which resulted in the union of barons and people in an effort to limit the autocracy of the Crown. The Angevin despotism had done its best work in bringing about the union of England. Like all despotisms, it was a bad thing in itself, even when necessary as the only alternative to feudal anarchy. In John's capricious hands it did not so much as secure the continuance of the law and order for which England had long been willing to pay a heavy price. When the mass of the English people, abandoning their traditional devotion to the monarchs who had saved them from feudal disorder, united with the baronial leaders to wrest from the unwilling king the grant of Magna Charta, the first faint beginnings of English liberty and constitutional government were already at hand.

Of recent years it has become almost the fashion to decry the importance of Magna Charta. It is easy to see that John, in sealing the charter, thought of nothing but obtaining a momentary respite, and repudiated his act as soon as he found it safe to do so. It is equally patent that the barons who forced John to accept the charter were mere feudalists, careless of all but their personal wrongs and the grievances of their class, and quite unconscious that they were acting otherwise than their ancestors had always acted. Yet emphasizing the unworthiness of these men should not blind us to the significance of their work. However unconscious they were of their high mission, the Fitzwalters and the Vescys were in a very real sense the pioneers of English liberty. The opportune death of the tyrant, the withdrawal from England of the barons' dangerous ally, Louis of France, and the wisdom of the papal legate, Gualo, who accepted in the name of his ward, the infant Henry III., the charter which John had repudiated, insured the permanence of their principles. For nearly a century the great event of English history is the struggle for the charter. Under the long minority of Henry III. the ideas of limited monarchy and constitutional control, which were its essence, had time to assert themselves. When the young king attained manhood, his personal weakness made impossible any effective attempt on his part to carry on the government on autocratic Angevin lines. The aristocratic control of the administration was now secured, though it was long before that control was vigorous or effective. The chief danger to England was that the nobles in resuming their former power might also have fallen back on the old separatist ambitions of their feudal ancestors. Luckily the reaction toward feudalism was slight and easily suppressed. The baronage of Henry III.'s reign was a very different body from that of Norman times, and only a few isolated individuals still cherished the ancient feudal ambition of each nobleman ruling like a king over his own hereditary estate, and caring nothing for the manner in which the central government of the country was carried on. The barons of the 13th century accepted the unity of England, and accepted the central administration which the Norman and Angevin kings had built up. Their chief concern was to see that the government of the country was under their own control, and not regulated by the king's despotic caprice. Thus the unity of England remained, but the central government was henceforth an aristocracy rather than an autocracy. The barons claimed to be the hereditary counsellors of the Crown. Even a strong king was compelled to frame his policy to their liking, and to admit them into a sort of partnership with him. Under a weak king, like Henry III., the barons aspired to rule the realm as they would. Their moment of triumph came in 1258, when the Provisions of Oxford transferred the administration of the country from the monarch to a committee of 15 barons, without whose counsel and consent the king was not permitted to take any action. Thus the Angevin despotism developed into the constitutional monarchy of later times, though at this stage the only effective limiting force was the baronial aristocracy. Side by side with this constitutional development was the blossoming of every aspect of mediæval life, which made the 13th century one of the most brilliant periods of English annals. The age of Henry III. witnessed the consummation of Gothic architecture; the beginnings of the most spiritual aspects of mediæval Christendom in the orders of mendicant friars; the rise of a new intellectual life in the scholastic philosophy, and the organization of teachers and scholars, called universities. For a long time the political weakness of the reign of Henry III. checked the general progress of the nation, but with the revolt of the barons a new political development began.

The purely baronial conception of the English Parliament had hardly been formulated when its inadequacy became self-evident. Even in Norman and Angevin times the authority of the Crown had been largely based on the mute but hearty support which the average Englishman gave to the one power which could maintain order, and save him from the caprice of the local feudal tyrant. The machinery by which this popular backing of the royal authority had been effected still survived in the popular local courts, and the jury system of Henry II. had enlarged the representative principle by affording facilities for representative committees of the shire moots to treat directly with the king or his agents. Administrative convenience and financial necessity brought about during the first half of the 13th century a further extension of the idea of representation. It became not unusual for knights, representing the shires, and burgesses, chosen from the boroughs, to be gathered together in a single assembly to voice complaints, frame laws, testify to ancient customs, and make extraordinary grants of money. Such was the state of things when the narrowness and selfishness of the triumphant baronial oligarchy provoked a strong reaction among their own more enlightened supporters, and gave a unique chance to the broader-minded friends of the monarchy to rescue it from the impotence into which it had fallen. Simon of Montfort, Earl of Leicester, made himself the leader of the former; Edward, the king's son, the future Edward I., put himself at the head of the latter movement. The momentary triumph of Earl Simon over both his baronial colleagues and his royalist enemies was marked by the Parliament of 1265, which, if not the "first House of Commons," was at least the first occasion when the new machinery of representation was applied to the determination of grave political issues. The effect of Simon's work was that the lesser landholders and the citizens were called upon to enlarge the narrow circle which had hitherto alone aspired to control the crown. Though Simon perished within a few months on the field of Evesham, his enemy and supplanter, Edward I., carried on and completed the work. Edward was every inch a king, and loved power too well to abandon any of it willingly. But he dreaded the might of the greater barons and of the still independent Church; he appreciated the advantage of having the people on his side; and he was the first king after the conquest who was in a real sense an Englishman. Up to now the progress made in England had been on lines common to all Christendom. There is nothing specifically English in the Church, the friars, Gothic art, scholastic philosophy, the universities, feudal warfare, or even in the system of representative control of the Crown by the estates. At last under Edward I. a newer and more specially national note is sounded. Under this great king the constitutional system became perfected; the council of the nation became permanently strengthened with a popular and representative element; the baronial parliament was enlarged with the three estates of barons, clergy, and commons. Edward I. was even less of an innovator than Henry II., but old ideas took new shapes under his direction. The materials of the Constitution had been supplied during the creative period of the barons' wars. His work, as Stubbs has truly said, was a work of definition. Henceforward the main outlines of the Constitution were clearly marked out and defined. As far as outward forms went, they remained as Edward established them, until quite modern times.

The most permanent result of Edward I.'s work was the creation of the English parliamentary system. Edward's other ambitions were less completely realized. He aspired, with but little success, to maintain his position in Gascony and on the Continent against Philip the Fair, the greatest of the mediæval Kings of France. He aimed at playing a prominent part in Europe, and checking the ever-growing usurpations of the Church in the political sphere, and at establishing his authority over all the British Islands. In most of these directions he was not very successful, except that by the destruction of the state of Llewelyn of Wales he made the English monarch supreme over southern Britain. Even in his lifetime his attempt to absorb Scotland showed no great prospect of success. Under his unworthy son, Edward II., Robert Bruce's great triumph at Bannockburn (1314) secured the independence of Scotland and made permanent the division of the English race into two unequal halves. So far as concerned internal politics, the reign of Edward II. seemed marked by an equally strong reaction. The Lord Earl Ordainers and their leader, Thomas of Lancaster, take us back to the oligarchical atmosphere of the Provisions of Oxford. It was only after their fall that the Despensers identified the triumphant monarchy with the representative parliamentary system. The revolution of 1326, which cost Edward II. his throne and his life, perpetuated the constitutional authority of the estates. During the long reign of Edward III., the king's foreign preoccupations made it essential for him to keep on fair terms with his subjects. The subsidies and support, necessary to enable Edward III. to carry on the early stages of the Hundred Years' War with France, finally consolidated the constitutional fabric and ensured its permanence.

England had already become a nation under Edward I. During the reign of his grandson Edward III. the might of the English state was revealed to all Europe by the extraordinary military successes which laid low the ancient feudal fashion of fighting in famous battles such as those of Crecy and Poitiers. It was now that the English King first aspired to be lord of the seas, and that English mariners and wool merchants prepared the way for the industrial England that was ultimately to supersede the military state that now claimed a great place in the affairs of Europe. It was the age of Chaucer and Wycliffe, when the English tongue and English literature blossomed anew, and when the new nation became impatient of the narrow limits and strict restraints of the mediæval fashions of life and thought. It was in this age that the Church first provoked successful opposition, and first manifested signs of conscious weakness. The ravages of the Black Death, the direst of mediæval pestilences, undermined the old social order and prepared the way for all that ultimately differentiated the social and economic system of England from that of its continental neighbors. Chivalry, whose deeds were glorified in the pages of Froissart, was threatened with decay at the moment of its apparent triumph. The brilliant successes of the French war were succeeded by disastrous failures. In his embarrassed old age Edward III. saw the loss of his foreign conquests, and the undermining of his authority at home. During the troubled reign of his grandson, Richard II., the economic troubles of the period culminated in that Peasant Revolt of 1381 which, even in its failure, was to ring the knell of villeinage and the old social system. As Richard attained manhood, he ventured upon the most serious effort made by a later mediæval king to overthrow the constitutional system, and strove to make himself an autocrat like his ancestors and his contemporaries, the French kings. His boldness drove him from his throne to a prison where he soon met his fate. With the Revolution of 1399 England was brought back permanently to the constitutional path.

The Revolution of 1399 was a conservative reaction in at least two directions. It restored the old parliamentary Constitution and insured the loyal continuance of a limited monarchy by establishing on the throne with a parliamentary title that house of Lancaster, which since the days of Earl Thomas had almost continuously led the constitutional opposition to the sovereign. Under the Lancastinian kings the mediæval constitutional monarchy attained its height. Not only weak kings, like Henry IV. and Henry VI., were perforce true to their constitutional obligations. We see the same loyalty even in a strong monarch like Henry V., who was vigorous enough to renew Edward III.'s claim to the French throne and lucky enough to profit by French divisions and make himself ruler of the more important half of the French monarchy. Under Henry V. also the other characteristic feature of Lancastinian policy manifested itself most fully. This was the ecclesiastical reaction in favor of the strict orthodoxy with which the house of Lancaster was as much identified as with constitutional principles. If Edward III. and Richard II. had trifled with Wycliffe and his followers, Henry IV. and Henry V. were only content with extirpating Lollardy and all its works. Their policy was made easier by the socialistic and revolutionary extremes into which some of the Lollards had drifted. The early 15th century was not ripe for radical revolution in the Church, and the downfall of heresy was the more rapid and complete since Wycliffe's teaching had never really established itself in popular favor. For another hundred years the majestic unity of the mediæval Church was to be maintained. But even leading churchmen were half conscious that the Church's hold over men's minds was no longer what it had been. The life and freshness of mediæval Christianity were gone, even though the Church remained as rich, as proud, and as outwardly glorious as ever. In its weakness the Church clung for support to the State which in the great day of mediæval religion it had aspired to direct and control. A chief feature of 15th century life is the political ecclesiastic serving Church and State with equal fidelity, but discharging his duty to both masters in a thoroughly worldly spirit.

Lancastinian constitutionalism lasted little more than 60 years, though Lancastinian orthodoxy preserved England from religious revolution for nearly a century and a half. It was soon found that constitutional government under mediæval conditions meant weak government. Power went, not to the people at large, but to the great landholders. A turbulent aristocracy took advantage of the rule of a weak king to wage hereditary feuds against its rivals and reduce the land to a condition of chronic anarchy. Things grew worse when a revival of French nationality followed the wonderful deeds of Joan of Arc, and Henry was gradually deprived of the monarchy of France which had been conferred on him in his cradle with the good-will of many millions of Frenchmen. The bloodthirsty heroes of the French war transferred their fierce activity from France to their native land, and the permanent anarchy developed into a generation of intermittent civil war. This is the period of the so-called Wars of the Roses, which, beginning with the first battle of Saint Albans in 1455, went on with occasional breaks until the Battle of Bosworth in 1485. The nominal occasion for these wars was the legitimist claim of the house of York as the true heirs of Edward III., but the real cause of the triumph of York over Lancaster lay not in Edward IV.'s superior nearness in blood to the common ancestor, so much as in the fact that Edward IV. was a strong man who could give the English people the peace and order which were necessary to enable the ordinary citizen to till his farm or transact his daily business. The fall of Henry VI. involved the failure of mediæval constitutionalism, and the supersession of a lawless anarchy that adopted the name of liberty by the capable and autocratic rule of a vigorous monarch, who cared little for constitutional forms and everything for making his authority supreme. Family divisions within the Yorkist house and the last expiring efforts of the baronial party retarded the restoration of a strong monarchy after the death of Edward IV. and gave the house of Lancaster a chance of reasserting itself. Lancaster was now represented by the Welsh house of Tudor, which on the female side claimed a connection of doubtful legitimacy with the line of John of Gaunt. But Henry Tudor's triumph at Bosworth Field meant not the abandonment but the strengthening of the new system of strong monarchy which Edward IV. had first begun. The Tudor despotism continued the Yorkist tradition and made permanent the fall of mediæval constitutionalism. But the middle ages were now wearing themselves out. The Church and the baronage had in turn exhausted themselves, and even the disorder of the Wars of the Roses did not do much to check the growth of the middle classes, and the spread of a higher standard of national prosperity than more heroic earlier conditions had permitted. The Reformation and the Renaissance were at hand, and a new chapter in English history was about to open.

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5. **Great Britain — The Reformation.** There are three main factors in the Reformation. It represents, first, the conflict of the

growing spirit of nationality, symbolized by the State, with the mediæval idea of the unity of the civilized world, expressed especially in the Catholicism of the visible Church. Secondly, it embodies the revolt of a laity increasing in wealth, education, and intelligence, against the control and privileges of a priesthood declining in enthusiasm, conviction, and moral fervor; and, as such, it may also be described as the religious aspect of the political advent of the middle classes. Thirdly, it is an assertion of individuality against a collectivist control over thought, opinion, and curiosity. These three ingredients are found in varying proportions in different countries. The second element was obvious everywhere, though it was weak in such countries as Spain and Poland, where a commercial class was almost non-existent. In Germany, where national unity had been shattered in the struggle for Empire, and where particularism ran riot in the absence of national control, national feeling, after a momentary explosion in the Hundred *Gravamina* and a transient enthusiasm for Luther at the Diet of Worms, failed to concentrate in practical channels, and individual Protestantism held sway until it too became the state religion of territorial princes. In England all three elements were present, though individuality, or Protestantism, fought an unequal fight with the New Monarchy and toleration was beaten by an Established Church.

The spirit of nationality, of which the New Monarchy and the Established Church were the outward manifestations, had been stimulated by reaction against foreign influences in the 13th century, misdirected in the 14th toward the conquest of France, and dissipated in the 15th by civil broils. At length it found unity and direction under the Tudors, who frankly and firmly based their power upon new social forces. Feudalism, as represented by the great noble houses, was discredited and trampled under foot; political authority was taken from it and entrusted to lay or ecclesiastical ministers, who, like Wolsey, Cromwell, Cecil, Walsingham, were sprung from the upper or lower middle classes. Order at home and peace abroad were dictated by the interests of these commercial classes. Peace with money was Henry VII.'s ideal. Even Henry VIII. compressed the wars of a reign of 38 years into a few months, and insisted that they should not disturb trade relations with the Netherlands; and Elizabeth's wars were waged for piracy or self-defence. The age of chivalry was gone; wars, if waged at all, were waged with ledgers, not with lances. Men were made esquires and knights in the countinghouse and not on the field of battle.

For these struggles new kinds of brains were wanted, different from those which had designed mediæval castles or coats of arms. The day of the knight had passed away, and to him there succeeded the merchant, the manufacturer, the financial expert. These men were as yet unused to political responsibility; they needed training under the Tudors — and they got it. Under that dictatorship Parliament was moulded and developed as the instrument of government, and Parliament is the work of the Tudors to an extent which an age nurtured on Parliamentary legends is unwilling to admit. Parliamentary privileges first became real in the 16th century; freedom of speech, freedom from arrest, and control of taxation are conceded, not because monarchy is weak, but because it recognizes that the people are its source of strength. Parliament is the foundation, not the rival, of Tudor power. It is true that in the interests of expediency and efficiency many a time-honored maxim is strained or broken; benevolences are levied, though benevolences had been declared illegal; but that is because benevolences, in the words of a Tudor statesman, "do not grieve the common people." Morton's Fork and Dudley's Mills were instruments of extortion, but the operation was not painful to the poor. Dukes and cardinals passed suddenly and swiftly from the palace to the prison, but the man in the street did not pass his time in palaces and generally escaped the prison. The success of a dynasty, whose tyranny has been so loudly denounced, is, in the absence of the usual supports of despotism — a standing army or a vast bureaucracy — only to be explained on the supposition that, while the vocal classes were offended, the dumb masses were content.

It was the work of Henry VII. to base the Tudor throne upon the interests of the commercial classes. His son appealed to national feeling against a universal Papacy and to lay impatience of ecclesiastical control. But he did not appreciate either grievance until Pope and Church crossed his personal will. The first half of his reign was a brilliant and somewhat tawdry pageant, staged by Wolsey with the effect, if not with the object, of diverting the king's and the nation's mind from more serious matters. In it England played the part of arbiter of Europe with a success due to the wealth left by Henry VII., to Wolsey's diplomatic skill, and to the evenly balanced rivalry between Charles V. and Francis I. But the pageant came to an end; wars and subsidies to foreign princes exhausted Henry's wealth (1522); Parliament refused to become the paymaster of Europe (1523); the balance between Charles and Francis was destroyed at Pavia (1525), and Wolsey's influence abroad collapsed. A domestic question intruded into Henry's notice. Catherine of Aragon was now (1527) beyond child-bearing, and her only issue was the Princess Mary. No Queen regnant had ever sat on the English throne, and it was popularly thought that they were disqualified. Henry VIII. had no brothers, and no nephews except the alien Scottish King, whose title as an alien might be barred at common law. A recrudescence of the struggle for the crown was feared, and various claimants had already been suggested. The prospect was horrible to a generation begotten in the civil wars; and as early as 1514 it was rumored at Rome that Henry would get a divorce because of Catherine's failure to present him with an heir to the throne and of the estrangement between England and Spain. But matters mended in this last respect, and the Princess Mary arrived on the scene; she gave promise of brothers, and Henry was satisfied for the time. But brothers never came, and the idea of a divorce revived. There were precedents enough in Henry's family circle; both husbands of his sister Mary had been released from inconvenient matrimonial ties, and his sister Margaret was no less favored by the Papacy. Henry's need was quite as great as theirs, his merits in his own eyes greater. Anne Boleyn doubtless added zest to the suit, but Henry's anxiety for a wife and not a mistress was due to the state of the succession.

He met with unexpected obstacles. Pavia had made not only Francis but also Clement VII. practically the prisoner of Catherine of Aragon's nephew. Charles cared little for his aunt, but it was a matter of vital importance to him that a princess who was half a Spaniard should sit on the English throne and secure England for the Spanish instead of the French alliance. His control over Clement would make a divorce harder for Henry VIII. than it had been for Louis XII., Henry IV. of Castile, Margaret, Queen of Scotland, or the Duke of Suffolk.

For a time, indeed, success seemed possible and near. France recovered from Pavia and sent an army into Italy. Charles's star seemed on the wane: Cement was freed and Campeggio was sent to England in 1528 with a commission ample for Henry's requirements. But appearances were deceptive; the French hope failed; Campeggio was ordered to do nothing except pass the time till the fortune of war should decide the divorce. In 1529 Italy became imperialist and Clement with it; Campeggio was recalled, and the case revoked to Rome. As Wolsey said, this meant not merely his own fall but the ruin of the Church in England. He alone stood for 15 years between it and its enemies. The Parliament of 1514 had anticipated some of the demands of 1529–36. The unpopularity of the Church alarmed ecclesiastics at that time, and men knew well enough that the Crown had only to abandon the Church for the Church to fall. Doctrine had little to do with this antipathy at first. It was the privileges, the perquisites and the power of the Church which excited discontent; not its ritual or its dogma. The laity were Catholic and they did not object to persecution; but they did object to persecution by priests; they wanted lay control of the penal machine, and they envied the wealth of the Church. In spite of theological appearances it was a commercial and utilitarian age which saw no advantage in vast endowments for contemplative monks or for non-reproductive purposes, and in holy-days on which men were precluded from the pursuit of wealth. There was moreover the sentimental grievance against Papal power which was the tool of a national enemy, and the growing spirit of nationality caused everything foreign, and especially a foreign jurisdiction, to be regarded with suspicion.

The first thing Henry did in 1529 was to turn out his ecclesiastical ministers, and put laymen into their places. This restored harmony between Parliament and the government; and although there were occasions on which Henry VIII. came into conflict with the Reformation Parliament and had to give way, both were bent for different reasons on "reforming" the Church in the sense of reducing its power. The foundation of that power was the Papacy, an institution beyond the reach of national control. The Church in England could never be curbed so long as it drew support from an independent authority. Nor indeed could a reformation, in a more legitimate sense, be effected by any other means than the national state. General councils had failed; Popes had ceased to try; the acts of a national Church acting independently of the Papacy would be *ipso facto* void. Not a monastery could be dissolved without the Papal sanction; and Archbishop Warham said that he was merely commissary of the Pope, exercising as *legatus natus* a jurisdiction which he did not possess as primate. The national state was the only authority which could act independently of the Pope. The Reformation was therefore a revolution carried out by Acts of Parliament at the expense of the Church. By the successive acts of Annates, Appeals, and Supremacy the financial and jurisdictional rights of the Pope over the Church in England were transferred to the King; the Church was nationalized by the substitution of a national for a cosmopolitan head, and it became the Church *of* and not the Church *in* England.

Such a transformation was incompatible with the continued existence of the monastic orders. They were a negation of the national principle, being essentially international in government and in spirit. They had secured exemption from every sort of national control; and their immediate subjection to the Papacy caused them to be regarded as in a special sense the militia of the Pope. This was the ultimate cause of their dissolution, as opposed to their reform. The necessity for reform was admitted by a Papal commission in 1537, but Henry VIII. and Cromwell assumed the case for mending the monasteries to be a case for ending them. They were also useful as a gigantic bribe to induce the upper class laity to concur in Henry's measures and support them after his death; but this use of monastic endowments forbade their devotion to educational purposes, and from this point of view an unequalled opportunity in English history was sacrificed.

So far as doctrine was concerned, Henry VIII. made comparatively little change, though the denial of purgatory in 1536 cut deep at the root of the Catholic system and there were indications that the King was preparing for further changes in 1546–7. But the general impression was, as Hooper said, that the king had destroyed the Pope but not Popery; the doctrinal reformation was the work of Edward VI.'s ministers. Protector Somerset's changes were comparatively moderate and are represented by the first Act of Uniformity and the First Book of Common Prayer (1549). The latter especially was a compromise and its design was to open the door for the new learning without closing it upon the old. The definite breach with Catholicism came when Somerset had fallen as the result of his sympathies with the peasants in their protest against enclosures. Northumberland, who engineered the reaction against the Protector's liberal policy, played for the support of the extreme Protestants on whom alone he could rely in an attempt to exclude the Princess Mary from the throne. In 1552 by the Second Act of Uniformity and Second Book of Common Prayer the door was definitely shut on Catholicism; but so far as inspiration was sought from the continent and not from Wycliffe, that inspiration was Zwinglian and not Calvinistic. It was not till the Marian exiles returned from Geneva that Calvin began to exert an appreciable influence on the Church in England.

Northumberland's championship was enough to ruin any cause; and the identification of Protestantism with his harsh and violent rule involved it in a discredit from which it was only redeemed by the blood of the Marian martyrs. Queen Mary came to the throne as a representative of the Tudor tradition against a self-seeking revolutionist; even her Spanish marriage was based on the approved policy of alliance with the House of Burgundy, and in religious matters few dreamed at first of anything more than a return to the system of Henry VIII. Wyatt's ill-advised rebellion, the truculent spirit of Mary herself, the character and conduct of many of the Reformers were responsible for the persecution which reached its height in 1555–6. It involved a gross miscalculation. Englishmen of that day were not squeamish, but no generation in England had witnessed anything like the burnings of Queen Mary. They rehabilitated instead of discrediting the Reformation; and the subsequent popularity of Foxe's 'Book of Martyrs,' with all its exaggerations, is proof of the impress of the persecution on the national mind. It was deepened by the association of this violent policy at home with weakness and disaster abroad. Tudor prestige depended largely upon the figure they cut in Europe, and Mary's well authenticated remark about Calais illustrates her appreciation of the failure of her policy. Her fate was hardly less tragic, though more deserved than her mother's.

Elizabeth personified the revolt from Rome, but not a Protestant or a Catholic theology. She was purely a *politique*, and if she ostentatiously kissed the Bible in the streets on her way to coronation, she was careful to show the crucifix in her private chapel to her brother-in-law's ambassador; and the ambiguity of the Ornaments Rubric had its value in international politics. That the late persecutions would cease was certain, but all the rest was made as doubtful as might be to the prying eyes of the foreigner. It was, however, largely a diplomatic pose adopted by the Queen, partly to parry a real danger and partly because it was of the essence of her nature to shirk responsibility. The wonderful unanimity with which the bishops refused to countenance Elizabeth and her ecclesiastical settlement shows that they were under no misapprehension. That settlement was no mere return to the Anglo-Catholicism of Henry VIII.; it did not go so far as the second Prayer Book of Edward, but it went a good deal farther than the first. Nor was repudiation of Catholicism so novel or so dangerous a thing as in Henry's reign. By the Peace of Augsburg (1555) the Empire had resigned itself to the public licensing of heresy. Calvinism was planted in the heart of Europe; the revolt of Scotland from the Papacy withdrew a thorn from England's side, and civil war in France placed another Catholic country *hors de combat*. Spain alone could think of a Catholic Crusade, and Philip II. soon had enough to do with heretics and rebels in his own dominions. Elizabeth had more to fear from plots than from invasion, and her main task was to keep her subjects in a state of tolerable suspense until the financial and military weakness of the realm had been repaired. State and Church had become so closely interwoven that national unity was thought to require some sort of ecclesiastical uniformity. But it was to be one of externals principally; men must go to Church on Sundays, but Elizabeth boasted that she made no windows into men's souls. It was, however, impossible to avoid religious persecution when one religion involved a royal, and another a papal supremacy over both Church and State; and religious persecution went on in England until the Church practically abandoned politics and the State theology.

The plots against Elizabeth were, however, almost as much political as religious. The Bull of Deposition (1570) was a convenient screen; but even Philip II. did not launch his Armada until Mary Stuart had left him her claims to the English throne and Drake had goaded him into fury by attacks on Spanish trade. The northern Earls who rebelled in 1569 were fighting the fight of expiring feudalism as much as of the Counter-Reformation; nor is it easy to believe that the Catholic religion was the sole concern of the Queen who married the Protestant Bothwell according to Protestant rites. The political chessboard was divided into national and religious squares, and the moves were often complex; for while the bishops were supposed to keep to their own color, the rival Queens and their knights might move on either. From the dynastic point of view Elizabeth was handicapped. Precluded from matrimony by a physical defect, she had to leave the succession to look after itself, and makeshift with suitors. She prolonged this game almost beyond the limits of public decency; but it was done with inimitable skill and gave England an invaluable breathing space of 30 years. At length the success of Parma in consolidating his power in the Southern Netherlands (1580–84) and the stroke of fortune which gave Philip the crown of Portugal with its colonial empire, its harbors and its navy (1580) induced him to make a bid for the title of which the death of Mary Tudor had deprived him, and the death of Mary Stuart had left him heir. It was a forlorn hope from the first. Philip's failure in the Netherlands might have warned him of the odds against him under circumstances far less favorable. There is no reason to suppose that Philip would have been successful even if the Armada had disgorged its hosts on English shores. Drake and his colleagues saved England not from conquest but from a bloody and perhaps a long drawn struggle fought on English soil.

With the defeat of the Armada the work of the Tudors was done. Their dictatorship was the result of an emergency at first domestic and then foreign. So long as the danger lasted of internal disruption or external attack, Englishmen acquiesced in the despotic maxims of *droit administratif* and Roman civil law. The people supported arbitrary government to avoid a greater ill; but with the danger there passed the need and the inclination to subordinate self-government to national security. Elizabeth lingered a few more years on the stage, but she was losing touch with her people. Her waywardness, as Parliament told James I., was only tolerated because of her age and her sex, and the Commons were girding themselves for their hundred years' war with the Crown.

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6. **Great Britain—English History of the 17th Century.** The intensely dramatic nature of the events of the political life of England in the 17th century has led every English and American historian to attribute to the period an exaggerated importance. The generally accepted view held by these historians is that the Stuarts attempted to perpetuate or to live up to the pure type of Tudor despotism, and that partly because of their want of personal popularity, and partly because of the silent growth of national self-consciousness, the attempt was a failure; and that as a consequence the century witnessed the definitive overthrow of the Tudor system of paternal despotism — an overthrow in which the chief operating factor was the Great Rebellion.

Such a view involves a serious misconception of the real nature of the problem which the century had to solve and at the same time a still more serious misconception of the actual constitutional advance which that century achieved.

The real problem which the century had to solve was not the setting up of one ideal of State or government upon the ruins of another ideal. History does not concern itself with ideals. It concerns itself with men and things — men who are flesh and blood and intensely practical, and things which are more sternly practical still — such things as, when they mount the saddle, ride mankind. The real problem of the century was how to bridge over the gulf between the executive and the legislative.

Under Elizabeth the central power from which the whole executive machinery radiated was the Privy Council. That body was simply a small permanent Council of Government or Council of State. With the sovereign at its head, it was the government. The whole executive administration of the country rested upon it. Without dividing itself up into committees at all, but simply sitting together as a single and permanent body, this Council decided each and every question of administration, whether relating to the land forces, the calling out of the militia, their equipment, and the whole plan of any military operations, or to the naval forces, including the arranging of transport, the making of contracts with the victualler, and the stragetical distribution of men and ships, or again to diplomacy, including every species of confidential letters and instructions to ambassadors and agents abroad, or again to finance, including especially a most strict control of issues out of the exchequer, or finally to every branch of internal administration and law, the main channel of communication in this last instance being the justices of the peace in the counties.

Where does the Parliament, England's glory, come in in such an enumeration? The answer is simple. It finds no place whatever in it. And if Elizabeth, to take her for the moment as the type, had been able to live off her own, as the kings of England were then supposed to do, never a word would have been heard of a Parliament. So long as it could pay its way the executive was efficient and sufficient without the Parliament. During the 44 years that Elizabeth reigned she called 13 Parliaments at irregular periods but with an average interval between each of more than three years. These Parliaments sat as a rule about two months. The total aggregate period of session of the whole 13 Parliaments was less than 34 months. So that out of the whole 44 years of her reign the Privy Council or executive had uncontrolled management of the nation for nearly 42 years. Nor would it be correct to say that during the remaining two and a half years the executive was confronted by the Parliament. That body was called simply for the purpose of supplying the government with money. Having dutifully voted its tenths and fifteenths it was allowed to legislate on non-contentious matters and was then dissolved. In the whole of the statutes of Elizabeth's reign there is not one of any constitutional importance. More than this, not the slightest attempt was ever made by the legislative to extort from the executive an account of the expenditure of the money thus granted by the Parliament. Once the subsidies were voted there was an end of the matter as far as the two Houses were concerned.

After James I. came to the throne this docile attitude of the Parliament to the executive gradually changed. The important point about this change of attitude is not the cause which brought it about, but the form it took, the way in which it expressed itself. That expression is focussed for us in the terms of the Great Contract, the failure of which led to the dissolution of James's first Parliament in 1610. In this bargain of the Great Contract James's position was comparatively simple. In the first year of his reign the Parliament had granted him for life the subsidy of tonnage and poundage. That grant practically put him in the same position financially which Elizabeth had been in throughout her reign. His revenue (from Crown Lands, royalties, casualties, and customs) was his own. He was expected to live on it, and by that phrase was meant that out of his own he should provide for the whole government of the country — regal, legal, civil, military, and naval. If debts arose or extraordinary occasions demanded, he would have to ask for extra grants of tenths and fifteenths just as Elizabeth had been obliged to do. These extra grants Parliament never refused to the Virgin Queen; nor did James's first Parliament refuse them to him. But James tried for something more than this. He tried to get an increase of "his own," of his life revenue, that standing, permanent, ordinary revenue out of which he had to defray the ordinary expenditure of the State. Nor was the Parliament indisposed to meet him. It accepted the general principle of his demand, and agreed tentatively to increase his life revenue by £100,000 a year on certain conditions. These conditions embodied the Parliament's demands on the subject of their grievances, the Impositions, such oppressive royalties as purveyance, and certain ecclesiastical complaints.

Stretch or construe these points as we will we shall not find in them anything in the nature of a challenge from the legislative to the executive. All the points which the Commons demanded were to be conceded by the Crown as a matter of bargain. They were to be voluntary sacrifices of prerogative on the part of the king in return for so much cash. When carried out, the executive was still as before to occupy the whole governmental field alone. No part whatever of that field was it for a moment in the Parliament's mind to itself occupy or usurp. It never dreamed of demanding some control over the executive, or even the slightest share in it, either by requesting to be consulted in affairs of State, or by claiming the appointment of any of the king's ministers. The executive was the king's, the ministers were the king's, his completely and his alone, and Parliament never once thought of challenging such a flower of the prerogative. Had the Great Contract gone through the only difference would have been that for the future the king's executive would have agreed to avoid certain acts or to cease the exercise of certain rights of prerogative which had been felt as a grievance. For the rest the executive would have been stronger, not weaker, by the compact, for it would have been better able to pay its way, and so to avoid frequent appeals to the Commons.

Equally noticeable with the subject-matter of the Great Contract was its form. The negotiation was carried on as if it were a treaty between two foreign and totally unrelated powers. The want of connection between the two parties to it could not have been more complete if the king had belonged to one country and the Parliament to another. And between these two parties, the executive and the legislative, the Crown and the Parliament, there was not even a regular and recognized channel of communication. Practically the only means of intercourse was a direct message or speech from the king on the one hand or a petition from the Commons on the other. For the rest all was haphazard. Such members of the executive as sat in the House acted individually each as he thought fit, or as he was bidden, in promoting the king's business. On its side the Court party or the executive had no more thought of creating and working some piece of machinery by which the king's business could be piloted smoothly through the House than the House had on its side of ever challenging a share in the executive. There was a gulf between the two which neither side dreamed of permanently bridging over. On neither side did the slightest conception exist of a Constitution in which the executive and the legislative should be linked together.

It was the problem of the 17th century first of all to perceive the necessity of such a link, and then to invent the mechanism. If this statement is a correct diagnosis of the true bearing of English 17th century history, then the constitutional importance which has hitherto been attributed to that history will be found to be exaggerated. For the simple fact remains that the clear perception of the need was only attained at the close of that century, and the mechanism itself was only gradually elaborated in the 18th century.

Fortunately or unfortunately the Great Contract broke down, and from that moment commenced that antagonism between Crown and Parliament which was destined to produce the Great Rebellion. The steps by which that antagonism developed itself until it blazed out in open war need not be detailed here. They are the commonplaces of history. The point to notice is that the moment the antagonism emerged the opposition of Parliament to executive, or of nation to Crown became not so much constitutional as political. What is the distinction between these two terms? The difference is fundamental, for whilst the one is a matter of principle and abiding, the other is a thing of time and place, and may be transitory. Had the nation said to James through Parliament as its mouthpiece, "You represent and wish to perpetuate the Tudor type of government by prerogative; we have outgrown that and claim for ourselves a share in the government," such an attitude would have been constitutional. But nothing of the kind was either said or thought of. The opposition which developed itself was conditioned in its form by the mere force of circumstance. When, after ten years of rule without a Parliament, James in 1621 summoned his third Parliament, there were reasonable prospects of a complete agreement. The House, glowing with Protestant fervor, made not the slightest reference to the old burning question of impositions. It sat down at once to consider supply for the support of a war in defense of the Palatinate. For the first fortnight of the session James could have done anything he pleased with the Commons. Ten months later, in December 1621, after with his own hands tearing out of the journals the Protestation of the Commons, the king dissolved the Parliament in anger and sent three of its members to prison. How could so complete a change have happened? The answer is simple. The Constitution provided no mechanism by which James could explain to the Parliament his foreign policy. He could not, nor would he if he could, take the whole House into his confidence, and he never thought, any more than did the House itself, of such a device as that of taking a select few of the leaders of the Commons into his counsels. Nothing is more remarkable in this Parliament than the scrupulous regard which the House paid to the king's prerogative in the matter of foreign affairs. It was for the king, and the king alone, to make treaties and to decide peace or war, nor could they press him to disclose his policy. Had the Commons felt as certain of the patriotic and Protestant trend of James's foreign policy as the Parliament of Elizabeth's days had been of her foreign policy, not a word of criticism or contention would have been heard. But they were not so certain, and as a consequence felt that they were being called upon to vote supply for a policy which might even be the very opposite of that which the nation yearned for. Then a side issue arose. In his impatience at the slightest doubt being cast upon his foreign policy James was led to assert his view of the prerogative in so dogmatic a way as practically to deny free speech to the House. To this the House of Commons replied by the Protestation, in which they claimed practically nothing but the parliamentary privilege of freedom of speech, just as it had claimed it in Elizabeth's day. This, and this alone, was the cause of the breach.

Will any one contend that there is anything of constitutional principle in this? If the Parliament had said "We demand to know what your foreign policy is, and that it is in accordance with our views before we vote supply" there would have been constitutional principle involved. But over and over again the Commons disclaimed any such idea. If James was antiquated in his devotion to the Tudor ideal of prerogative the Parliament was just as antiquated as he in their devotion to it, for they distinctly admitted his view, and when they joined issue with him it was on the minor point and on the lower plane of parliamentary privilege.

A remarkable change, however, though transitory as it proved, came over the scene as James's reign came to a close. For some unexplained reason his powers decayed whilst he was still young, for he died at the early age of 57. Whether it was due to this premature decay, or to his own intense chagrin at the failure of his long negotiation with Spain, we cannot say. But certain it is that for the last two years of his reign he was a mere tool in the hands of Buckingham. Had it not been for this senility it is certain that the astounding constitutional departure which marked the career of his last Parliament would never have been enacted. James met that Parliament with the practical confession that his foreign policy had been a failure, and he invited their co-operation in the evolving of a policy to take its place. He informed the Houses that his secretaries would tell them the whole story of the marriage treaty with Spain. After they had heard the story, he continued "I shall entreat your good and sound advice. . . . I assure you you may freely advise me, seeing of my princely fidelity you are invited thereto."

The marvellous thing about this sudden and revolutionary surrender of prerogative by James is that it sprang from the dictates of Buckingham. But more extraordinary still was the sequel. Following the dictates of the imperious favorite as tamely as a sheep, James, after receiving the advice of both Houses, informed them that if they made him a grant for a war they might appoint their own treasurers to see to the spending of the money, and further "I promise you on the word of a king that although war and peace be the peculiar prerogative of kings, yet as I have advised with you in the treaties on which war may ensue, so I will not treat nor accept of a peace without first acquainting you with it and having your advice." (8 March 1623–24.)

Accordingly when twelve days later the Commons voted three subsidies and three fifteenths the money was ordered to be paid to treasurers appointed by Parliament and not into the Exchequer: and at the same time the Houses in an address to the king plainly laid down the object for which the money was voted.

In the whole course of 17th century history, including the civil war and regicide, there is no more revolutionary incident than this complete, sudden, uninvited surrender of prerogative on the part of James. Had it happened as the result of deliberate thought, and whilst James was still in his prime, it would have shortened by more than a century the birth throes of modern constitutionalism, and have saved the Stuarts from exile.

But it did not so happen. It was a momentary inspiration of Buckingham's, the genesis of which is to be explained by the favorite's own personal position and policy at the time, and it was by him forced upon the feeble king with an impetuosity that swept everything before it. But as with all Buckingham's inspirations, it was no more than a flash and almost as soon over. After the old king's death the versatile but unstable minister made one or two disingenuous efforts to revert to such relations with the Commons. Though the mouth of his creature, Sir John Coke, he submitted to Parliament in July 1625 a rough statement of the expenditure of the subsidies granted in 1624 and again in the following month of August 1625, when the Parliament was sitting at Oxford because of the plague, the lord treasurer made a similar statement. But further than this the concession was not carried. From the position which James had adopted in 1624 Charles gradually receded, not so much from deliberate design as from the mere force of circumstance and from a growing perception of the revolutionary consequences which that position entailed. The desire on the part of the Commons to inquire into the expenditure of the subsidies led them to utter their opinions on the merits of Charles's foreign policy, and in particular to call into question the advice given to the king by the Council of War as to that expenditure. The moment this was clear to Charles any further surrender of prerogative was impossible. Backed by the king the members of the Council of War refused to reply to the interrogatories of the Commons. Their resistance proved successful. Before the determined attitude which Charles thus took up the House quietly receded and dropped any further attempt at pressing the interrogatories. (March 1626.)

With this incident practically ended the whole two years' episode of attempting to take the Parliament into partnership with the executive by means of a voluntary and undefined surrender of prerogative. Had the king allowed the members of the Council of War to answer the interrogatories of the House the principle of ministerial responsibility (that is, the responsibility of the executive to the Parliament, and not to the king alone) would have stood forth in abrupt nakedness. When Charles resisted that demand the emergence of such a principle was postponed for a century. For be it borne in mind, the impeachment of Buckingham, and the later proceedings against Strafford, Clarendon, and Danby never advanced the enunciation of that principle a jot. The mere punishment of a minister great or small does not imply ministerial responsibility in our sense of the phrase. All through the 17th century the ministers were the king's servants and were responsible to him, their master, alone. After the exile of Clarendon the Commons did not demand to be consulted as to the choice of his successor, or as to the policy of his successor. Charles had simply sacrificed one of his servants. That was all. Then he engaged another servant to do exactly the same things, and went on as gay and unconcerned as before.

But had the episode of 1624–26 ended differently the acceptance of the principle of the responsibility of ministers to Parliament as well as to Crown would have led inevitably to the forging of some such link between the executive and the legislative as only came generations later. From the moment such a link had been forged questions of adequate supply for the services and of a proper audit, and again questions of the personal liberty of the subject, of habeas corpus, and what not, would have solved themselves harmoniously. For the participation of the Parliament in the executive would have insensibly tinged the spirit of the whole administration of the country. As compared with the evolution of such a principle the Petition of Right, habeas corpus, nay, even the Revolution itself, are minor incidents.

Such I take to be the true constitutional bearing of 17th century history.

The remainder of the reign of Charles I. when he ruled without a Parliament, the outbreak of the Civil War, and the consequent military despotism of Cromwell are devoid of constitutional significance. The rule of Oliver Cromwell was a despotism as pure as that of the Tudors, the only difference being that the prerogative of the Crown, which had formed the ultimate sanction of the executive government of James I. and Charles I. was replaced by the naked power of the sword. The quarrels between Oliver and his Parliaments were in substance and essence the same which had been fought between Charles and his Parliaments. They one and all turned upon the question as to whether and how far the Parliament, the legislative, should thrust itself into the domain of the executive, notably, of course, but not solely, in the matter of the command of the forces. To any such demand Oliver's reply was a much more peremptory, indignant, instantaneous *non possumus* than ever James or Charles could have uttered. And when the sword fell from his dying grasp and the succeeding anarchy swept away the chances alike of his dynasty and of pure republicanism, the Great Rebellion had become a mere tale that is told. When Charles II. returned at the Restoration in 1660 the Stuart dynasty reassumed the inheritance of an undiminished prerogative, one that is in no whit distinguishable from the prerogative wielded by Elizabeth, James I., or Charles I. He was granted a revenue for life which might, had it been fully realized and carefully husbanded, have made him independent of the Parliament. He was left in uncontrolled possession of the executive. His ministers were his own, nominated by him and responsible alone to him. His revenue was his own, to spend as he pleased, without the slightest restriction in the way of appropriation. His foreign policy was his own, he could make war or peace or treaty unquestioned, and as he chose. Had it not been for the outbreak of the Dutch War it is probable that his reign would have witnessed no parliamentary incursion upon his prerogative. As it was, when under the strain of the shame caused by the first Dutch War the Parliament did actually make an incursion into the domain of the executive, the novel departure took exactly the same form which it had taken in 1624 under James I. No more speaking comment than this could be passed upon the fruitlessness and futility of the intervening period of civil war, regicide and revolution.

The full story of the episode in question is too long to be given here. It has been treated fully in the introduction of the second volume of the 'Calendar of Treasury Books.' In brief, what happened was this: With the full consent of the executive (Charles himself) the Parliament in voting supply for the Dutch War appropriated that supply specifically to that war. The necessary corollary was that a few months afterward the Commons were driven to demand an account of the expenditure of that supply. Had the war been successful there would have been no boggling over such an account. But the war had not been successful. It had brought with it disaster and humiliation, and men's minds were correspondingly inflamed. But even so, the action of the Commons was astonishingly mild. Although the inquiry might have led the Commons to cover the whole field of administration and to question the whole conduct of the executive during the war, the Parliament practically in the end restricted its attention to the question of the auditing of the accounts. Charles at first resisted the proposal as a breach on his prerogative; but in the finish, with his usual subtle adroitness, he gave way.

The immediate outcome of the inquiry was in great measure the exoneration of the executive from the suspicion of financial dishonesty. But the immediate result is insignificant by the side of the ultimate results. On the one hand it furnished a now unchallengable precedent for appropriation of supply and for audit of accounts; and once the right of auditing accounts should be fully conceded, the further right of questioning the conduct and policy of the executive was bound to follow. Once that consequence was fully established the gulf which sundered the (king's) executive from the (people's) Parliament was narrowing and a bridge was being built over it. The Parliament was coming to identify its interests with those of the executive instead of maintaining an attitude of permanent aloofness or even hostility. Of the two parties to this conversion the Parliament itself was slower of comprehension and more unwilling of movement than the Crown. For to identify itself with the administration was to forfeit all the vantage ground of complaint and agitation on which it had stood in the past. Accordingly the change did not actually accomplish itself in Charles II.'s time. For the rest of his reign the parliamentary opposition was swayed by motives which were merely and purely factious. But as the century drew to a close the gulf was in great measure bridged over, and in the course of the 18th century the new structure was perfected. The executive ceased to be the personal property, appanage, officialdom of the king. It became identified with the parliamentary system through the device of parliamentary departmental heads; and the practice of annual estimates took the responsibility for the financial administration of the country from the shoulders of the king, and laid it upon the broader shoulders of the Parliament. From that moment the development of English constitutional and political life has been smooth and harmonious.

But these ultimate results lay unfolded in the bosom of the future. To Charles II. the Commission of Accounts taught another and quite different lesson. It taught him the art of parliamentary management, not merely how to buy off the opposition, but also how to organize his own friends in the House. Danby's corrupt leadership of the Parliament, and the various devices employed to influence the constituencies on the one hand, and Sir William Temple's scheme of a reorganization of the Privy Council on the other, are but manifestations of this side of Charles's statecraft. Thanks to this statecraft of parliamentary management, Charles remained easily master of the situation for the rest of his reign, and when he died he left to his brother a prerogative as unimpaired as that which James I. had wielded — complete control of the executive at home, complete control of the forces, complete control of the foreign policy of the nation.

From the point of view which has been thus expounded, what was the historical significance of the Revolution of 1688? In a sentence it lies not so much in the direct challenging of prerogative as in the quiet, undefined, unobserved usurpation of it by the Parliament. In the first place the Parliament voted a standing revenue of £1,200,000 for the support of the Crown in the time of peace. This was exactly the sum which the Restoration Parliament had granted Charles II. in 1660. But whereas in 1660 that sum was meant to cover the complete national expenditure, civil and military alike, the details and management of which were left absolutely unchallenged in Charles's hands, the vote in 1689 was intended only for the civil establishment in time of peace. Immediately after this vote the Parliament proceeded to consider the question of separate supply for the army, navy, and ordnance, and in order thereto detailed estimates of the charge of the army and navy were laid before the House.

Herein lies the Great Revolution — not in the clauses of the Bill of Rights. For the moment the Parliament realized that the provision for and regulation of the army and navy was its province it had assumed to itself half the domain of that kingly prerogative which had endured through Tudor and Stuart times. It had stepped over the gulf which had hitherto divided the domain of the executive from that of the legislative. Once this first step had been taken, there remained only the problem of evolving the machinery by which the participation of the Parliament in the executive should be expressed and regulated. The course of the evolution of that machinery — the selection by the Crown of its advisers and administrative departmental heads from the chiefs of the parties in the Parliament — was determined by the mere force of circumstance, that is, by the situation in which William III., and again, a generation later, George I., each found himself as the imported ruler of a strange country. The gradual development of the party system of government afforded the key to the solution of the problem of which the 17th century had been so long in labor. For when once the obvious step had been taken of selecting the party chiefs as the heads of the various executive departments, the development of the system of Cabinet government was bound to follow sooner or later. But even so, generations had still to elapse before this new parliamentary executive fully grasped the control of that last and most highly prized flower of the kingly prerogative, the direction of the foreign policy of the country.

So far as these results depended upon the mere accidents of the Revolution of 1688 and of the Hanoverian Succession they may be regarded as, in a sense, fortuitous. If it is true that England has blundered into an empire, much more true is it that she has blundered into a Constitution.

If the ordinarily accepted view of the constitutional importance of our 17th century history is wide of the mark and distorted, much more truly may this be said of the ordinary view as to the religious history of that period.

The chief outstanding features of that religious history are, firstly, the absolutely unreasoning fear of a Catholic reaction, and, secondly, the temporary exaltation of Puritanism.

The two are by no means synonymous. For whereas the jealous fear of Catholicism was national, pervading the country blindly from end to end, the triumphant emergence of Puritanism was local, partial, temporary. But if the two are not synonymous they have been alike in their fate. With the inscrutable irony of her passionless lips the Muse of History has consigned them both to the region of human futilities. The further we are drifted from the 17th century by the stream of time the more difficult does it become to us to realize the standpoint of that century on the question of the Catholic reaction. We can see now that whatever form that attempted reaction took, whether it be of the theological discussions which waged in the presence of James I. as the divines flocked round his chair, or of Laud's unattainable conception of an unifying Catholicity, or again of Charles II.'s cynical but more statesmanlike conception of Indulgence, or finally of James II.'s grossly bigoted intrigue, in one and all of these or any other forms the movement was doomed to failure before its birth. The panic, the absolutely unreasoning fear, the blinded and relentless fury which seized the nation again and again throughout the period and which not only accounted largely for the rebellion of 1642 and the revolution of 1688, but also left their malignant trail on two centuries of our later history, fill us to-day with only a sense of disdainful surprise.

As for Puritanism, the second religious phenomenon of the century, the judgment of our own day has been more sympathetic, partly because it has been the fashion since Carlyle's day to speak of it in terms of respect, and partly because the movement has not yet lost its force in English and American life. But be it borne in mind, in the 17th century Puritanism in its day of power did not show itself a constructive force either in the domain of dogma or in the domain of ecclesiasticism. The dogmatic wrangles of the Westminster Assembly — the discussions as to the method of the imputation of Christ's righteousness and what not else — are utterly meaningless to us. And when Puritanism was called upon to solve the problem of the erection of a national church it completely failed. In the mere interests of human tolerance Cromwell, himself a Puritan of the Puritans, was forced to take the problem out of the hands of his co-religionists and thereby to dash to the ground their half-finished and futile structure. And will anyone contend that either in its persecuted birth or in its day of exaltation, when for a brief span it wielded the wooden sword, or again in its day of adversity when at the Restoration 2,000 of its ministers left the national church to wander in the byways of Separatist Dissent, that in any one of these its forms Puritanism was ever a missionary movement or a missionary church in the sense in which 18th century Methodism was a missionary movement? Such contention could not be maintained. The basis of Puritanism was dogmatic and clerical throughout; the fervor of humanity never breathed into it a spark of missionary fire. Its zeal was spent in the dogmatic defense of forms of church government, in the safe-guarding of the church membership of each little community. To the nobler issues of life, to the higher conception of toleration, of humanity, of national religion it was, and throughout the succeeding century it remained, cold and dead.

Bibliography.— The original authorities for 17th century English history consist of:

1. Parliamentary records: the 'Lords Journal' and 'Commons Journals' which are in print; and much material still in manuscript at the House of Lords, but which is being gradually printed by the Historical Manuscript Commission. The only full edition of the Acts of Parliament is the 'Statutes of the Realm,' but this collection does not contain the Commonwealth Acts and Ordinances. These latter can only be obtained from the collections of Husband and Scobell, and from the separately printed ordinances.

2. The archives in the Public Record Office: comprising mainly (a) Domestic State Papers calendared up to 1675 and from 1689–93. (b) Foreign State Papers, not calendared at all for the 17th century. (c) Colonial papers, only partially calendared. (d) Certain departmental archives, and Commonwealth Committee archives, only partially calendared as yet. Of the departmental archives the Treasury Records are the only ones at present being calendared; similarly the printing of the 'Register of the Privy Council' has not yet reached the 17th century.

3. Archives not preserved at the Public Record Office, viz.: (a) Collections of manuscripts and individual manuscripts at the British Museum, at the Bodleian (including the Clarendon manuscripts, Carte manuscripts, and Tanner manuscripts), and at Lambeth (including the Commonwealth Church Manuscripts). So far as these sources have been worked at all it has only been by individual effort or by societies such as the Camden. Of the manuscripts printed by the Camden Society, the 'Clarke Papers,' 'Nicholas Papers,' and 'Lauderdale Papers' may be particularly instanced. (b) The archives in the possession of private families are being systematically printed by the Historical Manuscripts Commission. So many of the reports bear on the 17th century that it is almost impossible to particularize, but the 'Buccleuch manuscripts,' 'Portland manuscripts,' 'Ormonde manuscripts,' 'Cowper manuscripts,' 'Rutland manuscripts,' 'Fleming manuscripts,' 'Stuart manuscripts,' and 'Kenyon manuscripts' may be specially instanced.

4. Printed collections of state papers, viz.: Winwood, Sydney, Roe, Wentworth, Rushworth, Nalson, Thurloe, Milton, Clarendon, Orrery, Macpherson, Hardwicke, Rochester, Carstairs, Kemble, and Stuart Papers.

5. Diaries, memoirs, etc., other than those published by the Camden Society and other societies, viz.: Whitlock, Burton, Ludlow, Holles, Fairfax, Hutchinson, Price, Herbert, Reresby, Warwick, Berkley, Evelyn, Pepys, Anchitell Grey, Luttrell, Ellis Letters.

6. Constructive synoptic works: Rapin, and Tindal, Baker, Clarendon's 'History' and 'Life,' Carte's 'Ormond,' Kennett's 'Register' and 'History,' Burnet's 'Own Time,' Andrew Marvell's works, Sir William Temple's works, Boyer, Ralph and Dalrymple.

7. Of tract literature the mass is so great

that the portions which have been printed in the 'Cabala,' 'Harleian Miscellany,' 'Somers' Tracts,' 'State Tracts of Charles II.', and 'State Tracts of William III.', are an inconsiderable fragment of the whole.

8. Of modern constructive historical work the only English one worthy of the name is S. R. Gardner's great work covering the years 1603–54. Carlyle's 'Cromwell' is a constructive work of distorted view; Macauley's history for the later part of the century represents a type of historical writing which is deservedly falling into disrepute among professional historians. Ranke's 'History of England,' and Doctor Ono Klopp's work on the fall of the House of Stuart are scientific and exhaustive. For Church History, Shaw's 'History of the Commonwealth Church' is a specialized work covering only the years 1640–60. The various denominations of the Dissenting Churches, as also the Quakers have an abundant historical literature of their own, but, generally speaking, neither the religious history of the century as a whole, nor the intensely important and interesting economic history of the century have as yet received adequate specialized attention, though Doctor Cunningham has covered many aspects and much of the ground of the latter section in his 'Growth of English History and Commerce.'

William A. Shaw,
Author of 'The History of the Church Under the Commonwealth;' 'The Knights of England,' Editor of the 'Calendar of Treasury Records' at H. M. Record Office, etc.

7. (a). **Great Britain — Eighteenth Century.** *Historical Sketch.*—The 17th century had settled two very important questions. It had been finally decided in 1689 that the government was to be carried on in accordance with the will of the House of Commons and that there should be freedom for both religious and political opinion outside Parliament. The questions of taxation without consent of Parliament and of the state control of religion, which had convulsed the 17th century, were no longer all-absorbing, and the 18th century found an outlet for its energies in new directions. It is therefore the century of great economic advance, of commercial wars, of the expansion of trade, of the growth of colonies, culminating toward the end in the transformation of the whole rural and industrial life of the country.

The leading features of the period from 1702 to 1815 are those connected with the rule of the great Whig aristocracy in Parliament, the expansion of England abroad in spite of the opposition of France, the consolidation of the Britannic state at home and the change of the whole character of the country by the coming of machinery. See Great Britain — Industrial Revolution.

The great constitutional fact of the 18th century is that the era of the responsibility of the monarch for the welfare of the nation had passed away for ever. William III. had been called to the throne by Parliament and it was on Parliament that he depended for his support. In 1702 the Crown was vested by an Act of Parliament in the Electress Sophia of Hanover and her Protestant descendants, and the first two Georges happened to be men who were thoroughly German and so left English affairs to the English Parliament. Hence the predominance of the House of Commons became firmly established. It was found convenient that a group of ministers should form a committee to carry on the affairs of the nation. Gradually it became the rule for them to be chosen from the party which had the majority in the House of Commons and to vote under the leadership of one man. The delegation of monarchy to the Prime Minister and the Cabinet was accomplished by the end of the 18th Century. See Great Britain — Crown and Cabinet.

The Revolution of 1689 had split the country into two great parties — the Whigs and the Tories. The Whigs, who were the active commercial party, were in favor of a Protestant succession and toleration in matters of religion. As they believed in a Parliamentary King as opposed to a King by Divine Right they were bound to reduce the power of the monarchy but to support the existing line which they themselves had chosen. The Tories had to choose in 1689 between their religion and their King. If they supported the King they would destroy the Established Church and set up the Roman Catholic Church. Hence they decided against the King and joined the Whigs to get rid of the Stuarts. Then they repented, especially when they found that the Whigs obtained all the emoluments of office, and to restore themselves to power they looked to France and the descendants of James II. who had French support. Meanwhile they were quite willing to join the Whigs in depriving the Hanoverians of as much power as possible and so we see both parties disposed to lessen the power of the Crown. It was not until the reign of George III. that the Tories became reconciled to and supported the King *de facto*. The Whigs were the great war party because they were anti-French; the Tories were the peace party since in France lay their hopes of getting back their own King.

In the reigns of William III. and Anne the monarch was still able to hold the balance between the two parties. Under the first two Georges the Crown could only exercise its power by means of great Ministers, notably Sir Robert Walpole. George III. determined to throw off the yoke of Parliament and was successful in bringing in the Tories under Lord North in 1770, but even so popular and determined a King as George III. found it impossible to carry on the Government except through Pitt. The power of the Crown was still further weakened during the period of mental incapacity of the monarch and by the incompetence of his immediate successors.

During the 18th century it was gradually found advisable in the interests of the despatch of business that the King should choose his ministers from that party which had a majority in the House of Commons. In 1696 a party ministry had been formed, but the lesson was only slowly learned that the Ministry must depend on the state of parties in the Lower House. In the time of William and Anne composite ministries were the rule. Under George I. and George II. there was a constant Whig majority in the Commons and a Whig Ministry in power. In 1784, however, George III. was successful in keeping Pitt in power notwithstanding an adverse majority in the Lower House. But the King only anticipated the decision of the country, for at the next election a House was returned which supported Pitt, and from that time the Prime Minister and the Cabinet have always been chosen from the predominant party.

Thus, monarchy, as it "withered on the throne took root in the Cabinet." The Parliamentary Government of the 18th century was however by no means government by the people. It was government by the great aristocratic families, tempered by deference to public opinion. It was not till the electoral reforms of the 19th century that the democracy became predominant. The great era of English expansion and the command of sea power were attained under an aristocracy and not under a democracy.

The question of English colonial expansion during this period centres round the long struggle with the French. The most profitable line of trade in the world was considered to be that of the Spanish colonies and the adjacent islands, and with these England drove a considerable contraband traffic. On the other side of the world there were the riches of the East and the wealth of the Spice Islands. It seemed probable in 1701 that France, the great commercial rival of England, would inherit the throne of Spain, drive out the English from the Spanish Main and dominate that trade. Hence England's intervention in the War of the Spanish Succession. By a series of brilliant battles won by the Duke of Marlborough between 1704 and 1709 she attained her object, for by the Treaty of Utrecht (1713) England gained Gibraltar, Port Mahon, Nova Scotia, and Newfoundland; while the rights of the Hudson's Bay Company in their vast territory were definitely recognized. England had secured a base from which to operate against the French, and at the same time by the Assiento Contract (see Great Britain — Eighteenth Century Commerce) she won a share in the monopoly of Spain in America and prevented it being closed to her by France. The war left Holland and France financially exhausted. The Dutch trade began to fall behind. France was heaping up financial burdens which were to lead to national bankruptcy. England alone was in a position adequately to maintain a navy and the command of the sea. She thus became the foremost sea power and secured her trade supremacy in one of the most important quarters of the globe. An attempt to interfere with it led to the war with Spain in 1739, which merged into the war of the Austrian Succession ending in 1748.

In another direction, however, that trade supremacy was being threatened. In India a French and an English East India Company each had trading factories or settlements, the English posts being Bombay, Madras, and Calcutta. They were not subject to the English Government, but were under the Company, and England had no governmental responsibility whatever in the matter.

In India there prevailed, about the middle of the 18th century, a wild anarchy due to the break-up of the Mogul Empire in 1707, and military adventurers were beginning to make themselves supreme in various parts. The French governor of Pondicherry, Dupleix, a man of great military genius, began to perceive that it was quite possible for Europeans to gain predominance in the general scramble; and by supporting various native rulers and organizing native troops on the European model he soon made himself one of the chief powers in India. If the English were not to be ousted altogether they too had to organize. Clive copied the French policy so successfully that English influence became predominant, and the future of India fell into the hands of the English. The French settlements were restored, but they were no longer military establishments, and France was reduced to relative unimportance. In 1784 the English government became responsible for the administration of India, while the East India Company continued to have a monopoly of the trade.

The dominance of England on the Spanish Main and in India was followed by the ousting of the French in North America. The French had established themselves at the mouth of the Mississippi, and claimed all the country lying between the Saint Lawrence and the Mississippi west of the Alleghany mountains. The Seven Years' War in Europe gave England a chance to fight the matter out, and at the Peace of Paris in 1763 England gained Canada, all the land west of the Mississippi, four West Indian islands, and a promise not to fortify the French settlements in India; and from Spain she obtained Florida.

Thus by 1763 England was mistress of the whole American continent, and the dominant European power in India, while the trade and commerce of the East and West were in her supreme control.

England then felt that as she had done so much to protect the young colonies from being swallowed up by the French they ought to pay part of the cost of their own defence in future. She accordingly proceeded to increase the tax on colonial imports, and to prevent evasion instituted a stricter enforcement of the Navigation Acts. She also imposed a stamp tax. The colonists, who were no longer afraid of the French, wished to be free to work out their own destiny in their own way. Hence the revolt of the Americans in 1776, ending in the recognition of their independence in 1783. France and Spain had joined in against England, and, although the result was the loss of the American colonies, England was given a welcome opportunity of sweeping French commerce off the seas, and of finally ruining the Dutch shipping. England emerged in 1783 more decidedly than ever the great trading power of the world.

The loss of the thirteen American colonies raised the question of the disposal of convicts, since they could no longer be sent to the United States. Hence the Government turned its attention to Australia which had been explored by Captain Cook between 1768 and 1770. The island had been the resort of a few traders, but much preliminary work needed doing before it could become attractive to settlers, and the result was that convicts were despatched in 1788 to Botany Bay to do the preliminary work of road-making. Then, as the wool famine in England became more and more acute, the destiny of the colony shaped itself along the line of sheep-farming.

After the Revolutionary and Napoleonic wars England made a further addition to her possessions, gaining the Cape, from which she has been able to build up a South African Empire. Ceylon, British Guiana, Trinidad, Heligoland and Mauritius, were minor acquisitions made in 1815; and the foundations of her Far Eastern Empire were laid in the cession of Penang in 1786, which gave England a footing in the Straits Settlements.

The United Kingdom emerged from the Napoleonic wars with a huge national debt, but with an enormously increased trade; with fifty years start of Europe in manufacturing, and with the unrivalled possession of the sea-power which had been her definite goal from the time of Elizabeth onwards.

This great expansion could not have been accomplished if England had not been blessed with internal peace. Had Scotland declined in 1702 to accept a German line of kings and decided to pursue, as a large faction wished, her own independent way with her own king, England would have been in constant danger of invasion from the north on behalf of the Stuarts, or of intervention from an unfriendly kingdom. The Scotch, having been shut out of the best trading parts of the world, tried to establish themselves on the Isthmus of Darien, but met with disastrous failure, a failure which they laid to the door of England. In England this undertaking aroused a great fear of ultimate Scotch success in this particular line of commerce. It seemed better to absorb the Scotch than have them as rivals. England was also anxious to secure the assent of the Scotch to the House of Brunswick as the ruler of the two kingdoms and she accordingly offered them a share in the whole of the English trade if they would acquiesce in a union. The Scotch, who were most anxious to get a part of the English trade monopoly, assented. The union of the two kingdoms was thus accomplished, the Scotch sending members to the English Parliament and giving up their own, but preserving freedom in matters of religion. Scotland thus merged her individuality in that of England and accepted English trade privileges as a setoff against a German king.

Ireland was less fortunate. There was not the same necessity for conciliating her. The Irish Parliament was dependent on England, and when the Irish tried to set up their own king — James II.— they suffered crushing defeat at the battle of the Boyne. The English were not afraid of Ireland as they were afraid of Scotland. Ireland was a conquered country and as such must take the conditions imposed. She was, moreover, Roman Catholic, and England could not absorb her in the same way as she had Scotland. Hence Ireland was deliberately prevented from becoming prosperous by a series of laws which shut her out of the colonial trade and destroyed her woollen manufactures and cattle trade. At the same time a series of penal laws against the Roman Catholics were instituted which gave the power into the hands of the Protestant minority.

Both trade disabilities and religious oppression were successful in preventing Ireland from being a danger to England till the revolt of the American colonies gave Ireland the opportunity of claiming an independent Parliament, which demand was conceded in 1782. It became a question then of settling the trade relations between the two kingdoms and of the Irish contribution toward Imperial defence. No satisfactory solution had been reached when civil war broke out between the Irish Protestants and Roman Catholics. England felt that the Protestant interests in Ireland needed protection. Moreover the Irish finances became very involved, and it seemed as if Ireland was on the verge of national bankruptcy. The English manufacturers wished to secure the Irish market whereas the Irish Parliament showed a disposition to impose protective duties even as against England. It seemed best to the statesmen of the time to solve all these various problems by a complete union of the two countries. Scotland had come into the English system when the era of Whig protection was beginning, and she prospered exceedingly. It was hoped that Ireland would do the same. But Ireland came in just when England was engaged in a life and death struggle with France. She felt all the effects of the dislocation of trade and of the great financial strain. Later on her nascent industries were exposed to the overwhelming competition of the English machine-made products, and her provision and corn trade were vitally and injuriously affected by the English free-trade reforms, while she had no compensation as England had in her manufacturing prosperity.

Vast indeed are the changes recorded in the history of the 18th century. At the beginning of that century Scotland, jealous, sullen and separate, was a constant menace to the expansion of England; at the end she had become united with her southern neighbor in a political union cemented by identical trade interests. Ireland also had been united in a common Parliament, but cannot be said to have been absorbed in the same way. William III., like his predecessor on the English throne, acted as his own Prime Minister. Long before the death of George III. the monarch had given place to one of his powerful ministers as the real head of the executive government. In the early years of the century party ties sat lightly upon Ministers; at the end of it a Cabinet which was not homogeneous would have been an anomaly. At the beginning of the century France seemed destined to inherit the riches of the Spanish Main and the East Indies. The end of the century saw French commerce swept from the seas in East and West, and India under British rule. England's colonial empire of the first part of the 18th century was English speaking and not extensive. By the end of the century her principal English speaking possessions had cut themselves adrift; but had been replaced by a scattered empire of many races; and the foundations had been laid of that wide empire, the superstructure of which is not even yet complete.

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7. (b). **Great Britain — The French Wars of the Eighteenth Century.** Hostility to France is one of the chief characteristics of British policy in the 18th century. It may be ascribed to various motives, religious, dynastic, commercial, and to the purely political motive of maintaining the balance of power. At the beginning of the century the first and last of these motives were uppermost. The first collision between the two powers arose out of the efforts of Louis XIV. of France to gain complete control of the Spanish dominions, then comprising Southern Italy, Milan, and the greater part of the Flemish Netherlands, as well as a large portion of the New World. He would hear of no compromise such as was suggested by William III. of England, the Dutch Republic, and the House of Hapsburg, but, in the lack of a direct descendant of the Spanish Bourbons, claimed the crown of Spain for his grandson (subsequently Philip V. of Spain), a great-grandson of Philip IV. of Spain. He did more. He captured the Dutch troops who shared in the defence of the "barrier fortresses" of the Netherlands; and in 1701, on the death of James II., formerly king of England, but now an exile in France, he promptly recognized his son as King of England. The affront rekindled in England the dormant zeal for the Protestant succession; the House of Commons had to cease from its factious opposition to "Dutch William"; and the King prepared vigorously to curb the designs of Louis XIV. for a universal monarchy. He sent Marlborough with 10,000 troops to protect the Dutch Netherlands, and even the death of William, and the accession of Queen Anne, who leaned to the Tory or peace party, could not avert war. William's last diplomatic work, the grand alliance (1701), with Austria and the Dutch Republic held good, and the elector of Brandenburg-Prussia joined the league on the understanding that he should receive the royal title in Prussia, as Frederick I.

The world was soon startled by the display of genius such as had never been seen in the campaigns of William III. Clogged, as he was, by the dilatory procedure of the Dutch, Marlborough effected little of note in the years 1702–3; but in 1704, when the Hapsburg forces were sore beset in South Germany by the Franco-Bavarian army, he resolved to march up the Rhine valley to the help of the Imperialists in Swabia. Skilfully misleading the French as to his intentions, he surprised the hostile forces near Donauwörth on the Upper Danube and clinched this success by a brilliant triumph at Blenheim, 13 Aug. 1704. A daring attack delivered across marshy ground against the French centre cut their array in twain, and drove thousands of fugitives into the Danube. Of an army 60,000 strong in the morning, only some 20,000 survived uncaptured at night. Marlborough was able to effect little in the year 1705, when the interest centred on the brilliant though unsubstantial triumphs won by Lord Peterborough in Spain. In the campaign of 1706, Marlborough struck a decisive blow at the French army under Villeroi near Ramillies (23 May); the capture of Brussels, Ghent, and Antwerp resulted from this victory, which also had the effect of lessening the pressure on the Imperialist leader, Prince Eugene, in Northern Italy. In 1707 the tide seemed to turn in favor of the French and Spaniards; the latter on 25 April gained a complete victory at Almanza, regained most of the eastern and northeastern provinces of Spain for the Bourbon cause. In July 1708, however, Marlborough utterly overthrew the French at Oudenard on the River Scheldt, and followed up his success by bringing the great fortress of Lille to surrender (December). These events laid the Spanish Netherlands at the feet of the allies and opened up a way into France.

Nevertheless, Louis XIV. rejected their terms, and, making an appeal to his people, continued the war with fresh vigor, which was seen in his troops during the stubborn and murderous conflict at Malplequet, 11 Sept. 1709. The skill of Marlborough and Eugene gained the day, but it was a barren triumph. The war dragged on for three years more; but the growing desire for peace in England, and the partisan intrigues which resulted in the recall and disgrace of Marlborough, brought it to a conclusion in the Peace of Utrecht, 13 March 1713. Great Britain secured Gibraltar and Minorca, Nova Scotia, parts of Newfoundland, districts around Hudson's Bay, and the French part of Saint Christopher's. Spain, by what was called the Assiento Treaty, granted to her the sole right of importing slaves into the Spanish colonies of America. The Dutch retained their hold on most of the "barrier fortresses" of the Netherlands, and that territory, along with Naples and the Milanese, went to the Hapsburg Emperor, Charles VI. Philip V. retained Spain and the Indies, Great Britain rather shabbily deserting the Catalans whom she had instigated to rise against the Bourbon ruler. The treaty was not one to be proud of; but it restored the balance of power, and rendered impossible any further attack by Louis XIV. on Great Britain and Holland. The phantom of an almost universal monarchy ceased to trouble the world until it reappeared a century later in the person of Napoleon. Further, this war of the Spanish Succession so far exhausted France, Spain and Holland, as to leave Great Britain mistress of the seas.

The accession of the House of Hanover in

1714 tended to embroil Great Britain in the political struggles of Central Europe. As electors of Hanover, the Georges were among the chief dignitaries of that venerable but decaying fabric, the Holy Roman Empire, and involved England in the disputes caused by the rivalry of the Houses of Hapsburg and Hohenzollern. The War of the Austrian Succession, which opened in 1740 with the seizure of Silesia by Frederick the Great of Prussia, aroused the sympathy of Britons with the young ruler, Maria Theresa of Austria; and when France joined the ranks of her would-be despoilers, Great Britain intervened in order to maintain her power as a counterpoise to that of France. George II., leading his troops in person, gained a victory over the French at Dettingen on the River Main, 27 June 1743; but two years later (11 May 1745) the British arms sustained a serious reverse at Fontenoy, near Tournay, where the genius of the Maréchal de Saxe prevailed over the stubborn valor of the British infantry. The Guards' Brigade retrieved the honor of the Union Jack by a splendid advance, which, if supported by cavalry, might have turned the fortunes of the day. As it was, the defeat at Fontenoy and the romantic campaign of "Bonnie Prince Charlie," grandson of James II., in Scotland, clogged British efforts on the continent with results disastrous to her allies. At sea, however, and in the colonies, the Union Jack was nearly everywhere successful, the capture of Louisburg (21 June 1745), leading to the reduction of Cape Breton Island and the opening of the Saint Lawrence to British attacks. Both powers at length became weary of the war, and by the Peace of Aix-la-Chapelle (October 1748), agreed to restore their conquests — a clause deeply resented by British seamen and merchants. France, however, guaranteed the Belgic Netherlands to Austria, and agreed to dismantle the fortifications of Dunkirk. The balance of power was thus restored, both in European and Colonial affairs.

In 1756 Austria's grievance against Prussia concerning the Province of Silesia lit the flames of war both in Europe, Canada, and India. Already France and Great Britain were practically at war in the valley of the Ohio and in the Carnatic, owing to the masterful policy there pushed on by Montcalm and Dupleix. Therefore, when France, reversing her traditional policy, allied herself with Austria for the partition of Prussia, Frederick the Great naturally became the ally of the Court of London (January 1756). At first matters went ill with the two Protestant States; Frederick could not at first make head against the coalition (joined by Saxony and Russia); and Great Britain lost Minorca, largely through Admiral Byng, who was executed. Matters did not mend until in June 1757, George II. recalled to office the one inspiring personality in English public life, William Pitt. Acting on the principle summed up in his famous phrase —"I will win America in Germany"— he lavished subsidies on Frederick the Great. Slowly but surely the tide turned; Frederick's brilliant victory at Rossbach (5 Nov. 1757), over the French and their allies paralyzed the French government; and the results of favoritism and incompetence became apparent. The French navy was speedily worsted in several fights; Louisburg surrendered to Boscawen on 26 July 1758, and Prince Edward Island also fell to the Union Jack. Late in November British and Colonial troops captured Fort Duquesne on the Ohio and it was renamed Pittsburg. In India success was chequered with failure. By the victory of Plassey (23 June 1757), Clive had subdued Bengal; but after the arrival of French reinforcements, Count Lally, the successor of Dupleix, captured Fort Saint David and nearly took Madras. Gradually the pressure of sea power told in favor of Great Britain, and the long struggle for the possession of the Carnatic was decided by Eyre Coote's brilliant victory of Wandewash (22 Jan. 1760), which led up to the capture of the French stronghold, Pondicherry, a year later.

Meanwhile, though Frederick the Great was very hard pressed, his ally reaped the full reward foreseen by Pitt. That statesman had the gift of choosing the right men; and his sagacity discerned in a young officer, Wolfe, the conqueror of Canada. The manner in which Wolfe captured the Heights of Abraham (13 Sept. 1759) is too well known to need description. Quebec and ultimately the whole of Canada were the fruits of a victory, which itself resulted from the ability of the mistress of the seas to attack when, where, and in what force she chose.

After the accession of George III. to the throne, and of the Bute Ministry to power, the Anglo-Prussian alliance lapsed; but the war with France continued. By the (third) Bourbon Family Compact, Spain made common cause with her neighbor; but the British navy overbore all opposition at sea; and in February 1763, the Peace of Paris put an end to what had now become merely a maritime and colonial war. France ceded Canada, Cape Breton Island, Prince Edward Island, together with Grenada, Saint Vincent, Dominica, and Tobago, as well as Senegal in Africa. Spain ceded Florida, but received from France as indemnity the great district of Louisiana. Great Britain restored to France several of her conquests in the East and West Indies, also to Spain parts of Cuba. Save that France handed back Minorca to England, the changes in Europe very slightly affected the Island Power; but she emerged, from what had been at first merely a continental war, the greatest of the world powers.

The completeness of her triumph brought its nemesis. The American War of Independence furnished France with the longed-for opportunity for revenge. She declared war formally against England in 1778 after her volunteers had long been helping the colonists. Soon the maritime policy of her rival leagued together the northern powers in the League of the Armed Neutrals. That war, however, having been described in the article United States — American Revolution, it is unnecessary to comment on it here, or to advert to the influence which sea power exerted on the decisive event, the surrender of Cornwallis at Yorktown (10 Oct. 1781). By the Treaty of Versailles (3 Sept. 1783), France recovered Senegal, several West India islands, acquired extended fishery rights on "the French Shore" of Newfoundland, and gained Tobago. Of all the wars between England and France, that of 1778-1783 was most completely colonial in character and in its results. Never before had France dealt her rival so serious a blow; but it recoiled on herself; for the ideas of liberty and civic equality which her soldiers learned in the land of Washington were now carried back to the mother country with results fatal to the Bourbon monarchy.

The Revolutionary War (1793-1802), stands apart from the previous struggles in that it was at the outset largely, though by no means wholly, a war of opinion. It turned mainly on the question whether the French Republic could with impunity set aside the rights of the Dutch Republic over the navigation of the lower part of the River Scheldt, which Great Britain by the treaty of 1788 had undertaken to guarantee. The French in their resolve to make Antwerp a great port, persisted in ignoring that treaty; and matters were in a very strained state between England and France, when the execution of Louis XVI. at Paris, 21 Jan. 1793, made all hope of compromise impossible. The French on 1 Feb. 1793, declared war against Great Britain and Holland. These powers therefore joined the first coalition (Austria, Prussia, "the Empire," Sardinia, and Naples); but the jealousy of Austria and Prussia, the incompetency of the allied leaders, and the enthusiasm and energy of the French soon drove the allies out of their territory. A British force was defeated at Hondschoote near Dunkirk, and had to retire toward Ostend (September 1793). Two months later Admiral Hood's bluejackets and their Spanish and Neapolitan allies were driven from redoubts near Toulon; mainly owing to the skilful dispositions of Bonaparte, and had to abandon that seaport. The campaigns in Flanders languished owing to the paucity of the British forces, which had to leave the Low Countries early in 1795. In that year Prussia came to terms with France.

The coalition was shattered by the astonishing triumphs of Bonaparte in Italy (1796-1797), which compelled Sardinia, Naples, and finally Austria, to make peace. Holland and Spain, having become allies of the French, the war became solely maritime and colonial. Mutinies at Spithead and the Nore (April-June 1797), threatened to complete England's ruin; but the gloom of that year was brightened by the victory won by Jervis and Nelson over the Spaniards off Cape Saint Vincent (Feb. 14), by Duncan's triumph over the Dutch fleet at Camperdown (Oct. 11). Pitt's overtures for peace to the French government in August-September, came to naught. The scene of war then shifted to the Mediterranean where Bonaparte's great expedition captured Malta and Egypt, with a view to the eventual conquest of India. His schemes were thwarted by Nelson's brilliant victory near the mouth of the Nile (1 Aug. 1798); and the pressure of sea power received further illustration by a severe check administered to Bonaparte at Acre by Sir Sidney Smith's squadron. Britain put forth great efforts in India, where Wellesley's capture of Seriogapatam early in 1799 led to the overthrow and death of that ambitious ruler, Tippoo Sahib; and after Bonaparte's secret departure from Egypt, a British expedition under Abercrombie and Hutchinson finally compelled the French army which he left behind to surrender (27 Aug. 1801). Malta had fallen to the British fleet in 1800.

Meanwhile, the aggressive conduct of the French government in Europe had enabled Pitt to form a second coalition which swept the French forces from Germany and Italy. An Anglo-Russian force in Holland, however, fared badly and finally had to leave the country (Oct. 1799). At the close of the year Russia left the coalition. In 1800 the allies lost ground rapidly. Bonaparte, virtually master of France after the *coup d' état* of Brumaire (Nov. 1799), overthrew the Austrians at Marengo (14 June 1800); Moreau completed their disasters at Hohenlinden in December, and the Court of Vienna came to terms with France early in 1801. Bonaparte with rare skill now prepared to turn the tables against England by effecting an alliance with Russia, and reviving the League of the Armed Neutrals. Again his aims were thwarted by Nelson, whose victory at Copenhagen (2 April 1801), paralyzed the league. The assassination of the Czar Paul, and the accession of Alexander I., facilitated a compromise on maritime affairs; and the losses of the French in Egypt and Malta predisposed them to peace with England. Ultimately the belligerents came to terms in the Treaty of Amiens (27 March 1802), whereby England agreed to restore all her colonial conquests to France, Spain, and Holland (including the Cape of Good Hope to the last-named), except Trinidad and Ceylon, which the Spaniards and Dutch, respectively, ceded to her. Malta was to be restored to the Knights of Saint John (on conditions which proved to be unworkable), while Egypt reverted to Turkey.

In the Anglo-French wars of the 18th century the importance of the commercial and colonial motives is increasingly apparent. The first two struggles originated in dynastic affairs relating to the then dominant principle of the balance of power; but the increasing solidity of the European States and the growth of commerce under conditions which were almost prohibitive to foreigners, turned the gaze of statesmen more and more to the new lands beyond the seas. The result may be estimated by reading over the causes and results of the wars here briefly set forth. Europe, after settling down on the foundations laid in 1713 and 1748, occupied less attention from statesmen at London and Paris. The French Revolution brought matters back sharply to the old field of debate between the two powers,—the Netherlands; but when the weakness of the coalition, and the genius of Bonaparte made France paramount on the Continent, the struggle quickly became one for supremacy in the Levant, and the East and West Indies. The vigor with which he played the rôles of Cæsar and Alexander the Great would have enabled him to wrest from England her world empire had he not been confronted by Nelson. Even so, the struggle between the secular rivals ended in 1802 on terms on the whole favorable to France; and it was soon clear that the first consul viewed the Peace of Amiens as an opportunity for strengthening the position of France in Europe, as well as her fleet and her colonies, in order to resume the struggle for empire under conditions far more favorable than Louis XIV. had ever known.

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8. (a). Great Britain — The Nineteenth Century. The history of the British people in the 19th century is dominated by three facts or tendencies, themselves the outcome of its past history and its physical environment: (1) a portentous development of the national resources, resulting from the industrial revolution, improved agriculture, and the colonial expansion of the 18th century; (2) consequent collisions or friction with other growing nations, especially Imperial France and Imperial Germany; (3) a revulsion of feeling in favor of peace, attention to domestic reforms and commercial expansion by pacific methods. These three phases of national life are closely related; the first is connected with the life of the 18th century of whose achievements — scientific and mechanical, military and maritime — it was the continuation. The second or warlike movement originated in the effort of an expansive but insular people to seek over-seas the material resources wanting at home, and prompted the efforts associated with the names of Nelson and Wellington, Dalhousie and Dufferin, John A. Macdonald, Parkes, Roberts, Kitchener and Cecil Rhodes. The third tendency, prudential or philanthropic in its origin, has as spokesmen Fox, Bentham, Shaftesbury, Peel, Cobden and Gladstone. The following brief sketch is not intended to be a commentary on these statements; but they may be regarded as sign-posts helping the historical traveller along paths which, though far from easy, yet frequently run on parallel or converging lines.

The first 15 years of the century witnessed a phenomenal development both of the material resources of Great Britain and of the strife with France — both of them well marked features of the previous years. In the years 1801–1815 the inventions of Watt, Cartwright, Trevithick and George Stevenson led to an enormous expansion of the factory system and means of locomotion. But in those same years the material resources of the land were consumed in a struggle for national existence. The year 1803, which saw the renewal of war between England and France after the brief truce of Amiens, is marked by the exhibition of Trevithick's first locomotive. In the year of Waterloo (1815) Stevenson proved his Killingworth locomotive to be a practical success. The skill and expansive energies of man, which went to feed the flames of the great war, were also in large measure its cause. The rise of Napoleon to absolute power in France and his masterful interventions in neighboring States, his prohibition of British imports, and his endeavor to found a Colonial Empire at the expense of that of Britain brought about the mightiest of all Anglo-French wars, that of 1803–1814. It is worthy of notice that the influence of the autocrat brought back the struggle from the sphere of opinion to that of material and colonial interests characteristic of the 18th century. The war had three well marked stages. Toward the close of 1805 Trafalgar left England mistress of the seas, while Austerlitz made Napoleon master of the Continent. In the next two years he strove to mass all the continental states against her in a commercial war styled the Continental System. Its pressure seemed to be bringing England to the verge of bankruptcy; but in 1808 the revolt of Spain threw open the Iberian Peninsula and the Spanish and Portuguese colonies in America to British trade. The defection of Russia in 1812 ruined Napoleon's prospects and the subsequent compaigns (1813–1815) assured the triumph of England and the overthrow of the great Emperor. Her gains were colonial. Mauritius, Tobago and Saint Lucia were yielded up by France. For the Cape of Good Hope, Dutch Guiana, and Curaçoa, conquered during the war, the victor paid to Holland a sum of £6,000,000. Malta, Heligoland and a protectorate over the Ionian Isles were the sole acquisitions in Europe from a war which added more than £600,000,000 to the national debt. The strain had been terrible and nothing but the new strength gained from the factory system, improved agriculture, and the mastery of the seas, could have brought the country through. Pitt, "the pilot who weathered the storm," died in 1806; but his heirs, the Tories, held on to power until 1830.

The burden of debt hung like a millstone round the neck of the nation for the next generation. In place of an income tax (then viewed as essentially a war tax) imposts were in and after 1815 placed on all possible articles, including foreign corn. Demonstrations and riots were the result; repressive measures, such as the Six Acts of 1819, were of no avail; and the unpopularity of George IV. (1820-1830) brought the monarchy itself into danger. Yet this time of malaise and political reaction was not fruitless. Canning, as Foreign Secretary, did much to thwart the reactionary policy of the monarchs who had framed the Holy Alliance, and his encouragement of the Liberals of Spain and of the Greek patriots led to notable results in the lives of those peoples, as also in the attitude of the United States toward Europe. The abolition of civic disabilities affecting Nonconformists in 1828, and the emancipation of Roman Catholics in 1829 with the reluctant assent of the Wellington Ministry, showed that the days of privilege were over.

The event of the next year ushered in a new era. The death of George IV. brought to the throne his far more popular brother William IV.; and the general election, held during the excitement caused by the deposition of the elder House of Bourbon in the revolution of July 1830, in Paris, led to the return of a majority favorable to electoral reform at Westminster. After a long and acrid struggle the Reform Bill of 1832 was passed. It enfranchised in all parliamentary boroughs householders paying a rental of £10, also copyholders in the counties. It disfranchised a number of very small boroughs and transferred their voting power to the new manufacturing towns and districts. Thus the influence exerted by the second French Revolution on English democracy was far more favorable than that of the first revolution. The anarchy and the wars resulting from that great upheaval put back the cause of parliamentary reform in England for 50 years. The seeming success of the second revolution (July 1830) now added vigor to the English movement which had meanwhile been strengthened by the silent yet potent changes in the distribution of population and modes of life resulting from the industrial revolution. That change, ever working with accelerated energy, necessitated the transference of power from the old rural England to the new manufacturing England; and thanks to the accession of William IV. in 1830, and of Victoria in 1837, this momentous revolution took place peacefully. While breaking the power of the old Tory party, it rooted the monarchy more firmly in the hearts of the people.

The ensuing decades were times of great strain and stress, but they were met firmly and on the whole successfully. The wider sympathies and business aptitudes of the new Parliament showed themselves in the Factory Act (1833) of Lord Ashley — afterward Lord Shaftesbury; in the emancipation of slaves in British colonies, for which a sum of £20,000,000 was voted as compensation to the owners; and in the Poor Law Amendment Act of 1834 which cut at the roots of the growing evil of pauperism. Nevertheless the working classes of the great towns were in a state sometimes bordering on sedition, partly owing to resentment against the Whigs for refusing to extend the franchise laid down in 1832, and still more owing to the harsh administration of the new Poor Law. Trade depression, low wages, high taxes and dear corn swelled the volume of discontent. It took form in two well defined movements, Chartism and the Anti-Corn Law League, which, beginning in the year 1837, ran a parallel and competitive course, and ended in the year 1848, the former in failure, the latter amidst almost complete success. This difference in the fortunes of the two movements may be ascribed to the following causes. The Chartists, (q.v.) sought to cure evils, which sprang mainly from economic causes, by purely political means. The six points of their Charter were (1) annual Parliaments, (2) manhood suffrage, (3) equal electoral districts, (4) payment of members of Parliament, (5) abolition of the property qualification for members of Parliament, and (6) vote by ballot. This programme (a revival of the advanced Whig programme of 1780) aimed at benefiting the working classes through Parliament. The Free Traders sought to benefit them by altering taxation so as to let in free, or nearly free, the necessaries and small comforts of life. Further, Chartism suffered from the unwise means used by the physical force wing of the party whose leaders fell out with one another. The Free Traders on the other hand had excellent leaders, Cobden and Bright, whose arguments finally brought over to their side large numbers of the workingmen and the Prime Minister himself, Sir Robert Peel.

This able man had pieced together the Conservative party from the more malleable of the fragments of the old Tory faction; and, largely owing to the failures of the Whigs in finance, he came back to power after the general election of 1841 with a strong and apparently homogeneous following. His openness of mind soon brought him into collision with very many of his followers. He became a Free Trader, while they remained Protectionists. He soon came to see that the long series of deficits could be ended only by recourse to direct taxation; and in his budgets of 1842 and 1845 he abolished or greatly lessened duties on large numbers of articles, making good the temporary loss by an Income Tax of 7d in the £. He also lessened the sliding scale duties on foreign corn. The result was seen in improved trade and in a decline of pauperism and misery. In 1845-6 the Irish famine brought him to sacrifice the corn duties — a measure which earned him unmeasured abuse from Disraeli and Lord George Bentinck and the gratitude of the poor throughout the whole Kingdom. Thus the working classes gained their chief aims through the efforts of the Free Traders and the legislation of Peel. Consequently when the continental revolutions of the spring of 1848 induced the physical force Chartists to copy the methods which had been successful in Paris, Berlin and Vienna, the result was a ludicrous fiasco, which brought Chartism as an organized movement to an end. The spirit that had animated its best leaders, namely a burning love of freedom and a passionate desire for the moral and mental uplifting of the working classes, lived on in those Radical parsons, F. D. Maurice and Charles Kingsley, in the second founders of the Co-operative and Friendly Society movements, and in the later Radicals, who by wise methods soon gained four of the six points of the Charter.

The same yearnings after ideals for other than those realisable by mere party strifes and sordid commercialism infused much of the best work of Carlyle and of his young disciple Ruskin, and throbbed in the youthful poems of Tennyson, Browning and Swinburne.

The decade of the forties, marked by political discontent, but dignified by ideal aspirations in all spheres — the disruption in the church of Scotland, the Anglican movement in the church of England and the pre-Raphaelite movement in art, belong to that momentous epoch — faded away into a period marked by expanding trade and mental quiescence. Gold discoveries, railways, steamships, these were the chief preoccupation of mankind; and under their subtle alchemy democracy and idealism of all kinds vanished for a time, both in England and on the Continent. As often happens in these expansive epochs (which recur after the introspective, critical and reforming epochs), a collision occurred with another growing Power, Russia. The Crimean War resulted largely from the efforts of that stern autocrat, the Czar Nicholas I., to browbeat the Turks, whose political power was then thought to be essential to the security of the overland route to India. The hope entertained by the British nation that the Sultan would reform his government and grant religious liberty soon proved to be vain; and England came to see that she had championed a moribund cause. She gained nothing by the war; and its first reverses did much to promote the ferment in native circles in India which led to the terrible mutiny of 1857.

Affairs in Europe soon engrossed public attention. In the Crimean War, England had had the alliance of Napoleon III. of France and of Victor Emanuel II. of the Kingdom of Sardinia. Her relations with the French Emperor speedily cooled; and complications in the years 1858–59 brought the two people so near to a conflict as to lead to the revival of the volunteer movement. Far different was the attitude of the nation toward the Italian movement for liberation and unity. The masterly statecraft of the Piedmontese statesman, Cavour, and the heroic deeds of Garibaldi in southern Italy in 1860 aroused the keenest interest. The diplomatic help given by British statesmen, Palmerston and Lord John Russell, then laid the basis of that friendship which has since subsisted between Great Britain and the United Kingdom of Italy.

Amidst these excitements Cobden did good service by promoting a commercial treaty between England and France on free trade lines, (it held good for the years 1860–1870) and Gladstone, the Chancellor of the Exchequer, by his budgets of the early sixties succeeded in further cheapening the necessaries of life. But no advance was made on purely political lines, firstly because the influence of Palmerston, the Prime Minister, barred the way, and secondly because popular interest centred largely in the wars of that troubled period — the American Civil War (which at one time portended a strife between the two kindred peoples), the Danish War of 1864, and the Austro-Prussian War of 1866. The end of this last struggle brought a lull which favored the hopes of reformers. The death of Palmerston on 18 Oct. 1865, removed another barrier; for, since the death of the Prince Consort at the close of 1861, his influence in the political world had been almost without bounds. Other causes now helped to turn attention to home affairs. The cattle plague and the sharp financial crisis of the year 1865, the Fenian outrages of the next year, and the general state of malaise throughout the United Kingdom brought men once more to that critical or introspective mood which is favorable to political reform. A singular concatenation of events brought into office in June 1866 a Conservative Ministry headed by Lord Derby and Mr. Disraeli — into office but not into power, for they were face to face with a hostile majority, irritated by the recent rejection of a moderate Reform Bill championed by Lord John Russell and Mr. Gladstone. The result was a series of acrobatic performances whereby Disraeli, erstwhile the denouncer of the inconsistencies of Peel, foisted on his party in 1867 a measure far more democratic than that of the previous year. Household suffrage was thenceforth the law of the land for all parliamentary boroughs. After a short time of uneasy balancing, the Conservative Ministry was overthrown by the general election of November 1868.

Democracy now came in as with a flood. The Gladstone Ministry (December 1868 — February 1874), carried legislative activity to lengths never before seen in England. The Disestablishment of the Irish Church (1869); the Irish Land Act and the Elementary Education Act (1870); the abolition of the system of purchase in the army, and the appointment of the Local Government Board (1871); the Ballot Act and Licensing Act (1872); the Supreme Court of Judicature Act (1873) — these were the chief measures passed in this period, which witnessed also the settlement of the Russian claims respecting the Black Sea and the Alabama claims urged by the United States. In these matters, as in the sphere of foreign policy generally, the Ministry was deemed to have sacrificed British interests needlessly.

The outcome of this feeling, and of the alarm felt by many classes at home whose interests were injured or threatened, was seen in the general election of February 1874, which marked a sharp reaction in favor of Imperialism and a spirited foreign policy. Disraeli (created Earl of Beaconsfield in August 1876) came back to power at a time when the Eastern Question entered on an acute phase. The years 1875–1878 were overshadowed by the atrocities committed by the Turks on their Christian fellow subjects, and by the Russo-Turkish War. Sharp differences of feeling were caused by Lord Beaconsfield's treatment of these events, as also by his acquisition of Cyprus (June 1878). Depression of trade at home and the outbreak of wars in Zululand and Afghanistan in 1879 made the Ministry more and more unpopular, with the result that the election of March 1880 brought back Gladstone to power with a large majority. His second ministry (April 1880 — June 1885), coincided with a time of great ferment in Ireland and of unrest abroad, with which he coped manfully but not very successfully. Irish affairs were not settled by his drastic Irish Land Act of 1881; his very large concessions to the Boers of the Transvaal in 1881 and 1884 aroused a most bitter feeling among loyalists in South Africa and sowed the seeds of future trouble. British intervention in Egypt (1882) was successful, but had as an unfortunate corollary the despatch of General Gordon to Khartum; and the dealings of the Ministry with Russia respecting the Afghan frontier at Penjdeh, as also with Germany respecting various colonial questions on the coasts of Africa and New Guinea, were marked neither by foresight nor firmness. In the midst of these disturbances Gladstone, with characteristic tenacity, pushed through the Reform Bill of 1884 and the Redistribution Bill of 1885 in face of prolonged opposition from the Lords. The former measure extended household suffrage to the counties; the latter divided the whole country into electoral districts with some approach to numerical equality.

The general election of 1885 was of singular interest as marshaling the revivified forces of Democracy and Imperialism. The former won, thanks to the votes of the newly enfranchised agricultural laborers; but the triumphant Liberal party was split in twain by Gladstone's Irish Home Rule Bill and Land Bill (April 1886). The general election of July 1886 reversed the decision arrived at 18 months earlier, and Lord Salisbury took office with a Unionist Ministry which sought — as he phrased it — to govern Ireland "honestly, consistently and resolutely." It also passed the local Government Bill (1888) the Irish Land Purchase Bill (1891) and strengthened the Army and Navy, and adopted a firmer tone on foreign affairs. In 1892 the swing of the pendulum brought Gladstone back to power — for the fourth time,— but in 1894 he retired and Lord Rosebery undertook to reconstitute the Ministry. Even his versatility failed to solve the difficulties arising from disunion in the cabinet and in the Liberal party, and from the tension in public opinion caused by massacres of Christians in Armenia and Crete. He resigned in 1895, and the ensuing elections brought back the Unionists to office with a majority larger than had been known since 1832. Lord Salisbury's new Ministry, which included some Liberal Unionists, had to grapple with a succession of difficulties — the Venezuelan affair, complicated by President Cleveland's message, Dr. Jameson's raid in South Africa, complicated by Kaiser Wilhelm's famous telegram, oppression and anarchy in Crete and many parts of the Turkish Empire, and the campaign against the Dervishes on the Upper Nile.

To these matters we cannot advert. We can point out here only two chief facts in the political history of the century — the gradual effacement of the old party lines, and the curious periodicity in the political life of Great Britain. To dwell on the latter of these, it is clear that the main tendency has been toward democracy and industrial development by peaceful means — a tendency dominant in the periods 1816–1848, 1866–1874, 1880–1886, 1892–1895. The intervening years were marked either by the quiescence which comes naturally after great constructive efforts, or by the striving after national security and the consolidation of the Empire which results inevitably from the insular position and expansive force of a virile people. The century closed, as it began, amidst what may be termed the imperial impulse, of which industrialism has been the unconscious but all powerful feeder. The era of great production, coinciding as it does with one of militarism and protection on the Continent of Europe, imposes on England the need of looking and living beyond the seas to an extent unimaginable to the men of Nelson's generation. In this dualism of her interests, democratic and imperial, lies the great problem of her political life — a problem never to be solved but ever keeping her faculties tense and keen.

Bibliography.—We can name here only a few of the chief works dealing with the outstanding events of British political life and with the men who made history in the 19th century. Besides the text books on the English history of the period written by Dr. Bright and Dr. Gardiner, there are 'History of England — 1800–1815' and 'History of the Thirty Years' Peace — 1816–1846' by Harriet Martineau; 'History of England from 1815' (6 vols.) by Sir Spencer Walpole (continued up to 1900); 'A History of Our Own Times' by Justin McCarthy, (continued up to 1900, 4 vols.); 'Social England' (vols. V. and VI.) edited by Dr. Traill; 'The Political History of England,' vol. XI. (1801–1837) by Hon. G. C. Brodrick and J. K. Fotheringham; vol. XII. (1837–1901) by S. J. Low. Also the following biographies: 'Pitt' by Lord Rosebery (1 vol.) also by J. H. Rose (2 vols.); 'Life of Nelson' by Captain Mahan (2 vols.); 'Life of Wellington' by Sir Herbert Maxwell (2 vols.); 'George Canning' by H. W. V. Temperley; 'Peel' by J. R. Thursfield; 'Life of Palmerston' (1846–1865) (2 vols.) by Hon. Evelyn Ashlet; 'Life of Lord John Russell' by Spencer Walpole (2 vols.); 'Life of Cobden' and 'Life of Gladstone' (3 vols.) by John Morley; 'Life of Lord Granville' by Lord Fitzmaurice (2 vols.); 'Life of Lord Randolph Churchill' by Winston Churchill (2 vols.).

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8. (b). Great Britain — The Political Parties. Party government begins, in primitive society, with the struggle for power, the nature of which is determined in each case by local and tribal conditions, and by the influence of men who are or aspire to be leaders. At a later stage, when abstract logic is applied to questions of policy, the parties begin to argue from principles; they profess themselves friends of the people, friends of the better class, and so forth. The principles invoked are not scientific propositions; they are rather forms of language, such as are received with favor in a mixed assembly; the party-leader uses them so as to combine opinions and interests, to draw together a working majority. Each party borrows freely what seems to be effective and popular in the programme of its opponents. Moderate men of all parties think very much alike; they are kept apart by the personal struggle for power.

These general truths are well illustrated by the contest between Whigs and Tories in the 17th century. The Whigs were an aristocratic party, relying on the nobles, the landed gentry, and the City of London. Their principle was, the supremacy of the law: they were determined that the courts which administer the law, and the high court of Parliament which makes the law, should be freed from the arbitrary interference of the King. Moderate Tories did not undervalue the law; they argued that by law the King was entitled to obedience, and that the King then reigning had done nothing to forfeit his claim. The Whigs carried their point in 1688, by bringing in a foreign king, a capable, magnanimous man, not less firmly attached to his royal prerogative than the Stuart Kings had been. With the advent of the House of Hanover in 1714, Whig principles came once more to the front; for the first George and his son were Germans; they needed an interpreter between the King and the people; and the statesman who could manage the House of Commons was not, like Strafford or Clarendon, dependent on the support of his royal master. George III. on the other hand was a patriotic Englishman; he thought himself strong enough to choose his own ministers and to throw off the yoke of the Whig nobles. If he had possessed the administrative talent of Frederick the Great, he might have made himself the head of the Government and set himself above the parties. But King George was neither a great statesman nor a great soldier; he relied too much on the smaller arts of political management; and in the middle of his long reign he came under the influence of a minister whose commanding character excluded the king from the personal conduct of national business. It is to Pitt that we owe the outline of our modern constitution. At Windsor he was the servant of the Crown, arguing, often in vain, against the obstinate purpose of his master. In the Cabinet he was himself master; he chose his colleagues, and dismissed them when they opposed his policy. In the House of Commons, which was still an aristocratic body, his ascendency was never seriously disputed, and he filled the House of Lords with peers of his own creation. So it was that Pitt, by birth and training a Whig, became the founder of the new Tory party.

Pitt's opinions were those of an official Liberal. He wished to reform the electoral system, to remove religious disabilities, to relax the rigor of laws which prevented the expansion of trade. But the fates had imposed upon him the task of steering the ship of State through a period of wars and revolutions: the work of reform was postponed to the necessities of foreign and domestic policy. When the great minister died, his unfinished schemes fell into the hands of men with whom postponement was a settled habit. During the long Tory administration of Lord Liverpool there was, in principle, but little difference between the parties. The middle classes were impatient, and some of them joined the workingmen in declaring that neither of the aristocratic parties could be trusted. These independent men called themselves radical reformers, and they sympathized with the aspirations of democracy in America, in Ireland, and on the continent of Europe.

The Reform Act of 1832 was a Whig compromise; it failed to satisfy the Radicals, but it gave them a foothold which they never lost. It was indeed the first attempt to apply abstract principles to the English constitution, and it started a momentous process of change. Tradition was dethroned, and the old party names had become unpopular. The Whigs began to call themselves Liberals, a name which some of them declined, because it suggested humanitarian tendencies with which they were not in sympathy. Macaulay, for example, would not call himself a Liberal, because, as he said, he was in favor of "war, church establishments, and hanging." The Tories in their turn became Conservatives; they accepted the results of 1832, but deprecated any further change in fundamental institutions. The Radicals of that day were middle-class men, disciples of Bentham; they stood for cheap government, freedom of contract, and individualism. Socialism made its appeal to the unenfranchised laborers, but as yet without much visible success. The Factory Acts, for example, were carried by Tory humanitarians, against the opposition of Radical manufacturers. Free trade, when it came, was the work of a Conservative administration; the Liberals approved; the older Whigs, like Lord Melbourne, thought that Peel had betrayed the landed interest. Lord Derby, a hereditary Whig, was carried over to the conservative Tories by his fears for the Church and his dislike of free trade.

The conflicting tendencies of the half-century after the first Reform Act are summed up in the careers of two men who were to take a leading part in the transition to democracy. Disraeli entered life as a Radical; he was always hostile to the Whig oligarchy. His sympathies were with the Tories; his father, a quiet scholar, had taught him to take the side of the Stuart Kings, and to regard the old nobility as the true leaders of the people. If Peel had given him office, he might have become an orthodox Conservative; but the leaders of that party had no place for an able Jew, who lacked the public school and University stamp. Disraeli took his revenge by attacking Peel and his free-trade policy; his merciless wit gave him the ascendency, even with men who still distrusted him; he gained the confidence of Lord Derby, and in alliance with him began the construction of what was really a new party, the party of Tory democracy. In 1867 the new Tories took their famous "leap in the dark" by establishing household suffrage in the boroughs. The immediate result was a crushing Liberal victory; but in 1874 the forces of Tory democracy were strong enough to place their leaders in power. Six years later, the pendulum swung back, and Mr. Gladstone was once more supreme.

Lord Beaconsfield died in the moment of defeat, but his genius presides over the party which he formed, and profoundly affects the mind of the nation. He never concealed his belief that the conduct of public affairs, especially foreign affairs, must be left to sovereigns and statesmen. At the same time, he was always in sympathy with the aspirations of the workingmen. He was the only public man of his generation who perceived that Benthamite Liberalism was certain, sooner or later, to become unpopular, and he prepared the way for that modified socialism which is now the accepted creed of both parties. And again he perceived that Englishmen, without distinction of class, are conscious of their position as an imperial power, and determined to maintain it.

Disraeli himself, in his earlier days, had taken the narrower views of England's responsibility to India and the colonies; his later speeches are full of the sentiment of empire. Englishmen are all (to some extent) socialists now; and are all (in one sense or another) imperialists.

Mr. Gladstone began his career as the rising hope of Oxford Toryism. He was honestly afraid of Radicalism; he distrusted the Whigs; the mission of the Tory party was to "maintain truth" by supporting the Church of England. At the age of 30 he published his book on 'The State in its Relations with the Church' — a noble vindication of the Church as a spiritual society, pledged to maintain her conflict with sin and selfishness, a society to which the support of the State is not essential, but may, under proper conditions, be useful. It was in the interest of the State that Gladstone argued for the establishment and endowment of the Church. His argument was coldly received; the qualified approval of Peel, the scornful criticism of Macaulay, began to work a change in Gladstone's political mind. No criticism touched his ideal; but in the present age of the world the ideal was, perhaps, unattainable. If Whigs and Conservatives were equally unable to rise to his conception of the Church, if the price of establishment was to be subordination to the State, what then? The Church, to preserve her freedom and purity, might withdraw from the alliance, surrendering those of her privileges which might be found inconsistent with abstract political justice. Within a few years after the publication of his book, Mr. Gladstone was discussing the possible advantages of disestablishment.

Sir Robert Peel was not pleased to see an able young party man so preoccupied with ecclesiastical questions. He drew Gladstone into his ministry, placed him at the Board of Trade, and worked him very hard. In the transition to free trade, master and pupil moved steadily together. While Peel was leader, there could be no doubt as to Gladstone's party connection; when that guiding influence was removed, he was carried about by various kinds of doctrine. Though more than half a Liberal, he was still afraid of Radicalism. He approved of Lord Palmerston's passive resistance to the extension of the franchise, but this was his only link of sympathy with the coming leader of the Liberal party. There was much agreement between Gladstone and Lord Derby; both were Oxford Tories, and devoted Churchmen; but by this time Lord Derby was identified with Disraeli, and the Peelites would not serve under the man who had planted so many barbed arrows in the sensitive spirit of their chief. After long hesitation, Mr. Gladstone threw in his lot with the Liberals. In June 1859 he supported Lord Derby in a critical division; ten days later he took office under Lord Palmerston.

As a member of a Liberal Government, Gladstone stood committed to parliamentary reform. His Whig colleagues discovered with alarm that this late convert was not merely a reformer; he was a democrat. He declared, from the Treasury bench, that the laboring class had a moral right to come within the pale of the Constitution. There was now only one link between the Liberal champion and the Toryism of his youth; he was still member for the University of Oxford. That link was severed when the University rejected him in 1865. Mr. Gladstone appealed to the people of Lancashire, and entered on the first of those oratorical campaigns, which were to change the face of English politics.

The franchise question was settled, for a time, by the Tories in 1867, and the popular vote of 1868 was a personal vote for Mr. Gladstone. With a wide and varied electorate, and many interests competing for notice, the people are easily persuaded to accept the supremacy of one man, who, like General Jackson, "acts always for the good of the country." Under such conditions, the leader of opposition, if he knows his business, has his rival at a disadvantage. It is the men in power who have to make terms with foreign governments, and to protect the national purse; however well they do, it is always easy to show that they might have done better. Mr. Disraeli made good use of his opportunities, and in 1873 the tide of Liberal success was ebbing rapidly. Mr. Gladstone was alarmed, and he would fain have made his defeat on the Irish University question an excuse for bringing his opponents into office. Disraeli saw the snare and avoided it, and the wisdom of his tactics was justified by the Conservative victory of 1874. As a leader of opposition, Mr. Gladstone disregarded what were then supposed to be the conventions of party life. He retired from responsible leadership; returned to the field just at the moment when his action was most likely to embarrass his successors; and finally presented himself to the country as a candidate for power. In the election of 1880 his success was complete, and the death of Lord Beaconsfield left him without a personal rival. But once more the tide ebbed as rapidly as it had risen. In a few years it became evident that the Liberal party was hopelessly divided on three issues of cardinal importance — disestablishment of the Church, Home Rule for Ireland, and the schemes of modified socialism advocated by Mr. Chamberlain. Old badges and cries were out of date. Mr. Parnell was forming an Irish party, so severely disciplined that no member of it could break away or disobey orders. For a few eventful months there was also a Fourth Party, a small band of Tories who obstructed their own leaders, addressed themselves in a democratic spirit to the conservative rank and file, and made themselves so strong that in 1885 Lord Salisbury was compelled to take them into partnership.

At the general election of 1885, Mr. Gladstone endeavored to keep his party undivided by postponing all troublesome questions. He did not declare against Home Rule, but he pointed out the danger of allowing Mr. Parnell to hold the balance of power. This was his reason for asking the country to give the Liberals a majority large enough to make them independent of the Irish vote. In the event, parties were so distributed that the Conservatives and Parnellites, if combined, would be equal or superior in number to the Liberals. Mr. Gladstone accepted Home Rule. It would be quite unfair to represent his conversion as a bid for power and nothing more. The argument for Home Rule was a strong one, and both the great parties were studying it in a practical spirit. But, with a'l his vast experience of affairs, Mr. Gladstone was subject to illusions. He believed that the Irish demand, as presented by him to the electors of England and Scotland, would prove to 'be irresistible. In this belief he cashiered those of his supporters who refused to follow, and when the House of Commons rejected his proposals, he hurried on a "penal dissolution" and went again to the country. The "classes," he said, were against him; he appealed to the "masses." The masses responded by placing the Unionists in power.

In the Parliament of 1886–92 the Liberal Unionists occupied a position somewhat analogous to that of the Peelites in 1850. They were stronger in ability than either of the great parties; they sat on the Liberal benches, and co-operated steadily with the Conservatives. Lord Salisbury in office did himself no discredit; but he had to make himself responsible for unpopular measures. The Crimes Act of 1887 was in itself a moderate measure, but it was a deep disappointment to many who had begun to hope that Ireland might be governed without repressive legislation. A good many independent Liberals fell quietly into line with their old party; the swing of the pendulum was felt. In 1892 Mr. Gladstone became Prime Minister for the fourth time, and entered buoyantly on the task of framing a second scheme of Home Rule. When the scheme appeared, his party saw plainly that it was not an improvement on the Bill of 1886. Discipline was maintained; the Bill of 1893 was carried through the House of Commons, and it was darkly intimated that the House of Lords must accept it, or take the consequences. The Lords rejected the Bill by a very large majority. Mr. Gladstone was at the end of his physical resources; and Lord Rosebery was not the man to succeed where the old leader had failed. The election of 1895 vindicated the shrewd forecast of the Lords and restored Lord Salisbury to office.

From this time forth the Liberal Unionists were identified with the Conservatives; but in consenting to share the spoils of victory they did not withdraw the Liberal or Radical opinions which they had professed. Mr. Chamberlain, for example, has not withdrawn his objection to church establishments; he cannot, of course, give effect to his opinion so long as he retains his connection with the Unionist Party, which is pledged, as a party, to the defence of two established Churches. On that question no difficulty has arisen, but, at the height of its success, the party has been broken up by the controversy initiated by Mr. Chamberlain's attack on "one-sided free trade." As conceived by its author, the plan of modified protection has two aspects, socialist and imperialist. It aims at securing constant employment for the British workingman, and at consolidating home interests with those of the colonies by means of preferential tariffs. The plan has been advocated in a series of speeches which could hardly be excelled for clearness and force; but the electors are not convinced. In January 1906 the fiscal question held the field; and free trade carried all before it. The Unionist Party is left, for the moment, in a helpless minority: its leaders find comfort in recalling the precedents of 1841, 1874, and 1886 — the years in which the Conservative party recovered its ground after an apparently crushing defeat.

The Government in power is supported by the Whig Liberals and by the Radicals, who combine Manchester doctrines with modified socialism as best they can. In former Parliaments, labor members were few, and voted with the Liberals. They still prefer Liberals to Unionists, but their support is given in return for concessions which put a strain on the Liberal members of the Cabinet. On Irish questions, the Nationalists vote with Government, on the understanding that Mr. Gladstone's policy will be revived at an early date; but where Catholic schools are concerned that vote is hostile to the educational policy which commends itself to most Liberals. The Unionists' opposition is seriously embarrassed by differences of opinion in regard to free trade. Amid these currents and cross-currents, the leader of the moment must steer the best course he can; at any moment forces now in conflict with one another may combine to sweep him out of his place. We still defer to the notion that there are two great parties in the State; but the House of Commons has in fact become a collection of groups, like the Reichstag or the Chamber of Deputies.

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THE MECHANISM OF GOVERNMENT.

9. **Great Britain — Parliament.** The British Parliament has its roots deep in the past. It has legislated continuously for a period of more than 600 years, a record unapproached in the history of the world. It has been developed by successive stages from the Great Council of the Norman and Angevin Kings. Much of its ceremonial dates from Plantagenet times. The foundations of this procedure are imbedded in Elizabethan Journals. It holds its sittings in a royal palace, which, though for the most part modern in its structure, is venerable in its associations. The New Palace Yard, through which members of the House of Commons hurry to their daily duties, is the yard of the new palace which William Rufus built, and

which is still represented by Westminster Hall. There is scarcely a feature of Parliament which can be adequately described without long historical explanations.

Parliament consists of the King, the House of Lords, and the House of Commons, or, as described in the enacting formula of Acts of Parliament, the King's most excellent Majesty, the Lords Spiritual and Temporal, and the Commons. These are not as is often, but erroneously, supposed, the three Estates of the Realm. The clergy, who once counted as a separate Estate from the Lords and Commons, have long ceased to do so. The bishops, or some of them, sit, as Lords Spiritual, in the House of Lords. The inferior clergy are, for purposes of representation, merged in the laity, and represented in the Commons. An image of the full Parliament, as it existed in Plantagenet times, may still be seen when the King in person formally opens Parliament at the beginning of a session. The King sits on his throne, attended by his great officers of State. The benches of the House of Lords are occupied by the Lords Spiritual and Temporal, and by the peeresses. The judges, summoned as attendants, sit on their woolsacks in the middle. The Commons, as beseems their humbler station, find such room as they can, in or about the bar, with their Speaker at their head.

The King, acting on the advice of his Ministers, summons, prorogues and dissolves Parliament. He communicates with the two Houses by speech from the throne, commission, message and otherwise. He gives his assent to Bills by commission. But he does not take part in, or attend, the deliberations of either House. Since Charles I. attempted to arrest the five members no King or Queen has been seen inside the House of Commons. Charles II. sought amusement in listening to debates of the House of Lords, but his example has not been followed.

The House of Lords consisted at the end of 1905 of nearly 600 members, including 3 Princes of the Blood Royal, 2 Archbishops, 22 Dukes, 23 Marquises, 126 Earls, 31 Viscounts, 24 Bishops, 315 Barons, 16 Scottish and 28 Irish representative peers. There are more than 24 bishops, but there is only room for 24 of them to sit as peers in the House of Lords. A junior bishop has to wait, unless he holds the see of Durham, Winchester, or London. Representatives of the Scottish and Irish peerage are elected by their peers, Scottish peers for each Parliament, Irish peers for life. But many of the peers of Scotland and Ireland are also peers of the United Kingdom and sit as such. Of the barons a few hold life peerages, as being, or having been, Lords of appeal; the other Lords Temporal hold hereditary peerages.

The House of Commons consists of 670 members, 465 for England, 30 for Wales, 72 for Scotland, and 103 for Ireland. Single-member constituencies are the general rule, but in a few cases one constituency returns two members. Every male householder who has resided in his constituency for a year, and has paid or compounded for his rates, is entitled to be registered, and, when registered, to vote as a parliamentary elector for that constituency. This is the most general franchise, but there are others, including the occupation of lodgings rented at £10 a year, and the ownership or occupation of land or buildings of a certain value. Some of the universities return members, elected by their graduates. Women are not entitled to the parliamentary franchise. A proposal to abolish the plural vote, *i. e.* the right to vote in more than one place, is now before Parliament. Subject to disqualifications arising from peerage, holding of office, bankruptcy, and conviction of treason or felony, every British subject who is of full age is eligible as a member of the House of Commons. A peer of the United Kingdom or of Scotland is not eligible, but a peer of Ireland is eligible for any but an Irish seat. For instance Lord Palmerston was an Irish peer. Where a member of the House of Commons is described as a Lord, he is either an Irish peer, or, more frequently, a commoner holding a courtesy title as son of a peer. Members of the permanent civil service, and most judges, are ineligible.

The evidence of election is the return sent to the Crown Office by the returning officer at the election. If the validity of an election is disputed, the question is tried and decided by election judges appointed by, and from among members of, the High Court. A member must, before sitting or voting as such, except in the election of Speaker, take the oath of allegiance, or make an affirmation to the same effect.

The chief alterations in the electoral law which took place in the 19th century were the Reform Act of 1832 which abolished pocket boroughs and enfranchised the middle classes; the Reform Act of 1867 which, by establishing household suffrage and introducing the lodger franchise in boroughs enfranchised the urban working man, the Ballot Act, 1872, which introduced secret voting, the Reform Act of 1884, which enfranchised the rural laborer by extending household franchise to the counties; and the Redistribution of Seats Act, 1885, which made single member constituencies the general rule, and raised the number of seats to 670.

The two houses hold their sittings in the Palace of Westminster, which is appropriated to their use and to the use of the offices connected with them. The chambers in which they sit are so placed that, if the intervening doors are open, the King's throne at the south end of the House of Lords is visible from the Speaker's chair at the north end of the House of Commons. The House of Commons does not occupy the site of the old Saint Stephen's Chapel, which was burnt down in 1834, but is constructed on the same general plan, and does not provide sitting accommodation, in the body of the House, for more than about 300 out of the 670 members. For discomfort of crowding there is some compensation in case of hearing.

The accident that the House of Commons sits in a narrow room, with benches facing each other, and not, like most Continental legislatures, in a semi-circular space, with seats arranged like those of a theatre, makes for the two party system, and against groups shading into each other.

The duration of a Parliament is limited by the Septennial Act of George the First's reign to seven years, but its existence is always terminated by dissolution before the expiration of that period. The royal proclamation which dissolves one parliament always summons another.

There are, or may be, several sessions of the same Parliament. A session is terminated by prorogation, which is an act of the Crown, done on the advice of Ministers. The business of each session begins with a King's speech, which announces its programme, and ends with another King's speech, which reviews its proceedings. Each House has the power of adjourning its sitting from time to time. Thus it adjourns from day to day, and always adjourns for a short recess at Easter and Whitsuntide. The two Houses usually meet in February and sit till some time in August, but sometimes hold a late autumn sitting after an autumn recess. The time of meeting is practically fixed by the financial year, which ends on 31 March. Estimates for the ensuing financial year cannot well be got ready before February, and there is certain financial business which must be got through before the end of March.

Each House has its own staff. The Lord Chancellor is Speaker of the House of Lords, and is assisted by a salaried Lord Chairman of Committees. The House has a permanent clerical staff with the Clerk of Parliaments at its head. The Gentleman Usher of the Black Rod, who has a Yeoman Usher to assist him, summons the Commons when their attendance is required in the House of Lords, and performs certain other functions, mostly ceremonial.

The Speaker of the House of Commons is elected by the House from among its own members for each Parliament. He is the representative and spokesman of the House in its collective capacity (whence his name); he presides at meetings of the House; and he declares and interprets its law. He is independent of party, and his tenure of office is not affected by a change of ministry. His powers are more extensive than those of the Speaker of the House of Lords. He has an official residence, besides his salary. He is assisted by a Chairman and Deputy-Chairman of Ways and Means, who take the chair at meetings of a committee of the whole House (there are temporary chairmen also) and who can take the Speaker's place as Deputy Speaker during his temporary absence. These are the only members of the House who receive salaries as officials of the House.

The Clerk of the House of Commons is the head of its clerical staff. The Sergeant-at-Arms sees to the maintenance of order within the precincts and to the execution of the orders of the House, and, as Housekeeper, looks after its domestic staff and arrangements.

The law of Parliament consists of the rights, usages, practice and regulations of each House. It may be classified, from a Benthamic point of view, as a substantive law of rights and privileges, and an adjective law of procedure; or, again, as an unwritten customary law to be gathered from precedents and decisions, and an enacted law to be found in orders of the Houses. The substantive law would include the rules which govern the rights of each House, or of the individual members of each House, in their relations to each other, to the Crown, to the executive and judicial authorities of the country, and to individuals and bodies outside Parliament.

The privileges which are formally claimed by the House of Commons by its Speaker at the beginning of each Parliament, bulked large in the 17th century controversies between the King and Parliament, and were much insisted on by the Commons of the 18th century, but in the 20th century have retired into the background. The cases in which a member of Parliament, as such, can claim any exceptional privilege or immunity are now few and rare.

The House of Lords is not only a branch of the legislature but the ultimate court of appeal from the ordinary courts of the United Kingdom. (Appeals from the colonies and dependencies and ecclesiastical and certain other appeals lie to the Judicial Committee of the Privy Council.) It performs its judicial functions exclusively through those of its members who hold or have held high judicial offices. It holds its judicial sittings in the morning, and can sit judicially when the legislature is not sitting. For legislative and general business, its sittings begin at 4.15 in the afternoon and, as a rule, are not of long duration. The cases in which they extend over the dinner hour are exceptional. It does not sit on Wednesday or Saturday.

The House of Commons, when in session, sits from 2.45 to 11 on Monday, Tuesday, Wednesday and Thursday, and from 12 to 5 on Friday. It begins with uncontentious private bills and other formal business. Questions to Ministers (which are not put on Fridays), occupy or may occupy the time till 3.45. As soon as questions have been disposed of, the public business of the day begins. Opposed business is not taken after 11, unless it belongs to a special "exempted" class, or unless the eleven o'clock rule is suspended.

The business of the House of Commons is three-fold, legislative, financial, critical. It makes laws with the concurrence of the House of Lords and of the Crown. It imposes taxes and appropriates revenue. By means of questions and discussions, it criticizes and controls the action of the executive.

While a project of law is before either of the two Houses it is called a Bill. When it has received the royal assent it is called an Act. A bill may be introduced into either House by a member of that House. When it has been introduced, it is read a first time and is printed by order of the House. The stage of first reading is formal. On the second reading questions of principle are discussed. If the second reading is affirmed, the bill goes to a committee, which, in the House of Commons, is either a committee of the whole House, or one of the standing committees on bills, or a select committee. In the absence of special order it goes, under the existing orders, to a committee of the whole House.

A committee of the whole House is really the House itself sitting in a less formal manner, presided over by a chairman at the table, the Speaker's chair being vacant, and freed from some of the restrictions which attach to proceedings when the Speaker is in the chair.

The standing committees on bills, of which there are at present two, are constituted by the committee of selection, and are intended to be microcosms of the whole House. Each of them consists of not less than 60 members, and the quorum of each is 20.

A select committee is appointed by the House, and its members are nominated by the House itself, or, in some cases, either wholly or partially by the committee of selection. The nomination of members by the House is made in pursuance of arrangements between the "whips" of the several parties. There may be joint select committees of the two Houses. When a bill has gone to a select committee, it must subsequently pass through a committee of the whole House, but this is not a case with a bill sent to a standing committee.

At the committee stage a bill is gone through clause by clause, and amendments are proposed, discussed, and, if agreed to, made in the bill. When the consideration of a bill in committee is concluded, it is reported to the House, with or without amendments, as the case may be. On consideration of the report, there is an opportunity for making further amendments.

The next stage is the third reading. In the House of Commons this is the final stage, and only verbal amendments can be proposed. In the House of Lords substantial amendments can be moved at this stage, and also on the subsequent question, not put in the House of Commons "that this bill do pass."

When a bill has been passed by either House it is sent by message to the other House to pass through its several stages there. If the second House amends a bill thus sent to it, it requests the concurrence of the originating House in the amendments. Should the two Houses differ, amendments and counter amendments pass to and fro until an agreement is arrived at. But if no agreement can be arranged, the bill drops. If a public bill is not either passed or withdrawn in the course of a session, it lapses at the end of the session.

The final stage of a bill is the royal assent, which is given, by commission, in the House of Lords, in the presence of representatives of both Houses. As the King can only act on the advice of his Ministers, who presumably command a majority in one of the two Houses, the royal assent to a bill is now given as a matter of course. The last instance of refusal was in the reign of Queen Anne.

A distinction is drawn between public bills, the object of which is to alter the general law, and private bills, the object of which is to alter the law relating to some particular locality, or to confer rights on or relieve from liability some particular person or body of persons. The procedure on private bills differs materially from that on public bills, and is governed by a different set of standing orders.

Every private bill goes, after second reading, to a small committee, before whom, if the bill is opposed, witnesses are called and counsel heard. The proceedings before these committees are quasi-judicial in their nature. Many things which used to be done by private bills, are now done by provisional orders, which are made by a public department, after local enquiry, and when made, are confirmed by provisional order confirmation bills, to which they are scheduled. Sometimes, to prevent hardships, the proceedings on a private bill are continued, by special order, to another session.

The right of granting money in Parliament belongs exclusively to the House of Commons. The House of Lords assents to, and may reject, a grant of money, but cannot initiate or alter a grant.

The right of the House of Commons to grant or raise money is subject to two important restrictions. It cannot vote money except in pursuance of a request from the Crown. It cannot impose or increase a tax unless the tax or its increase is declared by the constitutional advisers of the Crown to be necessary for the public service.

The demand by the Crown for the grant of money for the service of each financial year is made in the speech from the throne at the beginning of each session. As soon as practicable afterward estimates are presented to the House showing the amount which will be required for the public service. Supplementary financial estimates for the current financial year are also, if necessary, presented. The ordinary annual estimates are presented in three parts or divisions, each comprising one of the three branches of the public service, namely, the navy, the army, and the civil service. Each estimate contains first, an estimate of the total grant thereby demanded, and, then, a statement of the detailed expenditure under each grant, divided into subheads or items. For the purpose of considering these estimates, and voting the money required, the House resolves itself, at the beginning of each session, into a committee of the whole House, which is called the committee of supply. Not less than 20 days must be allotted in each session for the sittings of this committee. Votes which have not been previously considered and disposed of by the committee are passed *en bloc* at the end of the session. When the resolutions for the votes have been passed by the committee they are reported to and confirmed (technically "agreed to") by resolution of the House. Resolutions authorizing the grant out of the Consolidated Fund of the money required to make good the supply voted in committee of supply are passed by another committee of the whole House, called the committee of ways and means, and are also confirmed by resolutions of the House. And these resolutions are finally confirmed by one or more Acts of Parliament called Consolidated Fund Acts, and by the annual Appropriation Act which is passed when the supply for the year has been disposed of. Before the end of each financial year, a vote on account is always necessary to supply the current expenses of the civil service during the next financial year, and, for a similar reason, a sufficient amount of money must also be voted for the Navy and Army, in whose case there is greater facility for transferring money provisionally from one vote to another. A Consolidated Fund Act confirming these votes must also be passed before the end of the financial year, *i. e.* before March 31. It follows from the principles laid down above, that the committee of supply and the House can reduce, but cannot increase, a grant asked for by the estimates. Nor can they alter its destination.

Once a year the Chancellor of Exchequer, in committee of ways and means, makes his annual budget statement, reviewing the revenue and expenditure of the past financial year, estimating the revenue and expenditure for the next financial year, and proposing such increases or remissions of taxation as are in his opinion required for, or justified by, the position. These proposals are embodied in resolutions which, when passed by the committee of ways and means, and agreed to by the House, are confirmed by an Act of Parliament, called the Finance Act of the year. Here again the House and its committee can dissent from, or reduce, a proposed tax, but cannot impose or increase a tax.

Under the Cabinet system the executive government is dependent on the support of Parliament, and, in particular, of the House of Commons. The King appoints a Prime Minister who can command a majority in that House. The Prime Minister selects the members of his Cabinet, and the holders of minor political offices, from among those of his followers who have, or are likely to have, seats in one of the two Houses. The Ministry as a whole, and each Minister separately, is responsible to Parliament, and particularly to the House that supplies the money without which government cannot be carried on. If a Ministry cannot retain the confidence of that House the Prime Minister must either resign or appeal to the country by a dissolution of Parliament.

The control of the House of Commons over the executive Government can be exercised, not only by withholding assent to the legislative and financial proposals of the Government, but in various other ways. Thus it can obtain information as to the proceedings of the Government by means of questions and of orders for the production of documents.

Any member has the right to address a question to any Minister of the Crown, being also a member of the House, about the public affairs with which he is officially connected, or a matter of administration for which he is responsible. The proper object of such a question is to obtain information on a matter of fact within the special cognizance of the Minister, and the rules and practice of the House limit the right to ask questions so as to confine them to this object. Except in special cases, notice of any such question must appear on the notice paper at least one day before the answer is to be given. If a member wishes his question to be answered orally, he marks it with an asterisk, and a time is set apart at the beginning of each afternoon sitting for the answering of such questions. Debate is not allowed during this period, but an unsatisfactory answer may, if the matter is of sufficient urgency and importance, give rise to a motion for adjournment, so as to provide opportunity for discussion at a later period of the day.

The House can, on the motion of any member, obtain returns supplying such information on matters of public importance as is obtainable through departments of the Government. A motion for a return may be opposed on grounds of public policy, such as that the disclosure of the information sought is not for the public interest, or that its supply would involve unreasonable labor and expense, but much information thus sought is periodically supplied in the form of "unopposed returns." The Government can also, and frequently does, on its own initiative, lay papers before the House. Such papers are known as "Command Papers." These returns and papers, together with the returns presented in pursuance of directions contained in Acts of Parliament, and the Reports of Parliamentary Committees and of Royal Commissions, make up the formidable mass of official literature popularly known as "Blue Books."

But the principal opportunity for criticising the administrative action of the Government is afforded by the discussions in committee of supply, for which, as has been stated above, a minimum number of days must be set aside in each session. On the old principle that redress of grievances should precede the grant of supply, the action of each Minister and of the departments and officers over whom he has control, can be discussed on the vote for the branch of expenditure concerned. As has been seen, the House can reduce but cannot increase expenditure proposed by the Crown, and therefore any complaint made in committee of supply must be based on a motion for reduction of a vote, even, paradoxical as it may seem, though it be a complaint of insufficient expenditure. Other opportunities for criticising the action of the Government and raising questions of public policy are supplied by the debate, at the beginning of each session, on the address in reply to the speech from the throne, by debate on motions which must be made when the House first goes into committee of supply on the navy, army, and civil service estimates respectively, by the evening sittings appropriated to the discussion of private members' motions, by the second and third reading stages of the Consolidated Fund Bills and the Appropriation Bill, and by the motions which have to be made for the adjournment of the House over a recess.

A full account of parliamentary procedure would be impossible here. Some points have been touched on above, a few others may be briefly noted.

Each House has power to make its own orders, supplementing or modifying its customary rules of practice. A standing order continues in force until repealed. Other orders may be made for a particular session, for a more limited period, or for a particular occasion.

In the House of Commons any question of the law or practice of the House is decided, as a point of order, by the Speaker, or, in committee, by the chairman.

In the House of Commons, government business has precedence at most sittings, and Thursdays are usually devoted to committee of supply. Private members' bills have precedence on Fridays, and private members' motions have precedence, during part of the session, between 8.15 and 11 on the evenings of Tuesday and Wednesday.

The quorum of the House of Commons, and

of a committee of the whole House, is 40. (In the House of Lords the quorum is 3.)

A matter requiring the decision of the House or of a committee is decided by means of a question put from the chair on a motion proposed by a member.

If the opinion of the Speaker or chairman as to the decision of a question is challenged, he allows two minutes to elapse, in order to enable members to assemble, and then puts the question again. If his opinion is again challenged he directs the Ayes to go to the right and the Noes to the left, and appoints two tellers for each. The Ayes and Noes then pass through their respective division lobbies, on each side of the House, their names are taken down by the division clerks, and they are counted by the tellers, who announce the result at the table of the House.

If a debate on a question is unduly protracted, it can be terminated by means of what is called the closure, the procedure on which is as follows: A member rising in his place may claim to move "That the question be now put," and, unless it appears to the chair that the motion is an abuse of the rules of the House, or an infringement of the rights of the House, this preliminary question must be put forthwith, and, if it is carried, the main question is put forthwith and decided without amendment or debate. But a motion for the closure cannot be made unless the Speaker or the chairman of ways and means (or, in certain cases, his deputy) is in the chair, and is not carried unless it appears on a division that not less than 100 members voted in its support. The result is to leave to the chair discretion as to the time and circumstances in which closure should, with propriety, be granted.

The Speaker and chairman are also clothed with powers for checking irrelevance, prolixity, repetition and obstruction, for preventing the abuse of dilatory motions, and for maintaining order and decorum. If a member is guilty of grossly disorderly conduct, the Speaker or the chairman of a committee of the whole House can order him to withdraw from the House. If a member disregards the authority of the chair, or abuses the rules of the House by persistently and wilfully obstructing its business, he can be "named" for the offence by the Speaker or by the chairman of a committee of the whole House, and the House can, on motion made, make an order suspending him from the service of the House for the rest of the session. Orders of this kind, when made by the House, or by the Speaker or chairman, are enforced if necessary by the sergeant-at-arms with such assistance as may be required. In the case of grave disorder arising in the House, the Speaker may, if he thinks it necessary, adjourn the House without question put, or suspend the sitting.

The Parliament at Westminster is not only the oldest, but the mother of all existing Parliaments. Those who framed the constitution of the United States took the British constitution as their model, but studied it through the spectacles of Montesquieu, and thus brought about that separation between the executive and the legislative powers which makes such an essential difference between the British House of Commons and the American Congress. English Parliamentary procedure has made the tour of the world. The rules adopted by the French assembly after the Restoration were based on a sketch of English parliamentary procedure supplied to Mirabeau by Dumont. The influence of English practice, derived either directly or through the medium of France, can be traced in the procedure of all Continental legislatures. Thomas Jefferson, when President of the United States, drew up for the use of Congress a manual consisting largely of extracts from English parliamentary precedents, and Jefferson's Manual is still an authoritative work. Every legislature of a British Colony conforms to the rules, forms, usages and practices of the British House of Commons, except so far as they have been locally modified. Of all parliamentary institutions throughout the world the Parliament at Westminster remains the archetype.

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COURTENAY ILBERT,
Clerk of the House of Commons.

10. Great Britain — Crown and Cabinet. The crown is a chattel, and is kept in the Tower of London. But the genius of the British race, striving unconsciously toward the expression of national unity and permanence, has come to personify it as a power, which, though necessarily wielded by or in the name of an individual ruler, exists independently of the lives of kings and queens. The materials of which the crown is composed will outlast the lives of many rulers. Whilst they are mortal, is it not, in the strictest sense, immortal?

The late Dr. Hearn pointed out, in his admirable work entitled 'The Government of England,' that, in spite of the progress toward democracy of the 19th century, the British Constitution remained, in a very real sense, a monarchy. Not only is it still true that, as regards all foreign communities, the Empire is represented by the monarch alone, and that it would be a gross breach of political etiquette for any person or body to attempt to open up any other channel of official communication with a foreign community, but it is equally true, that every internal act of State — legislative, executive, or judicial — both in the United Kingdom and in the dominions beyond the narrow seas, is done in the name of the monarch, and that no such act can be *ultra vires.* It is of the essence of the British conception of State sovereignty that the monarch is incapable of committing legal wrong.

This apparently Oriental dogma is, however, balanced by the equally fundamental doctrine, that for every political act of the monarch there is an appropriate agent, and that such agent acts at his peril. In some cases, the peril is remote and uncertain; in others it is prompt and definite. The Parliament which advises bad legislation is amenable only to the judgment of the electors expressed at the polls. The judge who abuses his office, though he may be dismissed by the monarch for actual illegality, is amenable, so far as the citizen is concerned, only to the vote of Parliament. But the executive official who breaks the law is liable to an action in the ordinary courts by the humblest citizen whom he has injured; and his plea of "superior orders," though it may involve the superior also in liability, will not absolve the actual delinquent. And thus, inasmuch as, in the enormous complexity of State action, it is hardly possible for the personal act of the monarch to reach the individual except through the hands of some intermediary, the subject is rarely without redress. Even the House of Lords, the greatest anomaly in the Constitution, can be made to feel the pressure of public opinion.

The Independence of Ministers.— The natural consequence of this fundamental principle of the responsibility of the Crown agent is the independence of the agent toward the Crown. Historically speaking, the claim of independence was first put forward by the judiciary, whose members, though for centuries both in law and in fact the servants of the monarch, liable to dismissal at pleasure, succeeded, before the end of the Middle Ages, in banishing the king from his own law courts, and in acting as an independent department of State. Down to the end of the 17th century, their success varied with the political balance of power; but it was assured, soon after the Revolution, by the Act of Settlement, which, in fact, made the judges independent of the Crown, though still, technically, liable to dismissal for actual misconduct.

Meanwhile, Parliament, a later institution than the courts of law, had, by a series of struggles which have made it famous in the world's history, succeeded, not merely in emancipating itself from the control of the monarch, but in establishing itself as an essential part of the national government. The history of these struggles is told elsewhere.

Here it is sufficient to remember that, on his restoration to the throne, Charles II. realized that Parliament could be cajoled, but could no longer be bullied. Even the enthusiastic loyalty of the Restoration Parliaments would not tolerate violence, though it fell a somewhat easy prey to the more sinister influence of corruption.

The Executive was much longer in securing its independence. Down to the Revolution, the holders of executive offices were, in fact as well as name, "His Majesty's servants." Outside legislation and judicature the personal will of the king directed the policy of the country, subject only to the indirect check of a refusal by the House of Commons to grant supplies. But, with the accession of a foreign ruler, in the person of William III., and a renewal of the foreign element with the accession of the House of Brunswick, affairs rapidly changed. William was absorbed in great foreign schemes, and left home affairs to his Ministers. Anne was lethargic, and indifferent to matters which did not concern her personal comfort or the interests of the Church. George I. knew no English, and soon ceased to attend meetings of the Council, except purely formal meetings where his presence was absolutely essential. Thus the real control of affairs passed into the hands of the great officials of State.

At this point there was a real danger (not sufficiently appreciated by English historians) that the government of England would become a bureaucracy, each department in effect the private preserve of its chief, pursuing its way regardless of, or even in opposition to, the other departments, and intriguing for power and privilege. From this danger the country was saved by the peculiarities of the political situation, and by the financial power, based on long established tradition, of the House of Commons.

Ministers and the House of Commons.— During the first half of the 18th century, the dominating feature of the political situation was the possibility of a Jacobite restoration. So long as the throne was occupied by a daughter of James II., or even by the husband of one of those daughters, the country accepted the Revolution settlement with acquiescence, if not with enthusiasm. But, when it became clear that Anne would die childless, the hopes of the Jacobites revived. It was with difficulty that the Queen herself had been brought to accept the scheme of the Act of Settlement of 1700, by which the succession to the throne, on the failure of her issue, had been settled on the Princess Sophia of Hanover, the granddaughter in the female line of James I. The politically useful legend, that the "Old Pretender" (the son born to James II. on the eve of his flight) was a supposititious child, had long been exploded; the child himself, now a young man of winning personality, was prepared, at Anne's death to vindicate the claim which had passed to him on the death of his father; and the Queen was believed to sympathize fully with his ambitions. The House of Hanover was regarded as a mere stalking-horse for the ambitions of the Whig statesmen; and the first two of its princes to occupy the throne of Great Britain and Ireland were looked upon by the mass of the people as foreigners. In 1715, and again in 1745, the fate of the throne trembled in the balance.

Thus the Ministers of George I. and George II. carried their lives, or at least their fortunes, in their hands. A Jacobite restoration meant, at the very least, banishment and confiscation for them, if not something worse. They could not afford to run unnecessary risks.

There can be little doubt that the Whig leaders would have been glad, in spite of their constitutional principles, to dispense with the presence of Parliament during these troubled years. Apart from the possibility — the probability — that it might result in an accession of strength to the Jacobites in the House of Commons, there was always the fear that the license of a General Election would be made the cover of a Jacobite *coup de main*. This fear is shown by the striking step taken soon after the accession of George I.; when the Parliament, at the urgent instigation of Ministers, prolonged the term of existence, not merely of its successors, but of itself, from three to seven years, by the Septennial Act of 1716.

Fortunately, however, it was not possible for the Whig leaders to dispense with the assistance of Parliament; and this for the good old reason which had for so long been the sheet-anchor of Parliament in its struggle for power. In spite of the large hereditary revenue settled upon the Crown at the Restoration, and the rich inheritance of the Crown lands, George I. and George II., like their predecessors, continually needed money; and the only stable source of money was a vote of the House of Commons. The chief secret of Walpole's favor at Court, as well as of his ascendancy over his colleagues, was the power which he possessed of securing this vote. For the first time in the history of England, the power of the Executive depended, openly though not officially, on the fluctuating moods of the representative House.

Gradually, then, by the teaching of events, the Ministers of George I. and George II. began to realize the conditions upon which Cabinet government depends for its success. It was necessary, if they were to prevent the commission of blunders which might bring down the dynasty and its supporters in one common ruin, that they should, in fact, control the action of the king. To secure this control, naturally very distasteful to monarchs brought up in the absolutist traditions of mediæval Germany, it was necessary that they should (under forms of deferential politeness) be able both to coerce and to bribe the occupant of the throne. So long as they acted as individuals, the former object was unattainable; for both George I. and George II. were quite shrewd enough to be able to play off one rival against another. But a threat of resignation by all his Ministers at once was more than a foreign ruler, ignorant of the temper of his subjects and of the machinery of government, could safely disregard. Equally was it desirable, if not essential, that Ministers, if they desired to bribe the king, should act together. For the means of bribery were only to be obtained from the House of Commons; and that House, though it doubtless regarded this new harmony of Ministers with deep suspicion, found it more difficult to refuse supplies demanded by the unanimous voice of the Government, than when it could plead as an answer to the demands of one Minister, that his colleagues differed from him as to the wisdom of his plans. Thus gradually, from no very honorable motives, but as a mere counsel of expediency, Ministers acquired the habit of talking over their plans together; and the rival, and often openly quarrelling Ministers of William III. and Anne, were replaced by the Cabinets of George I. and his son. No doubt the unanimity, such as it was, was mainly superficial; but, for all that, in a matter wherein appearances counted for much, it was important.

The Modern Cabinet.—So much it seemed necessary to say to account for the appearance in English politics of a phenomenon so remarkable as the Cabinet, and so difficult to refer, for an explanation of its origin, to any particular crisis or any official document. Indeed one of the most striking features of the Cabinet system is its wholly informal character — a feature which adds both to its utility and to its interest as an object of study. It is natural, no doubt, that no one but those who have taken part in its proceedings should be able to speak authoritatively of the details of the working of a great political organ. But it is none the less curious that, until the appearance of the masterly essay of Bagehot, entitled 'The English Constitution,' in 1867, even the general outlines of the system by which they had in fact been governed for upwards of a century should have been unfamiliar to a people so keenly interested in politics as the British. And yet that such was the case is shown by the almost ludicrous difficulties experienced by the self-governing colonies of Australia, when, in the 50's, they endeavored to introduce it into their new Constitutions.

But here we must leave the historical method, passing by the vigorous but unsuccessful attempt of George III. to overturn a system which he thoroughly disliked, the brilliant new development introduced by Pitt in his gallant struggle against the coalition of Fox and North in 1784, the remonstrance made by Queen Victoria against the application of its principles to the famous "Bed-chamber" question in 1839, and the more successful vindication of her rights by the same monarch against Lord Palmerston in 1850. Let us make some attempt to enumerate the essential features of the system as it exists to-day.

Its Executive Character.— The first point to notice is, that the Cabinet is not a mere council of political experts, but a body of working administrators. With one or two exceptions, each of its members is actually responsible to Crown and Parliament for the conduct of some department of State. It is true that he is, almost invariably, chosen rather for his general political importance than for his skill in the affairs of his department, *i. e.* an office is found for him because his presence in the Cabinet is desirable. But, none the less, the official character of its members gives the Cabinet a power which no mere advisory council could ever exert. Not only is the Cabinet aware of the awkward secrets of public business, and the practical difficulties of carrying out any line of policy, it is its own executor; for, except in the improbable case of disloyalty to his colleagues, the Minister to whose department the carrying out of that policy belongs, at once insists upon its adoption by his subordinates, the officials of his department.

Its Parliamentary Influence.— In the second place, and still more important, the Cabinet wields vast Parliamentary influence. In effect, its members are invariably members of Parliament, though, legally speaking, no one of them need be; and most of them are men of commanding personal weight in the House of Commons. We have seen how the necessity of conciliating Parliament was forced upon the Ministers of George I. and George II. It is now fairly well understood that the influence exercised by those Ministers was obtained by means not the most creditable. But the death-blow to Parliamentary corruption, already checked by the Place Act of 1742, was dealt when Pitt appealed from the House of Commons to the country in 1784; and the *coup de grace* was given by the Reform Act of 1832. Since that date, the place of the old sinister influence of the "spoils" has been taken by the organization of the party system (see POLITICAL PARTIES); and the substitution of examination for patronage, in the vast mass of appointments to the permanent Civil Service, has rendered the working of the party system comparatively pure. For the most part, Ministers control Parliament by the support of followers who honestly believe their policy to be good, or, at least, the best available; and such corruption as exists is confined to the polling booths.

The Escape of 1705.— One of the most curious facts in the whole history of the Cabinet is that this control of Parliament by Ministers was very nearly becoming, so far at least as the House of Commons was concerned, a legal impossibility. The Act of Settlement of 1700 (so often alluded to) contained a clause expressly excluding from the representative House all holders of office under the Crown. This part of the Act, however, was not intended to take effect until the accession of the House of Hanover; and, before that date, it had been repealed by another Act of the year 1705. But neither the statesmen of 1700 nor those of 1705 appear to have had any idea of the importance of the question.

Dependence of the Cabinet on the House of Commons.— But it is of the first importance to remember that the influence of the Cabinet on Parliament is at least counter-balanced by the influence of Parliament on the Cabinet. Apart from the general attitude of the House of Commons toward Ministers, which is, of course, vital, the opportunities which occur in both Houses for criticising every action of the Executive are of daily occurrence during the session of Parliament. In fact, one of the chief cares of the Prime Minister in forming his Cabinet is to provide acceptable champions of its acts in either House. It is a constitutional maxim, that every Department must be represented in both Houses, so that there may always be present some responsible Minister to explain and give information upon any point of administration which any member of either House may choose to raise. This explanation and information are rendered chiefly in the form of answers to questions of which due notice has been given; and a glance at the Question-Paper for any day will reveal the vast and detailed mass of information which Ministers must be prepared to supply to Parliament. A Minister can, of course, plead "reasons of State" for withholding information. But such a plea is apt to provoke suspicion; and if, for that or any other reason, the reply of a Minister is not considered satisfactory, further steps can be taken (such as a motion for adjournment, a proposal to reduce the Estimates, or even a vote of want of confidence), in order to impress upon a Cabinet the error of its ways. The discussion on the Budget is the grand opportunity for criticism of the Executive by Parliament; and, though the power is sometimes abused, it cannot be denied that the constant liability of Ministers to justify their conduct in Parliament is one of the most valuable principles of the Cabinet system.

But the essential character of that feature of the Cabinet system which we are now discussing, is best proved by the unquestioned rule of constitutional custom: that a Cabinet defeated on an actual vote in the House of Commons must instantly either resign or persuade the king to dissolve Parliament. The former alternative, established by the resignation of Walpole in 1742, on the apparently irrelevant question of the Chippenham election, was long thought to be the inevitable sequel of defeat in the House of Commons. But Pitt, in 1784, added the second alternative, with striking success. Whether the king is bound to grant a dissolution upon the request of a Cabinet, is a delicate question which is said to turn on the point whether the Cabinet was in office when the previous General Election occurred. If so, the country has pronounced its opinion; and the Cabinet is not entitled to a second verdict. Probably, however, the true doctrine is, that if there is any reasonable probability of the Cabinet securing a majority in the country, it is entitled to a dissolution. Needless to say, if the verdict of the polls is against it, the Ministry at once resigns, as Gladstone's Government did in 1874, and Lord Beaconsfield's in 1880. It may be incidentally remarked, that the fall of the Cabinet results in the resignation of about 30 other high officials, *e. g.* the law officers, the under-secretaries of State and the chief household officials, who, though not members of the Cabinet, are more or less in its confidence, and are, in contrast to the permanent officials of the civil service, "liable to retire from office on political grounds." These removable officials, together with the Cabinet, constitute the "Government" or "Ministry."

Informal Character of the Cabinet.— The third cardinal principle of the Cabinet system is its completely informal character. The Cabinet is indifferently described as a committee of Parliament and a committee of the Privy Council; but, in law it is neither. It is true that in each House of Parliament there is a Ministerial (not a Cabinet) bench; and that, in the House of Commons, the Cabinet wields a great and growing control over business. None the less, it is undoubted that its members sit by virtue of their membership of the House, and not by virtue of their offices, and that the measures which they propose, though commonly called "Government measures," are, with the exception of financial proposals, technically brought forward in their capacity of influential members of the House, and not as Crown officials. Even the King's Speech, though unquestionably drawn up by the Cabinet, is delivered in the House of Lords by the King himself or by special commissioners; while in the Commons it is read by the Speaker, who is not a Government official.

On its executive side, the Cabinet is equally informal. Its members are always made members of the Privy Council, in order that the oath of secrecy may be administered to them. But, as a body, it has no legal existence. It is never constituted by Order in Council, the Clerk of the Council is not present at its meetings, no minute or record of its proceedings is made, no decrees or orders are issued in its name, and it is never alluded to in Acts of Parliament, though the phrase "Responsible Minister of the Crown" is once or twice to be found in the Statute-Book. The various departments, such as the Admiralty and Treasury Boards, have, by tradition or statute, certain limited powers of issuing orders and regulations; but, in the vast majority of cases, the deliberations of the Cabinet appear in the guise of Orders in Council, *i. e.* commands of the King, issued by the advice of the Privy Council, or in the form of simple executive acts of the Crown, signified through the appropriate Minister. Both these classes of acts always receive the personal approval of the King, in whose name they are done, though the approval of the Privy Council is a pure formality.

The Unity of the Cabinet.— Fourthly, the unity of the Cabinet is expressed by the Prime Minister, though it is only within a very short time (January 1906) that the existence of the working head of the Ministry has been formally recognized, and that only by a place in the official Table of Precedence. No Prime Minister's department exists, though the Estimates have recently provided for two or three private secretaries. Like his colleagues, the Prime Minister is simply the holder of an executive post, though it is usual to appoint him to a well-paid sinecure, in order that he may have time to devote to the general policy of the Government. But even this practice is very recent. Walpole, who really created the position of Prime Minister, always declined to assume the designation; and the fiction was long maintained by the unwise practice of charging the holder of the position with the actual cares of a working department, such as the Foreign Office or the Exchequer.

And, even now, the precise relations between the Prime Minister and the Cabinet as a whole depend more upon the nice balance of circumstances than upon any well-defined tradition. The fact that the Prime Minister has been charged with the formation of the Ministry, a fact which in itself is usually (though not always) a consequence of his election as leader of his party whilst in Opposition, necessarily gives him a strong position with regard to his colleagues, who are, in a sense, his nominees. This advantage is strengthened by the rule that the collective decisions of the Cabinet are always communicated to the King by his mouth, whilst his prominence in the public eye tends also in the same direction. But the desirability of including in a Ministry the ablest and most popular members of the party, the desire of avoiding any appearance of schism in the ranks of the Government, and the almost unfettered discretion conceded to individual Ministers in the administration of their own departments, upon the business of which they communicate directly with the King, all combine to prevent the leadership of the Prime Minister, in normal circumstances, solidifying into actual control. Whether this result is desirable or not, may be regarded as an open question. On the one hand, a weak Prime Minister is said to imply a weak Cabinet; and the moral is pointed by a reference to the history of the recent Balfour Government. On the other, a Prime Minister of overpowering strength is not without his drawbacks. It is often said, for example, that the Liberal Party was driven into its long exile in 1895, because, in the later days of his leadership, none of his colleagues was "able to stand up to Mr. G."

The Position of the Crown.— In concluding this brief sketch of the working of the Cabinet system, it may be well to anticipate a criticism which every succinct account of the working of British politics is likely to raise in the mind of a reader not himself personally familiar with its atmosphere. A foreign observer may well be expected to say, though it would hardly ever occur to a Briton to say: "What then is the use of the King, if he is merely the mouthpiece of his Ministers; if, except on the rarest occasions, he is bound to accept the advice tendered to him by his constitutional advisers? Does it not really seem as though the famous proposal for a 'cast-iron king' would fit the present British Constitution?"

The first answer to this criticism is the reminder that, though politics are an important side of public life in the British Empire, they do not by any means exhaust its interests. And the occupant of the throne is by no means confined to the sphere of politics. As the head of society, as the patron of religious, charitable, and scientific enterprises, as the encourager of art and sport, as the focus of that spectacular world which, even to the phlegmatic Briton, is no small share of his existence, the opportunities of the monarch are unlimited, and his personal discretion unfettered. To secure the presence of the King at any function, is to place success beyond the range of doubt. For the King to take a personal interest in the prosperity of a public enterprise, is the surest guarantee of its popularity. The recently organized King's Hospital Fund is but one of countless examples of this truth. And with all these matters the Cabinet has no concern.

But, even in the realm of politics, the King is very far from being the mere figure-head which superficial observers have sometimes supposed. It is true that the splendid service which the King renders to the State as the embodiment and symbol of the unity and permanence of a world-wide empire is, perhaps, the greatest of all the functions of the Crown; and, it may be added, there can hardly be any position more truly splendid, more worthy of the highest powers, more capable of being used as an instrument of good. Its singular value is that, while it affords scope for the powers of genius, the position is capable of being reasonably well filled by any man or woman of moderate ability and first-rate training, while even an unworthy holder cannot do very much harm in it. In other words, it is a position singularly well suited to an hereditary monarch.

And it would be a great mistake to assume that, even in the realm of politics, the function of the monarch is confined to the outward show of things, and has no place behind the scenes, where the real fates of nations are decided. Bagehot, in his work before referred to, has summarized, with his usual justice, the political rights to which a constitutional monarch, in a system like the British, is entitled. He has "the right to be consulted, the right to encourage, the right to warn." And, as the same writer very truly remarks, such rights, in the hands of a monarch of sense and sagacity, and it may be added, of experience, are singularly effective. In modern conditions, the air of a Court is by no means so fatal to width of outlook and knowledge of the world as in the days before the popular press and facile traveling. The late Queen Victoria, for example, was learning politics by instinct when many of her future Ministers were absorbed in the sports of youth or the narrow cares of professional life. Words of warning or encouragment must have fallen with singular force from her lips upon the ears of men upon whom rested the tremendous responsibilities of empire; while the completeness with which she could enforce her undoubted constitutional rights was shown in the famous letter in which she consigned Lord Palmerston to temporary oblivion in 1850. On that occasion Her Majesty simply insisted upon her undoubted right to be distinctly informed of every event, in contemplation or progress, which might result in an act of the Crown, "in order that she may as distinctly know to what she is giving her royal sanction."

Of late years suggestions have from time to time been made to the effect that the occupant of the throne should take a more personal and ostentatious part in the details of government. These suggestions not only savor of the political backwater, but they are singularly ill-advised in the interests of the monarchy. Britons feel so keenly upon political matters, that any one, however exalted, who takes part in controversial or debatable matters, inevitably meets with hostile criticism and periods of unpopularity. From such untoward accidents the Crown is entirely saved by virtue of its present unique position. Even where, as during the last two or three years of the Balfour Ministry, the policy of the Government was unpopular with the majority of the community, no one dreamed of blaming the King, for everyone assumed that he had nothing to do with it. How different was the attitude of the country to George III. during the long period in which he strove to restore the older type of monarchy. But perhaps the most complete testimony to the success of the present system, so far as the Crown is concerned, is the fact that republicanism, even as an academic ideal, has practically ceased to exist in the British Empire. Among all the schemes of political reform which are from time to time mooted, no one ever contemplates the disappearance or modification of the powers of the Crown; for the very good reason that the Crown, so far from being a stumbling-block in the way of reform, is seen to be capable of being employed as a valuable instrument to secure it. The working of the Cabinet system makes the Crown a splendid fixed sun, surrounded by a constellation of rolling planets destined, from time to time, to disappear from sight. No one becomes tired of the sun, because the desire for occasional change, planted in every human breast, is satisfied by the appearance and disappearance of the planets. The Cabinet system may be open to severe criticism; but its defects will not be amended by any change which would reduce the monarch from his proud position as head of an united nation, to the leadership of a faction of irresponsible politicians, opposition to whom would mean opposition to the avowed personal wishes of the Crown.

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11. Great Britain — The Judicial System in England and Wales. The English judicial system, like the English law, grew up naturally and spontaneously. It is of native growth. It has never been constructed *en bloc* on any scientific or strictly logical principle; but it is perhaps none the worse for this. It still contains anomalies, which are relics of Anglo-Saxon custom or Norman feudalism; but such anomalies are historically interesting and do not at all seriously impede the working of the more modern machinery.

We now draw a sharp distinction between courts of civil and courts of criminal jurisdiction. In the former debtors are compelled to pay the money which they owe, and wrongdoers to compensate those whom they have injured; so that the proceedings, if successful, generally end in a judgment that the defendant shall pay the plaintiff so much money. The object of criminal proceedings, on the other hand, is to punish more serious offences and to prevent their repetition. Hence these proceedings, if successful, terminate in a sentence inflicting fine or imprisonment on the offender. And for each purpose we now have separate courts. This was not so formerly. At the time of the Norman conquest the most important tribunal in England was the Shiregemôt, or County Court. This court took cognizance of felonies, breaches of the peace, nuisances, and other offences which concerned the State, as well as of actions involving title to lands and other civil suits, which concerned only the individual suitors; it also heard appeals from inferior tribunals, such as the hundred court. In Saxon times the County Court met twice or thrice a year. In the 13th century in the larger counties it met every month.

Under Henry II. the royal power made itself felt throughout the kingdom. His justices in eyre made their circuits through the land, and tried the more important civil and criminal cases in the County Court. By the Assize of Clarendon (1166) all landholders were obliged to attend twice a year to meet the King's justices. This was the origin of the County Assizes. To this day the King's judges still come at least twice a year into every county in England. To the larger counties two judges come together, one of whom tries civil causes and the other criminal cases—

"The great judge and the little judge,
The judges of a size!"

From the ordinary meetings of this ancient County Court are descended both the County Quarter Sessions and the modern County Courts. At the Assizes any crime can be tried which has been committed within the county, whether treason, felony, or misdemeanor. At Quarter Sessions no crime can be tried, which is punishable with death or imprisonment for life (except burglary); other grave offences, such as perjury and forgery, are also excepted. These Sessions are held at least four times a year in each county; the justices of the peace for the county — unpaid laymen — are the judges.

The civil jurisdiction of the ancient County Court had become almost obsolete, when the County Courts Act of 1846 was passed. This act created the modern County Court, which is held in every town of any size in England, at least six times a year. Actions for breach of promise of marriage, libel, slander, and seduction cannot be commenced in the County Court; nor can actions of ejectment or any other action involving the title to any land worth more than £50 a year, or to any toll, fair, market, or franchise; nor any action of contract or tort, in which the plaintiff claims more than £100. There are 56 County Court judges; they are appointed by the Lord Chancellor, and must be barristers of at least seven years' standing.

So much for the counties. But even in Anglo-Saxon times, cities such as Winchester, York, and London had acquired the right of holding courts of their own in which an officer appointed by the citizens themselves would decide all civil disputes which arose within the limits of the city, and also exercise some criminal jurisdiction over the citizens. In less important towns, however, it was found difficult to exclude the jurisdiction of the County Court. But in the 13th and 14th centuries the policy of the Crown was to strengthen the towns in order to create a counterpoise to the power of the nobles. The three Edwards and Richard II. granted many charters to boroughs, which created borough courts of criminal and in some cases also of civil jurisdiction. The citizens were proud of these local courts, for they were a badge of their independence. Some of them have fallen into disuse; from the others are directly descended our present Borough Courts of Quarter Sessions and our civil Borough Courts of Record.

In 111 of the larger towns in England and Wales there is held at least four times a year a Court of Quarter Sessions, which has the same criminal jurisdiction and adopts the same procedure as the Court of Quarter Sessions in a county. The judge of each of these courts is called a Recorder. He is the sole judge of the court, for although the justices of the peace for the borough are often present on the bench, they take no part in the proceedings. A Recorder is appointed by the Crown on the recommendation of the Home Secretary. He must be a barrister of not less than five years' standing. He is *ex officio* a justice of the peace for the borough. He may sit in Parliament for any other constituency but not for the borough for which he is Recorder.

In 18 of the largest cities or towns there exists also a Borough Court of Record of civil jurisdiction—such for instance as the Mayor's Court, London; the Court of Passage at Liverpool; the Salford Court of Record, and the Tolzey Court at Bristol. The jurisdiction of these courts is generally limited to causes of action arising within the borough, but unlimited as to the amount which can be claimed in the action. In most of them the Recorder of the borough is the judge.

When our Plantagenet kings were firmly established on the throne, judicial power became more centralized. The King's Council gradually extended the scope of its operations. It acquired important judicial functions; it became a court in which the King, in theory, was always present. From this council sprang gradually the courts of King's Bench, Common Pleas, and Exchequer; which for many centuries were the three Superior Courts of Common Law at Westminster.

Then as civilization advanced, it was found that the rigid rules of the common law required modification to meet special cases. Ancient custom had to yield to improved morality. The Lord Chancellor, who was at first an ecclesiastic, became "the keeper of the King's conscience." He presided over the Court of Chancery, which soon assumed power to restrain suitors from "unconscientiously" enforcing their strict legal rights. This Court of Equity, which usually sat in Lincoln's Inn, thus acquired control over the three courts of law at Westminster. Two systems of judicature in fact flourished side by side, which were in many respects at variance with each other. What was right at law was often wrong in equity. Judgment would be given on the same facts for the plaintiff in Westminster Hall, for the defendant at Lincoln's Inn.

By the end of the 18th century the Court of Chancery had become more technical, if that were possible, than the courts of common law themselves; its procedure had ceased to be elastic; it would only grant relief in certain specified cases. A plaintiff, who had undoubtedly a strong moral claim, was constantly told that he had no equity. And both at law and in equity, cumbrous procedure, technical pleadings, and preposterous rules of evidence caused the suitors much vexation of spirit, much unnecessary expense, and worst of all, intolerable delay. "Lord Eldon and the Court of Chancery pressed heavily upon mankind" (Bagehot).

Attempts were made from time to time to deal with this state of things by legislation—notably by the Common Law Procedure Acts of 1852 and 1854, the Chancery Procedure Act, 1852, and the Consolidated Orders in Chancery of 1845 and 1860. At last in 1873, Lord Selborne, then Lord Chancellor, with the assistance of Lord Cairns, his opponent in politics, carried successfully through Parliament the Judicature Act, which came into force on 2 Nov. 1875. This Act created the Supreme Court of Judicature, which administers law and equity concurrently. Its procedure is straightforward and simple. Every court now applies the same principles of law and equity to the actual facts of the case; every court has power to grant whatever form of relief the nature of the case may require, whether legal or equitable. This was the greatest and most beneficial law reform of Queen Victoria's long reign. On 4 Dec. 1882, outward expression was given to this fusion of law and equity by physically uniting the courts in one building—the new Royal Courts of Justice.

The Supreme Court of Judicature is composed of the Court of Appeal, and the High Court of Justice. Thus the civil courts at present are: The County Court, the Borough Court of Record, the High Court of Justice, the Court of Appeal, the House of Lords, and the Judicial Committee of the Privy Council. The High Court of Justice is divided into the Chancery Division, the King's Bench Division, and the Probate, Divorce, and Admiralty Division.

The Chancery Division has now six judges who work in pairs, each pair having four masters and a staff of clerks working under them. The bulk of the work of the Chancery Division consists of the equity business, to which its organization is especially adapted. Its powers are, nevertheless, not confined to any particular subject-matter; it administers law as well as equity, though it never tries a case with a jury.

The Lord Chief Justice of England, assisted by 14 puisne (*i. e.* junior) judges, conducts the business of the King's Bench Division. These judges try civil causes either with or without a jury; they preside at the Assizes, civil and criminal, all over England and Wales; they hear appeals from County Courts and magistrates, and prohibit all inferior tribunals from exceeding their jurisdiction.

In the Probate, Divorce, and Admiralty Division, there are two judges who decide as to the validity of wills, grant divorces, and manage the admiralty business of the country.

The rules of court made under the Judicature Act have defined the procedure in the High Court of Justice, which is simple and elastic. A Master now decides all interlocutory matters on a summons for directions, *e. g.* whether the action shall proceed with or without pleadings, with or without a formal trial, with or without discovery of documents and interrogatories as the nature of the case requires. Every amendment in any record, pleading, or proceeding that is requisite for the purpose of deciding the real matter in controversy can be made at any stage of the proceeding.

The Court of Appeal is composed of the Master of the Rolls and five Lords Justices, with the occasional assistance of the Lord Chancellor, the Lord Chief Justice of England, and the President of the Probate, Divorce, and Admiralty Division.

The Lord Chief Justice of England, the Master of the Rolls, and the Lords Justices are appointed by the Prime Minister; the puisne judges of the High Court of Justice are appointed by the Lord Chancellor.

From the decision of the Court of Appeal, appeal lies to the House of Lords — to the judicial body known by this name, not to the legislative assembly. An ordinary peer of the realm can no longer sit in the House of Lords when it is exercising judicial functions. The Judicial Committee of the Privy Council hears appeals in ecclesiastical matters and also from the Colonies. These appellate courts will probably soon be merged in one; they have been strengthened by the appointment of four paid Lords of Appeal.

The criminal courts now are: The Magistrate's Court, the Borough Quarter Sessions, the County Quarter Sessions, the Assizes, the Central Criminal Court, the King's Bench Division of the High Court of Justice, and the Court for the consideration of Crown Cases Reserved.

The proceedings usually commence with a *summons*, bidding the accused appear in court before the magistrates on a certain day: in some cases a *warrant* will be issued at once for his arrest. Simple matters are disposed of summarily by the magistrates. Graver cases are sent for trial to Quarter Sessions or to the Assizes. In these graver cases, the prosecution states in detail the precise charge against the prisoner in a pleading which is called an *indictment*. This is laid before a *grand jury;* and the accused will not be put on his trial unless the grand jury think that there is a case against him fit to be tried. If the grand jury is of this opinion they return the indictment into court, marked "True bill," and the prisoner is then *arraigned*. In some few cases the prisoner must state his defence in a written *plea;* but, as a rule, he merely pleads "guilty" or "not guilty" orally from the dock. If he pleads "guilty", or if after pleading "not guilty" he is tried and convicted, he may be sentenced to fine, imprisonment, or death, according to the nature of the crime which he has committed.

The Central Criminal Court — better known as the Old Bailey — tries all treasons, felonies, and misdemeanors committed in the Metropolitan district or within the jurisdiction of the admiralty. The lighter crimes are usually disposed of by the Recorder of London or the Common Sergeant; the graver by a judge of the High Court, who attends for the purpose. This court is at once both Assizes and Quarter Sessions for the city of London, and assizes for the counties of London and Middlesex and for certain specified portions of the counties of Essex, Kent, and Surrey.

The King's Bench Division occasionally exercises jurisdiction as a court of first instance in cases of grave public importance, such as the trials at bar of Dr. Jameson and Col. Lynch in 1896 and 1903 respectively. It also has an appellate jurisdiction over cases brought before it on writs of error or certiorari or on "special cases" stated by justices of the peace.

The Court for the consideration of Crown Cases Reserved is at present the only criminal court of appeal. It deals only with points of law submitted to it by the judge, who presided at the trial. There is no appeal where the prisoner has been acquitted. The court consists of at least five judges of the High Court of Justice, of whom the Lord Chief Justice of England must be one, unless he is prevented from attending by illness.

In the County Court and before magistrates, solicitors act as advocates. In all the other Courts only barristers can be heard at the actual trial, or on "appeal"; though solicitors are allowed to argue minor questions in Judges' Chambers. A barrister must be a member of an Inn of Court; he must have passed the Bar Examinations, and then have been "called to the bar" by his Inn. The four Inns of Court in London possess the monopoly of calling men to the bar; they will not "call" any woman. In litigation in the High Court it is necessary to employ both a solicitor and a barrister; the solicitor prepares the case for trial, and "instructs" the barrister by delivering a "brief" to him. Solicitors also dispose of a vast amount of non-litigious business. Every solicitor must have been articled to a solicitor for at least three years, and must have passed the Solicitors' Examinations at the Law Institution in Chancer Lane, London, W. C.

For further information the reader is referred to Odgers on 'Pleading and Practice,' 6th ed. 1906 (London); Kenny's 'Outlines of the Criminal Law,' 2d ed. 1904 (Cambridge); Broom's 'Common Law,' 9th ed. 1896 (London); 'A Century of Law Reform,' 1901 (London), and Odgers on 'Local Government,' 2d ed. 1906 (London).

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12. Great Britain — Local Government. As in other large and populous countries, the work of government in England* is classified as being either national or local. This classification has no reference to the place in which the work is done or to the area benefited; in England at any rate, it is based in practice — whatever may have been its origin — exclusively on the systems upon which these two branches of public administration are organized and controlled. That part of the work of government which is undertaken by the national organization of the state, directed from its capital, and administered under the direct orders of its executive head or principal legislature is termed national government; and is, indeed, by historians, politicians, and citizens alike, often exclusively thought of as government. That part which is left to subordinate organizations, relating only to particular geographical areas within the state; and which is immediately directed by and responsible to authorities belonging to those areas, subject only to more or less supervision, help, and superior control by the national government, is termed local government. In England and Wales, even more than in most other countries, the choice of the particular functions of government to be thus left to local authorities, and the amount and kind of the supervision, help, and superior control exercised by the national government in respect of each of these functions, have been determined rather by historical antecedents than by any consistent or logical theory. The aggregate amount, variety and relative importance of local government has, during the past half century, steadily increased; until it has come in the United Kingdom, nearly to equal in magnitude (measured by the annual cost of administration) that of the national government itself. This increase has not been due to any transfer of services from the sphere of national to that of local government. Such few transfers as have occurred (like that of the prisons in 1877) have been actually in the other direction. The enormous development of English local government which has marked the last half century has been due, partly, to the great expansion of the cities, which need more government than rural districts, partly to the progressive demand for new and increased services such as schools and libraries, and partly to the tendency to transfer the administration of services of common use from the sphere of private to that of public — usually local — administration.

*With England is included Wales and the Scilly Isles, but not Scotland or Ireland, which have entirely distinct systems of local government; as have also the Channel Isles and the Isle of Man.

THE SERVICES ADMINISTERED BY LOCAL AUTHORITIES.

The government at present entrusted to local authorities in England and Wales may be divided into four great classes, which we may term respectively the collective organization of public services, the collective regulation of individual conduct, the collective provision for special classes of the community, and the collective taxation upon individual citizens by which the net cost of the whole of the local government work is met. It has been a consequence of the great development of local government during the past half century, and of the absence of any logical or deliberately thought out plan of organization, that this or any other systematic analysis of local government functions does not correspond exactly with any definite classification of local governing bodies. We must therefore describe separately function and structure.

The collective organization of public services, though later in its great development than some other branches, now makes up the largest part of English local government.

1. *Protection.*— We have first the fundamental service of the protection of the individual citizen against aggression, for which there is, from one end of England to the other — not excluding even the most rural or the most desolate regions — a series of salaried, professional and highly organized local forces of preventive police. In marked contrast with the practice of most other European countries (and, indeed, with that of Ireland), these police forces, 187 in number, are (with the exception of that for the metropolitan area) exclusively under the control of the respective local authorities, and are subject neither to orders from, nor to control by the national executive. They are (outside the metropolitan area) entirely appointed, controlled, and paid by particular local authorities; in municipal boroughs, the town councils by their "watch committees"; in counties, by what are known as "standing joint committees," of which half the members are chosen by the County Council and half by the Justices of the Peace in Quarter Sessions. The total cost of mainte-

nance of the provincial police forces is three and one third million pounds, and that of the two metropolitan forces two and one quarter million pounds per annum, for which 44,000 men are maintained. A separate grant of part of this cost (at first a quarter, latterly one half) was long made from the national exchequer, conditionally on the local authority (1) permitting the Home Secretary to have its force inspected annually by an officer appointed for the purpose, (2) maintaining it at such a standard of strength and efficiency as the Home Secretary might consider satisfactory. No separate police grant is now made, the amounts (aggregating £3,000,000 per annum) having been merged in larger general contributions in aid of local authorities; but a certificate by the Home Secretary that the above conditions have been fulfilled is still annually required before payment is made. In the metropolitan district (which for this purpose extends to an area of more than 15 miles radius from Charing Cross) there are two police forces; one of small size, maintained by the Corporation of the City of London, without exchequer aid or Home Office inspection, for the protection of the one square mile of the old city; and the other the largest in the world, organized as a local force, but commanded without any shadow of local control, by officers appointed by the national executive itself (Home Office); at the cost, partly of a fixed local rate of five pence in the pound, which meets about half the expense, and partly of the national exchequer; for the protection of the 900 square miles of the metropolitan area. ('Annual Home Office Reports as to Police'; 'History of Police in England,' by W. L. M. Lee, 1902.)

While the central courts of justice form part of the national government, some of the minor tribunals are (though the judges are never elective) supplied by local government, either in form of (a) petty criminal courts held by the local justices of the peace; (b) the more important Courts of Quarter Sessions, held by the same; (c) stipendiary police magistrates in various cities, appointed by the national executive, but paid for by the cities themselves; and (d) a few local civil courts maintained in the City of London and some other of the older cities. The stipendiary police magistrates in the metropolitan district (outside the old city) are maintained in the same way as the metropolitan police force. ('Justice and Police,' by F. W. Maitland.)

Protection from fire is afforded by separately organized fire brigades, having no connection with the police. These are in all cases exclusively under the control of the local authorities; in London, the County Council; in the municipal boroughs, the Municipal Corporation; in other places, the Urban District Council, or the Parish Council. In London, the fire brigade is second in size and cost only to that of New York, and it is not clear whether, for the particular conditions of its task, its efficiency is second to that of any in the world. Its strength is 1,375 men, and its cost £240,000 per annum, toward which the fire insurance companies have to contribute a trifling percentage of the value they severally insure in London, and the national exchequer unconditionally contributes £10,000 a year in respect of the large amount of national property in the metropolis. Some of the provincial cities have also salaried professional fire brigades, often highly efficient. In less populous centres, according to the unfettered discretion of the particular local authority in each case, the fire protection passes by insensible gradations (some salaried professionals, men in other occupations partially paid for fire service, or unpaid but organized volunteers) down to the mere provision of a hand pump or buckets, to be used by any zealous citizen. Protection against fire in theatres and music halls, and against such methods of building houses generally as might facilitate dangerous fires, is afforded, in the metropolis, by the stringent regulations and inspection by the London County Council under its special building act. In other towns the Municipal Corporation takes such action of a similar kind as it thinks fit, by way of by-laws. Protection against drowning is afforded in the bathing season by the boats and boatmen provided by only a few seaside municipal corporations.

2. *Locomotion.*— In so far as locomotion is not abandoned to private enterprise (railways, most river steamers, some tramways, omnibuses, etc.), the whole provision for this service is left in England to the local authorities. The maintenance of roads is performed, over every part of England and Wales, by one kind of local governing body or another. Within London, it is the council of the particular metropolitan borough; in the municipal boroughs, it is the corporation; in other towns, it is the urban district council; and wherever none of these authorities exists, it is the rural district council which is responsible for this service. The method and standard adopted in each locality is left to the unfettered discretion of its local authority, which (for the 95,177 miles of by-roads) has itself to bear all the expense. But for what are deemed main roads (apart from London and the principal cities which are called county boroughs), the county council either itself undertakes the service or else contributes to the minor local authority a sum agreed between them as the cost of keeping up such main roads, of which there are 27,367 miles. The average amount per mile annually spent on road maintenance is main roads, £60; by-roads, £20. The county council, outside London and the county boroughs, moreover, maintain the bridges over streams, etc., with some exceptions. Where, as in urban districts, the road becomes a street, its maintenance naturally becomes more costly, and altogether new needs of paving, cleansing, and lighting arise, to be dealt with and paid for in each case by the local authority concerned, at its unfettered discretion. Further developments of the same service, undertaken under special powers, are the short lengths of canal of the Exeter and York municipal corporations, and the extensive canal navigation owned and operated by the Gloucestershire county council; the harbors, piers, and docks maintained by about 50 local authorities; the numerous bridges over the Thames, constructed and maintained partly by the Corporation of the City of London, partly by the London County Council; similar bridges over rivers in other cities nearly always maintained by the local municipal corporation; the great

tunnels under the Thames constructed by the London County Council; a few old-fashioned ferry services maintained (as at Saltash, Middlesborough, and Sunderland) by various local authorities; the development of the ferry into a moving "floating bridge" by the corporation of Southampton; and into river steamboat services across the Mersey by the Corporation of Birkenhead; across the Thames at Woolwich by the London County Council; and up and down the Thames by the same local authority. In other directions the road has been developed into a tramway; and cars — horse, steam, or electric — are now (1906) owned by about fifty local authorities, and operated under municipal management by an ever increasing number of them (in 1906 over 30), including the valuable hundred miles of track already worked by the London County Council, with gross receipts from fares which, in a normal year of full electric working, may be put at more than £1,500,000 sterling. In one or two cities the municipal corporation has obtained exceptional power to run an omnibus service in conjunction with the tramways. In all other cases the omnibus service, together with either the ownership and management of the tramway service, or else its operation under terminable lease from the local authority, is left to private enterprise. A few bridges constructed by groups of capitalists, with power to charge tolls, are still in the same position, as are most of the canals, and all the railways and coast steamboats. The 19th century has seen a marked tendency toward freeing from toll the use of the various means of locomotion maintained by local authorities. Their roads and streets — once barred to all but pedestrians by tollgates — are now invariably free; the bridges, on many of which even pedestrians were charged a toll, are now (with the exception of a few capitalistic ventures, still in private hands) uniformly free; the tunnels under the Thames are free to vehicles as well as to pedestrians; the steamboat service by which the London County Council maintains the Woolwich ferry is equally free; while the tendency in the municipal tramway canal and steamboat services is to charge only the smallest fares or tolls.

3. *Water Supply.*— The supply of water is only in a steadily diminishing number of cities, of which the largest are Bristol and Newcastle, a matter for private enterprise. In a couple of hundred cities this public service is in the hands of the local authority, usually the municipal corporation, or (as in the metropolitan district), of a council made up of representatives of different local authorities, the aggregate amount of capital invested in these public water enterprises being about £100,000,000 sterling. It is now generally thought to be a defect that there is no systematic distribution, among the great centres of population, of the natural water basins; and no local authorities entitled to control them.

4. *Heat, Light, and Power.*—Gas for lighting, heating, and power is produced and supplied, under the authority of separate statutes, in about 670 cities and towns, besides a number of smaller installations started without statutory powers. These gas works were, in their origin, mostly private enterprises (though the local governing body of Manchester started its own gas works in 1816), but there has been a steady tendency to municipalization, until 210 towns now (1906) govern their own gas production, with a capital of £40,000,000 sterling invested in their enterprises. During the last quarter of a century on an average five cities a year have municipalized their gas supply; and as these comprise a majority of the smaller consumers, no less than 46 per cent of the entire number of the users of gas in the United Kingdom are thus co-operatively supplied by themselves as citizens (Annual Returns as to Gas Works, Board of Trade). Electricity, starting only within the past quarter of a century, has been even more predominately a matter of municipal enterprise. More than 100 towns have their own municipal electricity supply, in which some £25,000,000 sterling is now invested. In Manchester the municipal corporation supplies also hydraulic power.

5. *Education.*— The extensive public service of education — as a function of local government scarcely a generation old — now makes up more than a sixth of the total expenditure of the local authorities. While the national executive, by contributing about a third of this expenditure on education, exercises great influence by means of the conditions which it attaches to its grants, the power of the local authorities to provide what kind and what amount of educational facilities they deem fit over and above the national minimum, is (so far as secular subjects are concerned) now practically unlimited. There is no limit to their current expenditure, or to the amount of rate they may levy. There is no limit of grade or of age. Anything that is education — whether elementary, secondary, or university in grade; whether infant or adult; whether literary, scientific, artistic, technological, or professional in kind — the local authority may, if it chooses, provide, without requiring any sanction or approval, in whatever way it chooses, under whatever regulations it chooses, gratuitously or at any fee. It is legally restrained only (1) by the statutory exclusion (or only conditional admission) of religious instruction in the nature of a catechism distinctive of any particular denomination; (2) by the statutory obligation to provide the "national minimum" of efficient elementary schools for all children between 5 and 14 requiring elementary instruction; (3) by the need for sanction of any projects for raising funds by loans. In practice, the dislike of the citizens to an undue increase in the rates restrains the local authorities at present to a comparatively limited use of their vast powers. While elementary schools, of one sort or another,— now always free and compulsorily attended — exist in adequate numbers, there is, as yet, a quite insufficient supply of secondary schools, apart from those maintained from ancient endowments, under separate governing bodies; and whilst, in most cities, much has been done for technological education of an elementary grade, the provision for university education and the higher technological instruction is, compared with the need, still only rudimentary. For everything above the elementary school, fees are charged. On the other hand, London has a "scholarship ladder" unequaled in extent and genuine accessibility anywhere in the world. By an unlimited provision of free

places coupled with maintenance allowances, awarded on a merely qualifying examination, the opportunity for secondary and university education is effectively opened even to the poorest child of more than average ability. Other local authorities have less extensive scholarship schemes on similar lines.

6. *Miscellaneous Services.*— Brevity compels the grouping together of a large number of diverse public services organized and administered by local authorities. With the exception of a few ancient chartered rights in the hands of private owners (of which Covent Garden in London is by far the most important), the markets are in public ownership, involving a total capital of some £7.000,000 sterling, and (while a few are leased) usually under public administration; often including warehouse accommodation, weighing machines, sometimes cold-storage and abattoir. The municipal provision of workmen's blocks in towns and of cottages in the country has been carried on to a great extent, not only by the London County Council, which has already (1906) over 20,000 people in its dwellings, but also by about 50 other authorities. ('The Housing Handbook,' by W. Thompson, 1904.) The existence of a few «joint-stock» cemeteries serves to remind us that the provision and management of burial grounds is an important function of the local authorities, in which millions of capital is invested, extending in one or two cases (as at Hull), to the provision of crematoria. Interment is, however, the business of the undertaker, and remains everywhere in private hands; not even subjected, as is the case in some continental cities, to public control. The provision of parks and recreation grounds, with bands of music, gymnasia, facilities for games, etc., has been lavishly undertaken. Hundreds of cities and towns have free public libraries and reading rooms; others have also public picture galleries and museums which are uniformly free; whilst a couple of hundred places provide for their citizens swimming and other baths, and public laundries, at low fees. Among the other miscellaneous public services maintained by English local authorities are the Bradford "conditioning house," or wool-grading establishment, the Burnley municipal cold storage, the Doncaster race course, and the Battersea and Saint Helen's municipal supplies of sterilized milk. The tendency of local authorities to embark in these enterprises has led to a discussion of what is called «municipal trading,» during which municipalization has proceeded at a greater rate than ever. (For the abstract case against this tendency, consult 'Municipal Trade,' by L. Darwin (1903); for an equally abstract defence, 'The Commonsense of Municipal Trading,' by G. Bernard Shaw (1904), and 'Mind Your Own Business,' by R. B. Suthers (1905); for statistics, 'The Municipal Yearbook' and 'The London Manual' (both annually); the seven volumes of 'Local Taxation Returns' annually published by the Local Government Board; and the periodical return of 'Reproductive Undertakings carried on by Municipal Boroughs,' also issued by that office.) In 1906 the amount of capital under municipal management cannot be put at less than £500,000,000 sterling; the aggregate municipal indebtedness (all repayable within 20 to 60 years), being over £400,000,000 sterling. Manchester and Birmingham have over £20 per head of population of capital under municipal management.

The part played by local government authorities in England in the collective regulation of individual conduct is less conspicuous than their organization of municipal services, but it is too important to be ignored. It is not merely that practically all these authorities exercise, in their power of making by-laws, a minor legislative function, on which we to a great extent depend for the prevention and suppression of nuisances, the regulation of the streets, all the ramifications of public health, and the operations of building and various noxious trades. If, as in England we must, we include among local authorities the justices of the peace, the regulation of the sale of alcoholic drink, the places where it may be sold, and to some slight extent the hours during which the sale may take place, fall within the discretion of local governing bodies. Finally, in the direction and control of all the provincial police forces, the local authorities have virtually extensive and scarcely defined opportunities of supervising and restraining any overt manifestations of individual conduct which is «disorderly» in character, and of which local public opinion disapproves.

The collective provision for special classes of the community is one of the oldest and was, until lately, the most costly of the functions of local government in England. Under the comprehensive term of the Poor Law there is now included a whole array of specialized provisions for orphan and deserted children, for the sick, for persons of unsound mind, for physical and mental «defectives,» for the aged and infirm, and for the men and women who become destitute, together with their children. The total amount spent on this service is about £15,000,000 sterling annually. Beyond the ancient limits of the Poor Law, and still within the sphere of local government, we have, in addition, the provision of hospitals for lunatics, idiots, and epileptics; the costly arrangements for maintaining and medically treating those suffering from any infectious disease; and the organized provision now made for the temporarily unemployed — making an aggregate annual expenditure from public funds on the care of particularly distressed or afflicted classes of the community, falling not far short of £20,000,000 sterling.

The taxation by which the local authorities maintain all these services (apart from the revenue of municipal property, the receipts from municipal services and contributions from the national exchequer), is levied entirely by themselves. They cannot create a new tax, but once the kind of impost is authorized by Parliament, the rate at which the citizen shall be charged is, as a rule, left to the unrestrained discretion of the local governing body. In amount, there is no limit to its taxing power. Of the total gross revenues of the English local authorities, which may (1906) be put at about £110,000,000 sterling, about 14,000,000 is received from the national exchequer, leaving some 96,000,000 to be raised locally. Of this nearly 30,000,000 is derived from the receipts from the various municipal enterprises that we have described, 3,000,000 from other municipal property, 1,000,000 from fines and fees, and 5,000,000 in reimbursements and miscellaneous receipts, leaving about 57,000,000 to be raised by local taxation. Tolls and dues (apart from those connected with markets and harbors) yield less than 500,000. The whole of the balance is found by one tax, the so-called "rate," a periodical levy, upon the occupiers of the real estate within the area of each local authority, of a specified proportionate part of the assessed annual value of that real estate. This universal impost, known as the Local Rate (sometimes as the Poor Rate, the District Rate, the Police Rate, etc.), varies widely from place to place, but is most commonly between two and eight shillings in the pound, or between 10 and 40 per cent of the annual rental. The actual average for all purposes, including both urban and rural areas, is (1906) about three shillings and sixpence in the pound, equivalent to an annual levy on the capital value of the real estate of less than one per cent, and to an annual contribution per head of population of about 17 shillings and sixpence. It is an interesting and little known statistical fact that the amount of this local taxation per head is only about the same as it was a century ago. This local tax is legally payable by the occupier of every house or farm, or other separate holding of real estate, who (if, as is commonly the case, he is not himself the owner), is left to make his own contractual relation with the owner or "landlord;" normally the occupier pays the rates in addition to his rent. But in "flats" forming part of large blocks, and in property of small annual value, especially that let by the week, the owner usually "compounds" with the local authority, in consideration of a discount to pay the rates himself instead of throwing the burden on the occupier (the so-called "compound householder"), whose rent then includes both rent and rates.

LOCAL GOVERNING BODIES.

English local government is everywhere, and for all purposes, carried on by one particular form of political machinery, which to the Englishman seems so inevitable that he seldom thinks of describing it. The powers and duties of government are vested, not in any officers personally, but in a board or council of members, having jurisdiction, for specific branches of administration, over a definite area. This governing body, which is uniformly unpaid and composed of citizens more or less engaged in their own avocations, appoints, supervises, and directs a staff of salaried, professional officers (the "municipal civil service"), by whom the actual functions are performed. The staff of salaried officers is invariably appointed by the governing body; and (though service is nominally only during pleasure), the appointments are habitually permanent, terminable only on misconduct. There is no such thing in English local government as removal for political reasons, or in order to make a vacancy. The board or council acts collectively, by resolutions agreed to at its meetings by a majority of the members present. Its deliberations are presided over by one of its own number, called chairman or mayor, whom it freely elects; and not by a person separately elected by the people for the presidential position, or appointed to it by some outside authority. Perhaps for this reason, it is a distinctive feature in English local governing bodies that the presiding member has but little personal power or responsibility, apart from presiding. Though in practice he often exercises out of sessions, some executive power, by giving orders to the salaried staff, this is always done in the name of the board or council, and subject to its ratification. The board or council habitually divides itself into committees, each charged with the supervision of a particular branch of the government, and required to report to the main body. The result is an intimate combination of legislative, executive, and occasionally even judicial operations, which the Englishman takes for granted as "administration." It may be added that national politics have little influence on local government. The salaried staff is almost universally "out of politics." In many cases, perhaps the majority, the elections are not contested on political grounds, or seriously fought by the political organizations. In London and many of the large boroughs, the elections are thus fought, but the issues are not primarily those of national politics, nor is the cleavage of opinion exactly the same. And once elected, the members (even where the contests have been keen) seldom habitually allow their politics or party divisions to affect their municipal administration.

The organization of local government in England, once extremely complicated, has been much simplified by recent statutes. The era of reform began, indeed, in 1834-35, when the ancient municipal corporations were made elective and systematized, and the Poor Law was placed in the hands of elective Boards of Guardians. Between 1848 and 1875, a system of elective rural and urban district councils was created principally for sanitation and roads. In 1888, the county councils were established on an elective basis, to take over from the nonelective justices of the peace the civil administration of the counties. In 1894, the rural parishes were provided with elective parish councils; and in 1900 the different parts of London with metropolitan borough councils. By these successive statutes every part of England and Wales has been placed under local governing bodies annually or triennially elected on the widest possible residential qualification, women having a vote whenever they are independent householders, and being eligible for election to all but town and county councils. There is, speaking broadly, no property qualification for election, and (unlike the English parliamentary ballotings) no obligation on the candidate to provide the election expenses. The members of the local governing bodies receive no salary or other remuneration for their work. Only very exceptionally, in positions such as the mayoralty of an important city, is any allowance paid even for expenses.

In spite of simplifying statutes, English local government is still shared among various strata of different authorities, constituted for different purposes under different statutes. London, moreover, with its 4,750,000 of inhabitants, has a local government of its own, and must be considered apart. We take first the network of local authorities administering the more obvious services of municipal government, including sanitation and education. To begin with the parish, we see this ancient ecclesiastical area in the rural districts forming the lowest unit of government; administered, if small, by the parish meeting open to all adults; if large, by a parish council triennially elected by the householders. The parish meeting or parish council may light the village, protect the footpaths and village green, establish libraries and reading rooms, baths and public laundries; but its power to tax is limited. Next to it stands the rural district council, dealing with roads and sanitation, triennially elected by and acting for the householders of a group of parishes. Places in which the population has become aggregated together, needing greater and more varied local government services, are (by Local Government Board order) given the status of urban districts. The householders of these urban areas elect an urban district council, which combines the functions of the parish council and the rural district council, with greatly extended powers. A steadily increasing number of urban districts (now over 300 in number) have, sometimes because of past historical importance, sometimes because of present populousness, been given by the Crown (nowadays the Privy Council) the status of chartered municipal corporations; these elect their councils annually by thirds instead of triennially, and women are not eligible as members. Moreover their councils elect to preside over them, not a chairman but a mayor; and they coöpt into their own bodies additional members styled aldermen. Such of them as have any considerable population (127 in number), have their own police forces, under the control of their own town councils. Apart from minor technicalities there is practically no other difference between an urban district which is, and one which is not, a municipal corporation. The words "town" and "borough," it may be mentioned, are used in England, for any urban place, irrespective of size. The word "city" is of equally lax usage, but it ought to be restricted to those towns, large or small, which have been specifically termed or created cities by statute or royal enactment. Above all these bodies stands the county council; elected triennially by the occupiers of houses or lands within the county, whether residing in rural parishes, urban districts or municipal corporations. The county council is the authority for education; it provides the public lunatic asylums; it either pays for or itself maintains the main roads; it administers various minor services for the county as a whole; and it exercises a certain amount of supervision and criticism and some slight control over the minor local authorities. It contributes half the members (the justices of the peace nominating the other half) to the standing joint committee, which controls the county police force.

Most of the boroughs over 50,000 inhabitants (and some ancient towns below that population) stand outside the area of the administrative county, and are neither represented in nor controlled by the county council. These, the so-called county boroughs (now over 60 in number) are entirely autonomous municipal corporations, which have, in addition, the powers of county councils. The town council, elected in the same manner as that of other municipal corporations, and presided over by a mayor (or in six cases a lord mayor) is (apart from the administration of justice and of the Poor Law) the sole local governing authority of the city, with practically unlimited autonomy within the scope of the statutory authority entrusted by Parliament to local authorities generally; and not even subject, as regards its expenditure on all but one or two subjects, to the general Local Government Board audit. It is an important feature of these county boroughs that they (like the other municipal corporations of any size) have their own police forces, exclusively under the control of their own town councils (by the "watch committee").

The 4,750,000 who inhabit the metropolis have a more complex local government than the citizens of Liverpool or Manchester. London is divided into 29 metropolitan boroughs, one of them being the ancient city preserving still its Corporation, its lord mayor, and other dignitaries and various other peculiarities. These metropolitan boroughs have each a council, elected triennially by the householders, which administers the paving, cleansing, and lighting of the streets, the minor house drainage, the removal of refuse, the suppression of nuisances and the collection of all the municipal taxes. The City Corporation, in addition, manages, with its own considerable estates, the central markets, some of the bridges, the special city police force and (in part) the port of London. Above these local bodies stands the London County Council, with annual receipts and expenditures exceeding £9,000,000 sterling, with 118 members elected triennially by the householders of the whole administrative county of London, together with 19 coöpted aldermen; and responsible for education, main drainage, parks, and recreation grounds, the lunatic asylums, the tramway service, the river steamboats, the great street improvements, the demolition of « slum » areas and the erection of new dwellings, the administration of the stringent Building Act and a host of miscellaneous county services, together with the management of the debt of London, not only for its own needs, but also for those of the other local bodies (except the City Corporation). The water supply of the whole metropolitan district, extending to much more than the county area, is in the hands of the Metropolitan Water Board, a body made up of representatives of all the local authorities concerned. The Thames is administered by the Thames Conservancy Board, a body constituted on a similar plan.

The foregoing survey of English local government omits two branches, which, from historical causes, still retain their separate organizations. Nearly the whole of the collective provision for special classes (but not that for lunatics, nor that for persons suffering from infectious diseases) is in the hands of what are called the Poor Law authorities. The country is for this purpose divided into 656 unions of parishes, often not corresponding with the boundaries of urban districts, municipal corporations, county boroughs or counties. The householders of each of these unions elect either annually or triennially, a board of guardians, which administers the public provision for the aged and infirm, the orphan and deserted children, the indigent sick, the tramps or vagrants, and the destitute of every kind. These boards of guardians levy, for the cost of their schools, infirmaries, workhouses and "outdoor relief," an unlimited tax on householders, the celebrated poor rate. They have complete discretion as to the amount of money that they will spend, and as to the amount of the relief that they will afford (above the legal "national minimum" of preventing death by starvation); but their discretion as to the mode of relief, as to the erection of buildings, as to the appointment of officers, and as to the raising of loans is guided, and, in the last resort, controlled, by the Local Government Board, which has (in this branch of local government more than in any other) the power of issuing peremptory orders having the force of law. In London, where there are 31 boards of guardians, these have also a joint body, the Metropolitan Asylums Board, made up chiefly of their nominees, which manages the infectious disease hospitals and the asylums for idiots. It should be said that there is a great tendency to make, by rearrangement of the unions, the areas of these Poor Law units coincide with those of rural and urban districts the county boroughs. The persons who are elected as members of rural district councils already serve also, without other election, as Poor Law guardians. It is not unlikely that a few years will see the boards of guardians abolished and their duties transferred in county boroughs to the town council; in counties, partly to the county council and partly to the urban or rural district council, and in London, partly to the London County Council, and partly to the metropolitan borough councils.

The other important branch of local government with an organization of its own, and the only one not upon an elective basis, is that of the Justices of the Peace. These are gentlemen of position who are individually appointed by the Crown (the Lord Chancellor), by being included in what is termed the Commission of the Peace. In practice, however, they are almost always chosen by the Lord Lieutenant of the county, who, in most counties, defers informally to the wishes of the existing justices. Thus, the "County Benches" are, in effect, recruited to a great extent by an informal system of coöptation. The principal function of the justices is that of acting as magistrates. Any one justice can issue summonses to appear and warrants to the police for the apprehension of offenders; any two within each county can hold a petty criminal court ("Petty Sessions"), with power to inflict sentences of fine and short terms of imprisonment (subject to appeal to Quarter Sessions), or to commit to prison pending trial at a higher court; and once a quarter, the meeting of justices in "Quarter Sessions" forms a criminal court trying, with a jury, all but the most serious crimes, such as murder and grave felonies. At Divisional Sessions, the justices license retailers of alcoholic drink, nominally at their discretion, but really without effective powers of refusing the renewal of existing licenses, except for grave misconduct. A recent statute enables them to award compensation, charged by a special rate on the district concerned, to the holders of licenses which they withdraw merely on the ground that they are unnecessary. Finally, the Justices in Quarter Sessions, by nominating half the members of the standing joint committee (the County Council sending the other half) go far to control the county police force. It should be said that a slight elective element is infused into the County Benches by the fact that the chairmen of the urban district councils are *ex officio* justices. The county boroughs, and also most of the smaller municipalities, have commissions of the peace separate from those of the counties, and the Justices of the Peace so appointed usually comprise the Mayor for the time being, and the leading members of the town council. They have the same judicial and licensing powers (though no control over the borough police force); but in most towns of any size they perform few judicial duties. In many towns there is also a stipendiary professional police magistrate, appointed by the Crown (Home Office) at the request and at the expense of the town council, who relieves the justices of the police court work. In towns having their own Court of Quarter Sessions, the duties of judge are performed by the Recorder, also appointed by the Crown (Lord Chancellor), who is always a barrister of position, merely visiting the town for the purpose of holding the quarterly court, and receiving for this duty a small annual stipend.

There remain to be mentioned certain local authorities standing outside the general system. At Liverpool and some other ports the port is managed by a harbor trust or board, usually elected by the payers of dock or port dues, including the shipowners, with more or less representation of other local governing bodies. The Mersey Docks and Harbor Board, as the Liverpool port authority is called, administers a series of docks representing a capital outlay of some £30,000,000 sterling. In low-lying or marsh districts there are ancient bodies called commissioners of sewers, appointed in form by the Crown (Lord Chancellor), but practically renewing themselves by coöptation. These bodies maintain the seawalls, sluices and embankments, enforcing on the neighboring land owners their obligations of tenure, and levying on them the cost of necessary common works. The most exceptional of these authorities is that of Romney Marsh, in Kent, where the owners for the time being of 23 ancient estates are, by themselves or their deputies, "Lords of the Level," with extensive taxing and judicial powers for the maintenance of the great seawall.

RELATION BETWEEN LOCAL AUTHORITIES AND THE NATIONAL EXECUTIVE.

In the matter of the relation between the national executive and the authorities administering the various services of local government, England occupies a position intermediate between that of France on the one hand, and the New England or Western States of the United States on the other. The very real autonomy of the English local governing body—greatest in the County Borough, or in such bodies as the Mersey Docks and Harbor Board or the Commissioners of Sewers of Romney Marsh, and least in the Boards of Guardians—marks it off from any analogous authority in continental Europe. The English local authority for each area is formed without any intervention of the national executive (except in the cases of the Justices of the Peace and the ordinary commissioners of sewers, and then mainly in form only), and entirely independently of its volition. It is, for the most part, not subject to the orders of any part of the national executive; it has, in nearly every case, real and complete discretion as to the manner in which its services shall be rendered or the law of the land carried out; it can, for the most part, determine whether or not a particular service shall be supplied in its locality; in all cases it decides on its own responsibility upon its own budget of expenditure, and (whilst not able to impose a new kind of tax) as to the rate of the taxation—of the kind prescribed by statute—which it will levy upon its constituency; and whilst in particular instances it is required to obtain the approval of the national executive, either for its projects or to its actual administration, its practical independence is such that a stubborn local authority usually gets very nearly its own way. To an Englishman, as to an American, it is almost inconceivable that a local authority should be appointed, wholly or in part, by the national executive (unless merely in form); that it should receive and obey orders from the Minister of the Interior; or that it should have to submit its budget for the approval of any superior. On the other hand, no local authority in England—whatever the case may have been in times past—has any original, inherent, or independent powers. With the possible exception of the ancient corporation of the City of London, all the English local authorities of to-day plainly owe their origin to and derive their governmental powers exclusively from the statutes which Parliament has enacted concerning them; and they are, without exception, in all cases, subject to the conditions and limitations of those and any new statutes. A local governing body has, in England and Wales, no rights, powers, privileges or duties inherent in it merely because it is representative of the people of the particular locality; or secured to it by a constitution or other authority independent of the national legislature for the time being. Nor is there in England anything corresponding to the complete separation between the state executive and the local authorities and their mutual independence of each other that characterizes so many of the United States of America. Every local authority in England is required by law at least to furnish an annual statement of its accounts to the Local Government Board; nearly all of them have to obtain the approval of that branch of the national executive before incurring expenditure to be met out of borrowed money, and before raising a loan; most of them receive annual grants from the national exchequer in aid of their expenditure on particular local services, and have therefore to comply with the conditions that may be attached to these grants by the Treasury, the Board of Education, the Home Office, the Board of Agriculture, or the Local Government Board; finally, nearly all of them have to submit—but the municipal corporations only in respect of part of their work—to an annual audit of their accounts by auditors appointed by and responsible to the Local Government Board. These auditors do not carry out, however, the wishes of the national executive; what they have to do is to prevent disobedience to the statutes of the national legislature. They have, in fact, to act in a judicial rather than in an executive capacity, having no power to override a mere exercise of the discretion of the local authority, but they are authorized, and indeed required, whatever the Local Government Board, or other executive authority might desire, subject to appeal to the ordinary courts of law, peremptorily to disallow and to cause to be refunded, any expenditure that (whether in respect of its subject matter, or by reason of fraud, embezzlement or mere waste) falls outside the statutory powers conferred upon the local authority. It should, moreover, be added that any difference of opinion between the Local Government Board (or other branch of the national executive) and a local authority, or between two local authorities, as to their respective legal powers and obligations, has to be determined (unless by mutual consent) not by the decision of any executive officer or by the national executive itself—not even by any special tribunal which the national executive might influence—but, as in the United States, by the ordinary Courts of Justice, applying to the dispute the ordinary law of the land, exactly as if it were a dispute between private individuals. In the same way, when a local authority disobeys or fails to comply with any of the statutes, or acts in excess of its powers, it can be coerced to obedience (apart from such disallowance of unlawful expenditure by the auditor, or such withdrawal of financial assistance from the national exchequer as has been already mentioned) only by means of actions in the ordinary Courts of Justice, which have to be initiated either by aggrieved individuals or by the national executive under the ordinary law.

But any description of the relation between the national executive and the local governing bodies in England would miss the most important feature if it omitted to lay stress on the Grant in Aid. It is the system of grants in aid from the national exchequer upon which the smooth and efficient working of the whole organization to a large extent depends. The expressed purposes of these grants in aid are (*a*) to assist poor localities, and prevent the local rates rising to an oppressive height, by promoting a partial equalization of burden; and (*b*) to induce apathetic or backward local authorities to incur expenditure on local services in which the community as a whole has a strong interest. Even more important to the student of political science is the utility of these national subventions to local government, when given in their most efficient form, in securing national efficiency, without destruction of genuine local autonomy. The basis of English local government is the statutory enactment, by the national legislature, of a minimum standard in each public service (notably in sanitation, education and police), the attainment of which is legally obligatory on every local authority, and is legally enforceable by mandamus. Beyond that national minimum in each public service, each local authority has complete discretion. It can, at the expense of its ever-rising local rates, and subject to the control implied in periodical popular election, do as much or as little as it chooses. But if it chooses to comply with certain specified conditions imposed by the national executive—conditions designed to secure a constantly rising standard of efficiency in particular services—it can (especially in education) obtain national grants in aid of its local expenditure, so calculated as to share the financial burden of increased efficiency between the national exchequer and the local rates. The position of authoritative criticism and ultimate power to withhold the grant, which this relation gives to the national executive—while leaving the local authority both freedom of decision and a genuine choice among methods, as well as complete autonomy in the appointment of officers—appears, on the whole, the best possible device for combining administrative efficiency with local popular control.

Bibliography.— Besides the authorities cited in the text the student should consult 'English Local Government,' by Dr. Joseph Redlich and F. W. Hirst; or 'The Parish and the County,' by Sidney and Beatrice Webb, 1906, forming the first of several volumes of an analytic and historical account of 'English local government from the revolution to the municipal corporations' act.' Brief descriptions of the actual organization of to-day are 'Local Government,' by Percy Ashley (1905); and 'Local Government,' by Dr. Blake Odgers (1902).

Sidney and Beatrice Webb,
Joint authors of 'Industrial Democracy,' etc.

13. Great Britain — Civil Service. The present organization of the English Civil Service may be said to have originated in the appointment by Order in Council in 1855 of a Civil Service Commission sufficiently strong and independent to check in some degree the then existing abuses of Parliamentary patronage.

In the earlier years of the reign of George III. the King had kept patronage in his own hands, and had used it with the single view of increasing his personal power. Edmund Burke's reform of the Civil List (1782) brought in a new and more permanent organization of the government offices, which made royal pressure on the "placemen" more difficult. In 1809 a Superannuation Act had the practical effect of giving civil servants the right to hold their office during good behavior. From 1810 they were paid by salary instead of by fees, and from 1816 the salaries of many posts were provided by a Parliamentary grant. By this time the royal power was exercised by the cabinet ministers, and they, through the "Patronage Secretary to the Treasury," who acted (and still acts) as Parliamentary "whip," avowedly used their patronage on the nomination of individual members of Parliament as a means of keeping together a majority in the House of Commons. Lord John Russell, in his 'History of English Government and Constitution' 1823 (page 402), speaks of Parliamentary patronage as being "of late years more completely organized."

The legislation which followed the Reform Bill of 1832 increased the number and importance of civil service posts, while the growth of the railway system and of other forms of joint stock enterprise made it more difficult for the government to retain its few really able officials. The majority of the persons appointed on the nomination of ministers and members of Parliament were notoriously incompetent. Each party respected the appointments of its predecessor and no one lost his post on a change of government — a fact which, while it mitigated the evils of the spoils system, added to the permanent inefficiency of the service. Occasionally a strong man (like Sir James Stephen, 1789 1859, or Herman Merivale, 1806–1874), was appointed from outside in middle age for special work, but as a rule men were appointed young and were employed for their first 10 or 15 years in copying letters and other routine occupations. The effect on the personnel of the offices is described by Sir Charles Trevelyan and Sir Stafford Northcote (Report on the Civil Service, 1854): "Admission into the civil service is indeed eagerly sought after, but it is for the unambitious and the indolent or incapable that it is chiefly desired. Those whose abilities do not warrant an expectation that they will succeed in the open professions, where they must encounter the competition of their contemporaries, and those whom indolence of temperament or physical infirmities unfit for active exertion, are placed in the civil service."

The effect on the constituencies was even worse. Sir Charles Trevelyan, writing many years later, says: "Every borough and county except a few of the largest had its local manager on either side — a banker, brewer, or solicitor — who purchased the vote and support of the leading men by a judicious application of the loaves and fishes. The corruption so engendered was more constant and general than the bribery carried on by means of money, and it was also more influential, in the degree in which a provision for life for a son or some other person in whom a voter was interested was more valuable than the customary five-pound note." (Eaton, 'Civil Service in Great Britain,' p. 431).

In 1853 the government appointed Sir Charles Trevelyan, with Sir Stafford Northcote as his colleague, to inquire into the whole question. Trevelyan had been (1826–1838) in the service of the East India Company and was the brother-in-law of Macaulay, who had been (1832–1834) secretary to the India Board of Control and (1834–1838) legal member of the Governor-General's Council. In 1833 Macaulay had suggested open competition for the "writerships" of the East India Company as the only effective method of controlling the patronage of the directors.

The Government of India Bill of 1853 carried this proposal into effect, the first open examination being held by the India Board in 1855.

Trevelyan and Northcote's report was presented in January 1854, and proposed open competition for the English civil service, and the separation of the service into higher and lower divisions. Gladstone, as Chancellor of the Exchequer in Lord Aberdeen's government, agreed with the scheme, and civil service reform was promised in the Queen's speech of 1854. Meanwhile the report had been sent round to a number of distinguished educators and administrators whose opinions, mostly pessimistic, were published by the government (Reports and Papers, 1854–55). In March 1854 the Crimean War began, which prevented any large reform being undertaken and the scheme was denounced in the House of Lords, by Lord Malmesbury and others, 13 March 1854, as inconsistent with aristocratic government.

In January 1855 Lord Palmerston, who disapproved of Trevelyan's scheme, became Prime Minister. But the administrative disasters of the war had stirred public opinion, and a strong Administrative Reform Association, under the leadership of Sir Henry Layard, had been formed. Dickens expressed the popular indignation of the time in his picture of the Tite Barnacle family in 'Little Dorrit' (1855-57), which perhaps was partly inspired by Carlyle's attack on "Downing Street" in his 'Latter Day Pamphlets' (1859). Palmerston so far gave way as to create by Order in Council (21 May 1855) a Civil Service Commission whose duty it should be to conduct an independent examination of all nominees. Resolutions in the House of Commons in favor of open competition were lost (10 July 1855) and carried 24 April 1856, and in 1857.

From the first, some of the examinations conducted by the Civil Service Commissioners were in fact competitive, owing to the nomination of more candidates than there were appointments. In 1860 a strong Select Committee inquired into the whole question and reported that their own preference was in favor of open competition, but that in order that the government should not go beyond public opinion they recommended the extension of this system of "limited competition" to the civil service generally. The evidence taken by the committee showed that some of the older civil servants still objected to the examination system, even under the conditions which had prevailed since 1855, on the ground that it had introduced "a class of men above their work." The opinions of one of the better officials who had been introduced by the old system of unchecked nomination are expressed in Anthony Trollope's novel 'The Three Clerks' (1858).

The recommendations of the Select Committee were accepted by the government, and for the next 10 years a competition between at least three nominated candidates took place for each appointment.

The introduction of household suffrage in towns by Disraeli's "Leap in the Dark" Reform Bill (1867) and the defeat of the Conservative party at the election of 1868, altered the whole political position of the civil service question. The existing aristocratic political families felt that their hold on patronage was gone, and were afraid of the results which would follow from the use of patronage by members of Parliament under the pressure of the newly enfranchised voters. The system of open competition for the Indian civil service introduced 15 years before had worked well, and Gladstone was able to publish (4 July 1870), almost without opposition, an Order in Council throwing open to competition most of the government offices. The Foreign Office and the Home Office (which controls the police) were excepted, owing to a belief that secrecy was better secured by a system of nomination. A few years later (1873) the Home Office was thrown open.

When the post-office took over the telegraphs from the railway companies in 1870 it was found that a few women officials were at work. These were retained, and since then the number of women civil servants has been increased. There were 7,000 of them recorded in the census of 1881, 15,000 in 1891, and 16,000 in 1901. A few women have been appointed to important posts as inspectors.

Gladstone's Order in Council of 1870 still in essentials regulates admission to the English Civil Service, though alterations of name have occurred, such as the substitution of "Second Division" for "Lower Division" in 1890, and changes of salary, status, and examination subjects.

The system has been worked with a certain amount of elasticity. Men of all ages are from time to time appointed without competition to posts involving special knowledge, and competitive examination is never used in such cases as a test of qualifications. In some cases, as in the starting by the Liberal government of 1892-95 of the Labor Department of the Board of Trade and the Inquiries Department of the Board of Education, appointments have been given without examination to men from outside, although the work to be done is similar to that done elsewhere by civil servants recruited in the ordinary way. Inspectors are practically never appointed by examination, and the "Examiners" of the Board of Education, whose work is practically that of the "first division clerks" in other offices, are appointed by the president of the Board, generally from men who have just distinguished themselves at Oxford or Cambridge. Artisans at the royal dockyards and on other government work are appointed without competitive examination from lists of waiting applicants, and the same method is used for recruiting the police of London (which is under the central government). The younger "second division clerks" are allowed to compete on equal (or slightly more favorable) terms with the outside candidates for first division clerkships, but in no case is competitive examination used as the method of selection for promotion within the service.

Speaking generally it may be said that the English government believes that competitive examination in the ordinary subjects of study is an excellent way of selecting young men for employment at the end of their school or university career, whether at 17 or at 22 years of age, but that it is not effective when applied to men engaged in professional work or as a test of professional knowledge. The fact however that the main body of the officials are appointed by competition has produced an *esprit du corps* which keeps the whole service out of politics, and the exceptional cases of appointment by nomination neither excite nor as a rule deserve criticism.

Any serious modification in the present arrangements which may be introduced in the future will probably be due to the changes which are going on in the English educational system. In 1855 and in 1870 almost all young Englishmen of the well-to-do classes who did not enter the army or navy went through the same course of education in classics and mathematics at the old endowed "public schools" and the two great universities. Professional preparation for the young "gentlemen" followed graduation, and therefore it was very easy immediately after graduation to compare their abilities and acquirements by examination. Those who failed began, without feeling that they had wasted either time or effort, preparation for the Bar or the Church or the "public school" teaching profession, or more often started their professional work with little or no preparation. In the same way an examination for the lower civil service confined to reading, writing, and arithmetic, corresponded to the facts of the time, for few boys who did not go through the public school course learnt much else. Since 1870 the number of "secondary" and "higher grade" schools with a fairly wide curriculum has enormously increased. In 1898 it was found that the old narrow examination for the lower division had become by the mere force of competition a difficult and technical test for which boys left their schools and prepared themselves at crammers. A wider curriculum including modern languages and science was therefore substituted. This fact and the facilities in London and other cities for obtaining higher education in evening classes is tending to lessen the educational advantages possessed by the average first division clerk over a clever and ambitious second division clerk, and to break down the original reason for their life-long difference of status.

A still greater difficulty is being created by the changes which are going on in English higher education. The English university course, both in the older universities, and still more in the new universities which are springing up in the great towns, is becoming increasingly specialized. Students come to the university for professional courses such as medicine or engineering, or law, or if they devote themselves to humanistic studies specialize on history, or philosophy, or philology. A course which is likely to lead to success in the first division examination (with which the Indian civil service examination was combined in 1897) must consist of several different non-technical subjects pursued with almost equal diligence. Such a course may tend, for those young men who have to work for their livelihood, to lead to no profession except the civil service and perhaps teaching. If so, the original advantage of that generalized examination which was introduced under Macaulay's influence into both the home and the Indian higher civil service will come to an end. It will be no longer possible for the clever youths from the universities to compete each year for civil service posts before finally deciding on their career. The generalized course will itself have become a special preparation, and it will be difficult to resist the argument that a specialized examination involving, as it does for instance in Germany, a technical course of study in law and economics would produce better results.

The term "civil service" is in England only used of the service of the central state. That fact has helped to disguise the unity of the problem of administrative employment under the central and the local government. The census figures class them together and show that the local employees are growing in number as fast as the central.

	National.	Local.
1871	53,000	51,000
1881	50,000	53,000
1891	79,000	64,000
1901	90,000	71,000

Only a few of the larger local governing bodies have a system of competitive examination for their administrative service and "influence" is undoubtedly very powerful in securing appointments under the rest. At the same time, as the size of local governing areas and the importance of local work increases, the need of abler and better trained officials is making itself felt. It is certainly not desirable that each local service should be a "water-tight compartment," admission to which must be sought by a separate examination and within which alone promotion can be hoped for. Nor is it probable either that the central state will lay down (as it does in the case of Medical Officers of Health) certain qualifications which must be possessed by all persons appointed to local administrative posts, or that the local bodies will combine for a general competitive examination from the successful candidates at which all local bodies may draw. But if a course of preparation including perhaps law, statistics, and "Staatswissenschaft" became accepted by public opinion as the best preparation for a professional administrator, it is probable that the central and local officials would be appointed to a large extent from the same body of candidates. At present, however, opinion in England might be suspicious of a "bureaucracy" trained, as in Germany, on a common body of knowledge and in a common form of thought.

Burke in his reform of 1782 not only helped to create the class of professional "cival servants" but attempted to distribute some of their work upon a more logical and economical basis. What we now call "Government Departments" consisted then of the clerical staff attached, either to certain ancient offices of State, such as those of the Lord Chancellor, the Chancellor of the Exchequer, the Postmaster General, and the Secretaries of State, or to Committees of the Privy Council, or to Boards of Commissioners administering other ancient offices such as those of the Lord High Treasurer, or the Lord High Admiral. Each office had "grown" of itself, and new offices had been created as work increased and without reference to any consistent plan. Of the two principal Secretaries of State, for instance, the Secretary of the North conducted all correspondence with the Northern powers of Europe, and the Secretary for the South not only corresponded with France, Spain, etc., but carried on Irish business and the whole police and other work of the "Home" Department. Burke re-divided their duties, making the Northern Department the office of the Foreign Secretary, and the Southern Department that of the Home Secretary. At the same time, England having lost the greater part of her Empire, he suppressed the Colonial Secretary, who had existed since 1768, and who had by hopelessly unworkable arrangement shared his duties with a Committee of the Privy Council called the Board of Trade and Plantations. The work of both was given to the Home Secretary.

But it was not until the period of legislative activity which followed the Reform Bill of 1832 that anything like a complete survey was made of the functions of government, or that any serious attempt was undertaken to create a department for each function. Both the recognition of the need of such a survey and the actual form taken by the redistribution of powers were largely influenced to the suggestions of Jeremy Bentham in his 'Constitutional Code' and other writings.

The Board of Works (Bentham's «Domain Minister») was created in 1832; the Poor Law Commission (Bentham's «Indigence Relief Minister») was created in 1834, became the Poor Law Board in 1847, and was merged in the Local Government Board in 1871; the Committee of Council for Education (Bentham's «Education Minister») was created in 1839 and became the Board of Education in 1899; and the Registrar General (to superintend Bentham's «Local Registrars» of vital statistics) was created in 1837. Separate Secretaries of State were appointed for War and Colonies in 1854, and for India in 1858. A Secretary for Scotland was created in 1885, and a Board of Agriculture in 1889.

At present under a bewildering variety of names (Boards, Commissioners, Secretaries, etc.) a fairly logical system is in existence. Nearly all the work of the executive government is divided among about fifteen main departments. At the head of each department is a political chief who sits in the Cabinet and who is assisted by another member of the Government, who generally sits in that House in which the Cabinet member does not sit.

In 1906 the Departmental chiefs and their Parliamentary assistants were: for Finance, the Chancellor of the Exchequer assisted by the Financial Secretary to the Treasury; for the Home Office (Police, etc.), Foreign Office, Colonial Office, War Office and India Office, a Secretary of State with a Parliamentary Undersecretary in each case; for Scotland and Ireland, a Secretary and Chief Secretary; the President of the Local Government Board (dealing with Poor Relief, Public Health and other functions administered by local authorities), with a Parliamentary Undersecretary; the President of the Board of Education, whose assistant (in the House of Lords) is called Lord President of the Council and is (1906) in the Cabinet; the President of the Board of Trade, with a Parliamentary Undersecretary; the President of the Board of Agriculture, without one; and the Postmaster General.

Bibliography.— The only book on the whole subject is D. B. Eaton's 'English Civil Service' (1880), a careful record of facts, but written without special knowledge of English conditions. The rise of the Indian civil service is admirably treated in A. L. Lowell's 'Colonial Civil Service' (1900). But the main sources are the reports and evidence of the successive Parliamentary committees and royal commissions which have sat on the subject, especially the Report of Sir Stafford Northcote and Sir Charles Trevelyan (1854), Reports and Papers on the reorganization of the Civil Service (1854–55), The Select Committee on the Civil Service (1860), The Playfair Commission (1874), and the Ridley Commission (1887). For the organization of government departments, consult Sir William Anson's 'Law and Custom of the Constitution,' Vol. II.

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THE JUNIOR PARTNERS.

14. Great Britain — Scottish History. *From the Invasion of Agricola in* 80 A. D. *to the Death of Alexander III. in* 1286.— In the main lines of its development Scotland has from the beginning been subjected to the same general influences that have determined the civilization of all the countries of Western Christendom. Like each of these countries, however, it has had a history of its own which has given a specific stamp to the character of its people, to its institutions, laws, customs, and social arrangements. Among the nations of Europe Scotland has an individuality as distinctive as that of any of its more powerful neighbors, and it has made its own contribution to the general sum of knowledge and to the advancement of humanity. Let us in a rapid survey glance at the general and special conditions under which her people became a nation and acquired the characteristics by which she is known to the world.

Remote as is her geographical position, Scotland, from the moment it appears in history, was an integral part of Western Europe. Like England, France, and other countries she also came under the domination of the Roman Empire, and her history begins with the invasion of Agricola in the year 80 A.D. In her case, however (and it is a note of difference at the very beginning of her history), the Roman dominion never passed beyond a military occupation, and, except material remains, left no permanent impression of its presence. The next powerful influence that helped to determine the future of Europe was the spread of Christianity, and for this influence Scotland had not long to wait. About the year 563 Saint Columba introduced Irish Christianity into the country north of the River Forth, and by the first quarter of the 8th century the whole of North Britain came nominally under the jurisdiction of the Bishop of Rome. Christianity was a common factor in the process which led to the formation of the nations of Western Europe, but in Scotland, as in other countries, there were specific conditions that determined the character of her development and permanently influenced the genius of her people. There was first the physical nature of the country, and, second, the fact that peoples speaking different languages divided the land between them. As far as her internal history is concerned, the dominating physical fact was the division of its surface into a Highland and a Lowland country. The River Forth «that bridles the wild Highlandman,» dividing these two territorial sections by a natural line, has been, in fact, a determining factor in the development of the Scottish nation. To the north and the south of the Forth respectively there have existed to the present day two distinct peoples, speaking different languages and possessing different characteristics, partly the result of original racial idiosyncrasies and partly the result of their respective histories. The mutual relations between these two peoples, it will be seen, have been of the first importance in the history of the Scottish nation.

In the first quarter of the 11th century the entire mainland of Scotland was nominally consolidated under one ruler, Malcolm II., who came of the Celtic race beyond the Forth. Though territorially consolidated, however, there was little cohesion between the northern and southern sections of the Kingdom, and the process in the next stage of national development (1100–1300) was the knitting of the bonds between the different peoples and their gradual subjection to an acknowledged head. In this process, also, there were general causes at work which were common to Christendom, and causes which were peculiar to Scotland herself. The general causes were the introduction of the feudal system, the organization of the Church with Rome as its centre, and the growth of towns and municipal institutions — all the result of the general movement among the countries of Western Europe. Peculiar to Scotland itself during this period of her development was the decisive supremacy obtained by the Teutonic over the Celtic peoples in the direction of the national destinies. The marriage (1079–1093) of Malcolm Canmore, a Celtic prince, with the Saxon Margaret marks the beginning of the struggle between the two races which was to decide whether there was to be the Scotland which exists to-day. From that marriage issued a line of kings with Teutonic names, Teutonic sympathies, and with the abiding purpose of Teutonizing the national institutions. The reasons for this policy are sufficiently obvious. The country between the Firth of Forth and the Tweed, which had been acquired through conquest by the Celtic kings of the north, and whose inhabitants were mainly Teutonic, was the most valuable part of their kingdom, and naturally tended to become its political centre. From the death of Malcolm Canmore in 1093 to the death of Alexander III. in 1286, therefore, the task of the successive Scottish kings was, on the one hand, to defend the southern part of their dominions against the encroachments of England, and, on the other, to hold in check their Celtic subjects to the north of the Forth and in the extensive district of Galloway (also mainly Celtic) in the southwest. By the death of Alexander the task had been accomplished, and Scotland was now a consolidated kingdom, effectually ruled by one acknowledged prince, with Teutonic influences in the ascendant.

The Struggle for Independence.— The death of Alexander III.'s only heir, Margaret of Norway, led to the attempt of Edward I. of England and his immediate successors to attach Scotland to the English Crown, and for more than half a century she had to fight for her bare existence as a nation. The results of the struggle were of the highest importance for the future of her people. Successfully maintaining her independence, by the very effort she made for self-preservation she became a united nation with a consciousness of a distinct destiny which had not been present to her even in the "golden days" of Alexander III. By the ordeal they had passed through, moreover, the Teutonic section of her people, who had been mainly interested in the issue of the struggle, acquired that national characteristic "the carl o' hemp in man" — that dogged persistence, which the world has recognized as a peculiarity of the typical Lowland Scot. But, as we shall see, there was another result of the struggle for independence which, if it did not affect the national character, powerfully influenced Scotland's laws and institutions, political, social, and municipal. In the contest with England she had sought the alliance of France, and for two centuries and a half she was in closer contact with France than with England. Previous to the War of Independence it was from England she had borrowed what she needed; now it was to France that she looked as her model.

The Development of National Institutions Under French Influence, 1472–1542.— From the death of David II. in 1472 to the beginning of the reign of Mary in 1542 is a well-marked period of Scottish history, during which the national institutions assumed the general form which they maintained till the union of the Scottish and English Parliaments in 1707. Throughout this entire period the dread of English aggression was still the constant preoccupation of the people, and this permanent dread at once deepened the national traits of hardihood and caution and contributed to the strengthening of national sentiment. In the development of institutions we have again to note the action of causes common to western Europe. Like the kings of other countries the Kings of Scots deliberately aimed at crushing the power of the feudal nobles and establishing a central authority over which they should be supreme. But in this endeavor they were checked by two hostile forces — the power of the Scottish nobles themselves and the insubordination of their Celtic subjects in the Highlands and the Western Islands. As the result of these opposing forces, whose relative strength was constantly changing, a Parliament like that of England, with well-defined privileges and efficaciously representing the different classes of the people, could not come to birth in Scotland. In the Scottish Parliament or Estates (so-called in imitation of the French *Etats*), the Lords Temporal and Spiritual, the Commissioners for the Shires and Burghs, sat in one House and nominally legislated for the nation, but the actual power of the Parliament was in the hands of a committee known as "The Lords of the Articles," the choice of which lay with the king or the greater barons according as the one or the other was in the ascendant. Till the Scottish Parliament ceased to exist, therefore, it was but the convenient instrument of whatever authority chanced to preponderate in the State. In the case of other institutions it was from France that Scotland borrowed the models she sought to imitate. It was from France, mainly during the period of which we are speaking, that she took over the Roman law, thus departing from the example of England; and the College of Justice (the present Court of Session), established by James V. in 1532, was formed on the pattern of the *Parlement* of Paris. In the election of municipal bodies in the burghs the method of France was likewise adopted (the retiring body electing its successor), a method which prevailed till as late as the 18th century. From France, also, during the same period was taken the arrangement of feu-farm by which land was leased in perpetuity — an arrangement encouraged by the Estates and intended (ineffectually as it proved) to remedy the system of short and precarious leases which till the 19th century disastrously affected agriculture in Scotland. When to these borrowings we add the fact that the majority of highly educated Scots studied in the schools of France, it will be seen that, apart from the political results of the alliance, the influence of France in Scotland is one of the important facts in the national development.

From the Reformation to the Revolution, 1542–1689. *Adoption of Protestantism and Alienation From France.*— With the beginning of the reign of Mary (1542) Scotland makes a new departure and enters on a period which definitely closes with the Revolution of 1689. The dominating fact of the period was the adoption of Protestantism in place of Catholicism as the national religion (1560). The immediate result of the change of religion was alienation from France as a Catholic country and approach to England, with an ever-growing conviction on the part of both peoples that political union was in the interests of both. But there were other results from the religious revolution which permanently affected the national character and the future of the country. For the first time in the nation's history an issue was presented which the public mind was mature enough to comprehend and which was of a nature to evoke the inherent contrarieties of thought and feeling which divide man from man. From the change of religion and the political consequences it involved there resulted a collision between two types of mind which have been in antagonism ever since. But this very collision of opposites produced a quickening of the general consciousness which made Scotland a nation in the strictest sense of the word. From the Reformation to the Revolution the country was cleft in twain by two opposing principles and two opposing parties, between which compromise was impossible and political equilibrium was unattainable. On the one side were the successive Stewart kings who aimed at absolute control in Church and State, and on the other, the religious party which adopted Presbyterianism as its form of church polity and which maintained the Church's independence of the State. After a struggle that had lasted above a century came the Revolution of 1689, when England and Scotland both cast out the House of Stewart and a new order began.

From the Revolution in 1689 up to the Present Time; The Union of Scottish and English Parliaments (1707); The Jacobite Risings; Subsequent Privileges; Modern Development.— For Scotland as for England the Revolution marks the beginning of the modern time. Throughout the foregoing period theological considerations had dominated the public mind equally in affairs of Church and State; henceforward secular interests become more and more the impelling motives that determine the action at once of the State and of the individual. The immediate result of this changed attitude was the union of the English and Scottish Parliaments in 1707. In the previous century ecclesiastical differences had been a bar to this union; now considerations of reciprocal interests determined both nations to accept it. For Scotland the union was a necessity if she was to take her place among the nations. Hitherto she had labored under disadvantages which, in spite of the strenuous efforts of her people, had impeded her free development. Her remote situation, her limited area of arable soil, her long antagonism to England, her political and religious distractions, and, as the result of all these concurrent disadvantages, the meagreness of capital, had crippled her in all her efforts to develop her resources and to compete with more fortunate nations. The immediate consequences of the union, however, did not give promise of the future that was in store for her. The old jealousies between the two partners increased rather than abated, and for fully half a century Scotland sullenly acquiesced in a union into which (such was the feeling generally expressed) she had been entrapped by unscrupulous statesmen, and from which she had only received insult and injury. The Jacobite risings of 1715 and 1745 are the significant commentary on the state of feeling even in the Lowlands, but, as the issue of both enterprises proved, the heart of the nation was too deeply committed to the new order to revert to a régime that would have been inherently opposed to the spirit of the new time.

By the middle of the 18th century the advantages that accrued from the union were no longer doubtful, and henceforward the industrial and commercial progress of the country exceeded the expectations of its most sanguine advocates. Manufactures multiplied; the mineral wealth of the country and the riches of its seas were utilized for the first time on an extensive scale. Foreign trade had hitherto been almost entirely restricted to the exchange of commodities with the countries bordering on the German Ocean and the Baltic Sea, but by the opening up of trade with America, Glasgow, Greenock, and Paisley — mere villages at the time of the union — grew into great towns and important commercial centres. Hitherto, also, of the three types of burghs peculiar to Scotland — Burghs of Barony, Burghs of Regality, and Royal Burghs — only the last had enjoyed the privilege of foreign trade in staple commodities, but this privilege gradually fell into abeyance, and every burgh with sufficient enterprise was at liberty to compete with its neighbors. In connection with the burghs a further progress has to be noted. In Scotland, as in other countries during the Middle Ages, trade and commerce had been shackled by conditions, necessary at the time but which were incompatible with free national development. Only Royal Burghs had possessed the privilege of being the homes of the great industrial crafts; in all the three types of burghs only burgesses had the right of pursuing any form of trade; jealous rivalry prevented free commercial intercourse between the different towns of the kingdom; and, finally, the fixing of the prices of commodities by the town councils or by the state obstructed the natural competition which is the life of trade. Later than in England, though not later than in France and Germany, these restrictions gradually ceased to be operative, and in 1846 «exclusive privileges» in trade and commerce were formally abolished by Act of Parliament.

Thus by the awakened spirit of her people and the surprising development of her resources, Scotland, for long a thorn in the side of her more powerful neighbor, came to be England's valuable ally in the building up of empire. To the growth of the British colonies it is admitted that she has contributed even more than her relative share: the number of pioneers whom she has sent to New Zealand, to Australia, and Canada is relatively greater than has proceeded from England, and equally out of proportion is the number of rulers and soldiers she has given to India and the other dependencies. In science, philosophy and literature it is sufficient to recall the names of Watt, Adam Smith, Hume, Burns, Scott, and Carlyle, to prove that she has contributed her own quota to the common stock of material and spiritual wellbeing.

In the rapid development of the country the Lowlands of the south and east were the principal agents, but the Highlands also were powerfully affected by the transformation of the rest of the kingdom. The risings of 1715 and 1745 may be regarded as the last efforts of the Celtic population of Scotland against the Teutonic element, to which it had been in permanent antagonism since the time of Malcolm Canmore. Through the action of the government after the last attempts of the Stewarts to recover their heritage the Highlands ceased to be a source of danger, but became a source of economic perplexity. The social conditions under which the Highlanders had hitherto lived now came to an end: the time-honored raids into the Lowlands were no longer possible, and the Highland chieftain ceased to be a feudal lord and became a proprietor interested in the produce of his land. Thus arose the problem, even yet imperfectly solved, how under their conditions of climate and surface and soil the Highlands might be made a tolerable abode for their populations and a partaker in the general prosperity of the country. But, though in the past debarred by physical conditions from playing a main part in the material development of the country as a whole, the Highlander is yet a constituent element of the Scottish nation. The nature of his home, the romance that has come to surround his character and his history are valuable assets among the national possessions. The natural complements the one of the other, the Lowland Scot supplies the cautious persistency, the sure hold of the fact indispensable in the conditions of modern life, while his Highland fellow-countryman by his quicker emotions and his natural grace is a standing reminder that there are other ideals than those of mere material prosperity.

Religion and Education.— We have seen that during the 16th and 17th centuries public affairs in Scotland were dominated by ecclesiastical considerations, and that at the Revolution of 1689 this domination came to an end, and material interests came more and more to occupy the public mind. Nevertheless, though religion thus ceased to be the determining factor in the national policy, it still remained a subject of absorbing public interest to the community at large, and throughout the 18th and 19th centuries religious controversy fills a large place in the national history. As a result of the Revolution, Episcopalianism, which had been made the national church by Charles II. at his Restoration in 1660, and which clung to the House of Stewart as its founder and patron, was disestablished in 1689, and Presbyterianism put in its place (1690), was bound by its own interests to support the Revolution régime. The National Church thus established remains till the present day, but in the course of the last two centuries there have been frequent secessions, resulting in the formation of various religious bodies of more or less importance. By the restoration of lay patronage in 1712 a division of opinion was created which led to the first Secession under Ebenezer Erskeil, whose members are known as the «Associate Presbytery,» or popularly as «Seceders.» Among the Seceders themselves there soon arose a division regarding the oath of allegiance enacted from the Scottish burghs, from which sprang the two bodies, respectively denominated Burghers and Anti-burghers. In 1761 came another Secession from the Established Church, also occasioned by difficulties connected with patronage — the new Secession taking the name of the «Presbytery of Relief.» In 1820 the Burghers and Anti-burghers united under the designation of the «Associate Synod of the Secession Church,» and in 1847 this body joined that of the Relief, to form the «United Presbyterian Church.» In 1843, one of the memorable years in Scottish Ecclesiastical history, the national church suffered its greatest disaster since the Revolution. Once more on the question of patronage, as involving the question of spiritual independence — the right of a church to independence of the State in all matters touching purity of doctrine — a numerous body of its ministers, led by Dr. Chalmers, effected the "Disruption" and set up what was known as the "Free Church of Scotland." Finally, in 1900, the Free Church and the United Presbyterian Church united under the name of the "United Free Church of Scotland." In this union, however, a minority of the Free Church refused to concur, and a judgment of the House of Lords (1904) decided that the property of the church belonged to the minority — a decision which occasioned an Act of Parliament appointing a commission to allocate the property between the two sections. Thus at the present time in Scotland there are two main bodies of the Presbyterian Church: the Established Church and the United Free Church. The Scottish Episcopal Church and the Roman Catholic Church, the latter mainly consisting of persons of Irish extraction, are the two other chief religious denominations. In the recent history of Scottish elementary education the most memorable event is the Education Act of 1872, by which Board Schools were substituted for the old Parish Schools and education was made compulsory from the age of five to thirteen. Seventeen years later elementary education was made free. While Scotland has always compared favorably with other countries in its provision for elementary education, her provision for secondary education remains defective, and she is now impatiently awaiting an Act which will remedy the disadvantage. Within the last half century the universities of Scotland have undergone reforms which have changed their original character and were intended to adapt them to modern needs. By the University (Scotland) Act of 1858 they received a common constitution, and by the Universities Act of 1889 this common constitution was further reformed. The supreme body in each case is a University Court; there is also a Senabus, consisting of principal and professors, who regulate internal administration. There are four universities — Edinburgh, Glasgow, Aberdeen, and St. Andrew's, to which last the University College of Dundee is affiliated.

Law and Justice.— The law of Scotland was originally based on Roman law, but there has been a gradual assimilation between the law of Scotland and that of England. This has been specially the case with mercantile law, which is now mainly identical in both countries. The system of real property law, however, is fundamentally different from that of England. In England the fee simple can be split up into estates for life, while fee simple in Scotland cannot be split up; and what is called a life-rent is merely a burden on the fee. Estates in remainder are unknown; the fee is destined to institutes and substitutes, and the word entail means in Scotland only a destination that cannot be broken except under defined conditions. In Scotland, in the law of contracts no consideration is necessary to make a contract actionable. In Scotland, law and equity have never been separated, but have always formed a single system. The law of personal and domestic relations, being largely founded on Roman law, differs in its broad principles from that of England. The tendency, however, has been to assimilate the two in the course of modern legislative changes. Marriage, for example, need not in Scotland be celebrated *in facie ecclesiae,* but can be constituted by mere informal contract of the parties. Marriage can also be more readily dissolved — desertion being sufficient ground of itself. The administration of the civil law is vested in the Court of Sessions subject to appeal to the House of Lords. This tribunal consists of an Inner or Appellate House, which sits in two Divisions, one of which is presided over by the Lord President and the other by the Lord Justice Clerk. There is also an Outer House, consisting of five Judges of First Instance who sit singly under the title of Lords Ordinary. There are also in each county local Courts with restricted jurisdiction, presided over by sheriffs or sheriff-substitutes, which in many respects correspond to the County Courts in England, but have a somewhat wider jurisdiction. The criminal law is administered by the same body of judges sitting on the criminal side and with a somewhat different organization. In his capacity as Head of the High Court of Judiciary, the Lord President is Lord Justice-General of Scotland. There are also Magistrates' Courts, burgh and county, which exercise police jurisdiction. These magistrates are for the most part unpaid laymen.

For geography, geology, hydrography, population, education, political constitution, etc., see SCOTLAND, and SCOTLAND, LANGUAGE AND LITERATURE OF. See also the articles under GREAT BRITAIN — GEOGRAPHICAL ENVIRONMENT; THE CONQUESTS; THE REFORMATION; CIVIL WAR; PARLIAMENT; CROWN AND CABINET; RELIGION; EDUCATION; etc. For agriculture, mining, manufactures, trade, etc., see GREAT BRITAIN — AGRICULTURE; MINING; FISHERIES; INDUSTRIES; COMMERCE; BANKING AND CURRENCY; RAILWAYS; SHIPPING; etc.

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15. Great Britain — Irish History. Ireland, lying to the west of Great Britain, forms one kingdom with it, which is known as the United Kingdom of Great Britain and Ireland. This designation was introduced in the year 1800, when the Act of Union which united the Parliament of Ireland with that of Great Britain was passed. So far as political institutions can avail, Ireland is one with the neighboring country. But in spite of the political tie she stands widely divided from Great Britain by most of the characteristics which are distinctive of a nation — historical traditions, racial spirit, social and economic conditions. The distinction is marked even in the physical character of the island. Possessing little mineral wealth — iron ores in Antrim and Leitrim and some coal deposits in Antrim, Leitrim and Kilkenny — Ireland has not within itself the resources of a manufacturing country. The great central plain, stretching across the island from sea to sea, richly covered with vegetation, is adapted to pastoral and agricultural industries only, while the hilly regions to the north and south offer a soil that only tillage can make fruitful. Though water is abundant, water-power is deficient, owing to the generally low level of the country, fully one-half of which does not rise to an elevation of 300 feet above the sea.

Ancient Legends.— From the earliest times to which tradition reaches back Ireland was occupied by off-shoots of that great Celtic race which spread from the Hellespont to the English Channel. Lying within easy reach of the coast of Gaul it was exposed to the incursions of the sea-faring Celts of northern Europe. According to the ancient legends it was successively overrun and conquered by five different invading tribes. The last of these were the Milesians. The legends represent these invaders as migrating from Spain about 700 B.C. and establishing their sovereignty over the whole of Ireland. Modern scholars incline to the view that the story of the Milesian invasion is the record in tradition of an invasion by British Celts which took place most probably about the beginning of the Christian era. The political organization of the Irish Celts was strictly tribal. The land of the country was parcelled out among a number of petty chiefs or heads of tribes, who owed certain duties of tribute and service to the more powerful over-kings; above these again was the Ard-righ or chief king whose authority was acknowledged in proportion to his power to make it effective. The tribal organization remained an enduring source of national weakness; it hindered the growth of an effective national power; it prevented any effective combination of the national forces against foreign invasion.

Christianity Established. — In the second half of the fifth century Ireland was converted to Christianity; its conversion was the work of a few years. That the new faith was accepted readily may be due to the fact that the previous religion of the people — if it can be called a religion — was ill-defined and unsystematized; a definite belief with a definite system of worship would not have been surrendered without a struggle. Saint Patrick, and the other founders of the Irish Church, accommodated themselves to the political organization of the country. Monastic institutions, established on lands granted by the converted chieftains, became the centres of church government, their jurisdiction being coterminous with the territory on which they were founded. They seem to have been regarded as identified with the local civil organization and were freely plundered and destroyed in the raids which, in the absence of a controlling central power, the petty rulers made on one another. This notwithstanding, monasticism exhibited remarkable developments in Ireland. For three centuries after the death of Saint Patrick the Irish monastic schools were the centres of learning in Europe. Scholars flocked to them from Great Britain and the continent; and from these schools went forth the teachers who carried faith and knowledge among the Teutonic conquerors of the Roman Empire. This missionary activity declined with the growth of civilized institutions in the new kingdoms that had been formed out of Rome's possessions. The source of supply was moreover sadly disturbed in Ireland. (See MONARCHISM.) At the beginning of the 9th century the Northmen, at the same time that they began their raids on England, extended their incursions to Ireland. They succeeded in establishing a few important strongholds on the coast and carried fire and sword through a country whose warring rulers met them as enemies or received them as allies according to the needs of their struggles with native rivals. The monasteries were a special object of hate to the Vikings; when their power was at length broken, in the 11th century, Irish monasticism was found to have run its course, and the field lay open to the Latin or Benedictine monasticism which was to succeed it.

Establishment of English Power. — With the 12th century opens that long chapter of Irish history which records the relations of Ireland to England. The history of those relations is the history of Ireland to the present day. In 1169 the first body of Anglo-Norman adventurers crossed the Irish Sea, the precursors of many a subsequent expedition. They came as the allies of a native chief who had been expelled from his territory. They came to stay, and after them came, in long succession, other bodies of adventurers. It was thus the foundations of English power in Ireland were laid. It was a fitful and tedious process, carried out for four centuries without any definite plan, and at no time during that period with forces sufficient to effect a general conquest. On the other hand the native Irish, owing to their tribal organization, and to the absence of an effective central authority among them, were never able to unite for common defense against the invaders. The growth of a national spirit and a national life was rendered impossible. Politically there were two Irelands within the island — one, that portion of the country in which English law prevailed, and the authority of the English Lord Deputy was recognized, and which came to be called the Pale; and, outside this, another, ruled by Irish chieftains, or by Anglo-Norman lords who adopted Irish customs, and who obeyed or resisted the authority of the Crown as suited their interests. Parliamentary institutions were introduced into Ireland soon after their establishment in England. But, as they were for the English settlers only, and were set in motion chiefly to provide subsidies for the English monarch, and as representation was bestowed much as the Lord Deputy chose to distribute it, the occasional summoning of a Parliament did little to promote the evolution of a national government. With the reign of Henry VIII. came the Reformation (q.v.), and, with this, the introduction of a new element of discord into Ireland. Racial and political feuds were now intensified and embittered by religious antagonism. Throughout the desolating wars of Elizabeth's reign, the «Plantations» of James I., and the sanguinary campaign of Cromwell (q.v.) the policy of at once destroying the «Irish Enemie,» and extirpating popery, was consistently pursued. The defeat of the Irish at the Boyne (1689) made the English interest in Ireland definitively safe from armed attack. The English power was now supreme, and it might have been anticipated that the country would enter on a career of economic and political development. But this was not to be for some time yet. Religious hate divided the country as effectually as animosities of race. A penal code was passed against the Catholic religion which demoralized alike those who administered it and those whom it oppressed. Mr. Lecky describes it as «ingeniously contrived to injure, to insult, and to impoverish the people of Ireland.» It is evident there could be no development of political organization in a country four-fifths of whose inhabitants were by law «excluded from Parliament, from the magistracy and from the bar, could not vote at elections, could not act as constables, sheriffs or jurymen, were debarred from every means of educating their children, from acting as schoolmasters, ushers or private tutors, could not marry Protestants, or purchase «manors, tenements, hereditaments or life annuities.» (LECKY.)

English Repression, Subsequent Poverty, and Passage of Land Acts.—A vigorous national spirit is the best cure for the excesses of religious intolerance, and through the 18th century there were causes at work which tended to create and develop this spirit. The English government, under pressure from English agriculturists and manufacturers, had, since the Restoration (1660), hampered by restrictive legislation every Irish industry which seemed likely to compete with England in the home or foreign market. This policy of stifling or starving industry affected Irish Protestants and Catholics alike, and roused in them the sense of common national interests. The ablest spokesmen of the dominant party began to demand free trade for Ireland, a free Parliament, and emancipation for the Catholics. Free trade and a free Parliament were secured, and some of the more galling disabilities of the Catholics were removed. A genuine national life began to animate the country, and its progress during the period of its Parliamentary independence was unexampled. As Lord Clare put it, "No nation on the habitable globe had advanced in cultivation, commerce and manufacture, with the same rapidity as Ireland from 1782 to 1800."

But in 1800 the Act of Union put an end to the Irish Parliament, checked the further growth of that prosperity which had been stimulated by distinctively Irish legislation, and hindered the further development of that spirit of religious tolerance which the sense of common economic needs and interests was generating. Explain it as we may, England and Ireland will not, and apparently cannot, form one economic organism, in which one stream of industrial life will circulate. The long series of repressive Acts directed against Irish industries is proof of this for the centuries that are past. For our own time, the proof is furnished still more cogently. The 19th century was, for Great Britain, a period of unexampled prosperity. Her growth in wealth, in power, in population was continuous. She secured for herself the supremacy among the manufacturing and trading nations of the world, and from that eminence she has not yet been displaced. But while Great Britain was thus rising to unexampled industrial greatness, the remaining portion of "the United Kingdom" was declining in wealth and population with a rapidity which has no modern parallel. Thirty years after the Irish Parliament had been abolished, the industries which had flourished under its care had almost disappeared. The people of Ireland were, in consequence, thrown wholly upon the land. Competition for the one available means of livelihood became excessive, holdings were divided and sub-divided, and rents rose far above the economic level. The population grew, but the means of subsistence did not increase proportionately. The peasantry subsisted mainly on the potato crop; in 1846 this crop failed and famine followed. The repeal of the Corn Laws, and the competition of foreign countries, brought down the prices of agricultural produce. High rents could no longer be paid by small tillage farmers. The only farm industry as yet safe from foreign competition was that of cattle raising — the means of rapid transport from the United States, the Argentine Republic and Australia had not yet been perfected — and to make room for large grazing farms the small cultivators were ruthlessly cleared off the land. With the famine and the clearances began a movement of emigration which has reduced the population by nearly one-half. But in time the grazing ranches of the United States and the Argentine, and the sheep farms of Australia were brought within reach of the English markets, and prices fell so far that the graziers could no longer pay the high rents. An agrarian revolution was the consequence. The Government intervened, first to fix farm rents on the basis of current prices, and, when this was found unsatisfactory, to mediate for the sale of the land to the occupiers with the aid of State credit.

A series of Land Purchase Acts was passed, and the transfer of the land to the tenants is now proceeding on a large scale. The last Purchase Act passed in 1903 provided for an advance to the tenant purchasers of £100,000,000 sterling.

Remedial Legislation Passed by English Parliament.— It must be said that the English Government has done much during the last half century to repair the injustices of the centuries preceding. Let us reckon briefly what has been done. Passing over Catholic Emancipation (1829) and the establishment of the system of primary education known as the "National" system (1831), both of which measures belong to the first half of the century, we have to put to the account of the English Parliament and Government, the Disestablishment of the Irish Church (1869) which gave equality to all religions before the law; the system of intermediate education (1878); the Royal University (1879), defective inasmuch as it does not *give* university education, but merely *tests* it and confers degrees; Local Government (1898), which bestows on elected bodies the administration of local affairs; the series of Land Acts designed to improve the position of the occupier — the Act of 1870, which put a check on arbitrary eviction, and gave the tenant compensation for disturbance; the Act of 1881, which established a tribunal to which the tenant could appeal for the fixing of a fair rent; the Act of 1885, which made the first advance (£5,000,000) to the tenants for the purchase of their holdings; the Act of 1888, which made another advance of £5,000,000; the Act of 1891, which advanced £33,000,000 for the same purpose; the Act of 1896, which amended the preceding acts; and finally, the Wyndham Act of 1903, which facilitated the operations of purchase and increased the loan for buying out the landlords to £100,000,000.

Previous to the passing of this last great measure a Department of Agriculture and Technical Instruction was established (1898) to instruct the people in the improved modern methods of agriculture and to diffuse among them a knowledge of the industrial arts.

Under these acts the operations of purchase have been carried out on a large scale. Up to 1902, under the earlier acts, over 70,000 tenants had purchased their holdings at sums amounting in the aggregate to over £20,000,000. In January, 1906, the sales under the Wyndham Act had amounted to £7,207,548.

Prospects. — In spite of all this remedial legislation it cannot be said that the prospects of Irish industry are improving. The manufactures are confined chiefly to the northeastern corner of the island, where the shipbuilding industry of Belfast, and the linen industry in the city and surrounding country employ a large number of hands. If we except the brewing industry in Dublin we may say that the rest of the country is devoted to farming. The farming is not of the intensive kind; of the

20,350,000 acres which form the area of Ireland close on 13,000,000 acres are devoted to permanent pasture and meadow, and thus, as has been said, "Two-thirds of the country is never touched by plough or spade." Under these conditions a large population cannot be maintained in comfort. Hence the ceaseless flow of emigration, chiefly to the United States and Canada. In 1841 the population was 8,175,124; in 1901 it was 4,458,775, and the drain still continues. Discontent is the natural consequence. The cost of the administration of justice is nearly double what it is in England, where the population is more than six times that of Ireland; and 10 times what it is in Scotland, where the population is about equal to that of Ireland. Of the 103 members sent by Ireland to the Imperial Parliament over 80 are sent there to offer persistent resistance to the English Government of Ireland. On the whole it must be admitted that under this government Ireland has not enjoyed the good fortune which the framers of the Act of Union promised her. Nor has Great Britain derived from the union the advantages which the authors of the measure anticipated. The predictions of Grattan and the other far-seeing opponents of the Act have found melancholy fulfilment, and English statesmen of the present day seem warranted by the experience of a century in reverting to the policy — now finding such favor amongst them — of trusting to self-government as the best means of securing material prosperity for Ireland and political harmony between the sister countries.

The Churches.— The principal religious denominations of Ireland are the Roman Catholic, the Episcopalian Protestant (late Church of Ireland, disestablished in 1869), the Presbyterian and the Methodist. The respective numbers of these communions, according to the census of 1901, are: Catholics, 3,308,000; Episcopalian Protestants, 581,000; Presbyterians, 443,000; Methodists, 62,000. The constitution and government of the Catholic, Presbyterian and Methodist bodies are the same in Ireland as in other countries. There are in Ireland 28 Roman Catholic dioceses, with 4 archbishops and 24 bishops, 1,084 parishes, and a total of 3,157 priests. The Presbyterian Church, mainly confined to Ulster, is governed by a General Assembly, in which are represented 571 congregations with 653 ministers arranged under 33 Presbyteries. The affairs of the Methodist body are managed by a General Conference which meets annually; the number of ministers in Ireland, according to the latest returns, is 254. The constitution of the Protestant Episcopalian Church presents some points of special interest. The constitution of this Church was framed under the Irish Church Act of 1869, by which the "Church of Ireland" was disestablished. The supreme authority is vested in the General Synod. The General Synod consists of two houses: the House of Bishops, which includes all members of the Protestant episcopacy, and the House of Representatives, consisting of 208 clerical and 416 lay members. These representatives are elected by the clerical and lay members of the Diocesan Synods, which, in their turn, are elected by the clergy and laity respectively of the several dioceses. The General Synod is the supreme authority in all matters relating to discipline and doctrine within the Church. The funds of the Church are held by a body of trustees called the Representative Body. The capital sums in the hands of this body amount, according to the most recent returns, to 8½ millions sterling.

Executive.— The supreme executive authority in Ireland is vested in the King's representative, the Lord Lieutenant, who enjoys the title of Lieutenant-general and General-governor of Ireland. He is appointed by the Crown, is a peer, and must be Protestant. Sometimes he has a seat in the Cabinet and takes an active part in the Government of the country; more frequently he is a mere figurehead, the real executive authority being held by the "Chief Secretary to the Lord Lieutenant." The Chief Secretary is usually a Cabinet Minister, and is responsible to the House of Commons for the acts of the Government. The salary of the Lord Lieutenant is £20,000; that of the Chief Secretary, £4,425.

Local Administration.— By the Local Government (Ireland) Act, 1898, administrative functions in reference to highways, public health, and relief of the poor, were assigned to local bodies elected by the rate-payers — Borough Councils for the six largest towns; County Councils for the counties; and under these, Urban Councils for the smaller towns, and Rural District Councils for the country districts.

Judiciary.—At the head of the Irish judicial system is the High Court of Justice, with a Court of Appeal. The High Court includes two divisions — the Chancery and King's Bench Division. The work of these courts is done by a Lord Chancellor and 16 Judges, all appointed by the Crown, with aggregate salaries amounting to £64,000. Cases of less importance are dealt with by the recorders of the cities, three in number, and 18 county court judges, who hold their sessions at various centres through the country. The aggregate salaries of these subordinate judges amount to £31,000. A numerous unpaid magistracy, assisted by "stipendiary" or paid magistrates, deals with minor cases.

Police.— The police force of the country is wholly under Government control. Dublin has a local police force, controlled by Government, consisting of about 1,000 men, and maintained at a cost of £163,000, of which £110,000 is contributed by the Exchequer. The rest of the country is policed by the "Royal Irish Constabulary," a semi-military force of about 10,000 men maintained by Government at a yearly cost of £1,300,000.

For topography, hydrography, geology, flora, fauna, climate, population, etc., see IRELAND, and also GREAT BRITAIN, GEOGRAPHICAL ENVIRONMENT. For agriculture, fisheries, manufactures, trade, commerce, transportation, finances, banking, etc., see IRELAND, and also GREAT BRITAIN: AGRICULTURE; MINING; LAND LAWS; FISHERIES; INDUSTRIES; CO-OPERATION; FACTORY LEGISLATION; TRADE UNIONISM; COMMERCE; FREE TRADE MOVEMENT; BANKING AND CURRENCY; RAILWAYS; SHIPPING, etc. For government, education, religion, etc., see IRELAND, and also GREAT BRITAIN: PARLIAMENT; CROWN AND CABINET; POLITICAL PARTIES;

CIVIL SERVICE; JUDICIAL SYSTEM; LOCAL GOVERNMENT; CHURCH OF ENGLAND; NONCONFORMITY; ROMAN CATHOLICS; JUDAISM; EDUCATION; etc. For language and literature, art and architecture, and further details of history, see IRELAND; CELTIC LANGUAGES; GREAT BRITAIN: THE CONQUESTS; MEDIÆVAL ENGLAND; THE REFORMATION; ENGLISH HISTORY OF THE 17TH CENTURY; NAVIGATION ACTS; THE 18TH CENTURY; THE 19TH CENTURY; etc. See also IRISH MUSIC; IRISH LAND LAWS.

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16. Great Britain — Wales. Wales derives its name from a Teutonic root meaning foreign, applied to the country by the English invaders of Britain. In Welsh it is called *Cymru* (formerly spelled *Kymry*), a name, in spite of a superficial resemblance, entirely unconnected with the Cimbri or the Cimmerii. The Welsh term for a Welshman is *Cymro* (plur. *Cymry*), a derivative of the old Celtic *Combrox* (plur. *Combroges*), meaning a "fellow countryman." This name is now thought to have been given by the Welsh and the northern remnants of the ancient Britons to themselves in post-Roman times in their joint struggles against the English. Before this they seem to have used for themselves the general term Britons (Lat. *Britanni, Brittŏnes*). For certain purposes, chiefly educational, Monmouthshire is now counted as part of Wales. In Roman times the chief tribes in Wales were the Ordovices in the north and centre, the Silures in the southeast, and the Demetæ in southwest Wales. In the post-Roman period, and until the assimilation of the Welsh territorial system to that of England, the chief divisions were Gwynedd (in the northwest), Powys (in the centre and northeast), Gwent (in the southeast) and Dyfed (in the southwest), together with the contiguous parts of South Wales. This latter division in its totality was often called Deheubarth (*i. e.* the south part). These divisions practically survive in the dioceses of Bangor, Saint Asaph, Llandaff, and Saint David's respectively. The country was anciently divided into cantrefydd (hundreds), and each cantref was usually divided into two cymydau (commotes). Some of these cantrefydd (pl. of can[t] *(hundred)*, and tref *(homestead)*, such as Rhufoniog (Romaniacus), in Denbighshire, Dunoding, the land of Dunod (from Donatus), in Carnarvonshire and West Merioneth, bear Latin names, and must have clearly obtained these names during or after the Roman occupation. The division into county and borough divisions is due to the assimilation of the Welsh territorial system to that of England. The title "Prince of Wales," derived from the ancient principality of Wales, is now conferred by the reigning sovereign on the heir-apparent. In recent times, the connection of this title with Wales has been emphasized by the acceptance of the office of Chancellor of the University of Wales by His Majesty King Edward VII., then Prince of Wales, and afterward by the present heir to the throne. Wales has also recently received recognition of her national emblem of the Red Dragon as part of the armorial bearings of the Prince of Wales.

The Welsh people, though comprising subvarieties, form a distinct type among the peoples of the United Kingdom. The causes of this are largely physical and economic, acting from the remotest times, and on this basis the Welsh have developed a political, social and mental history of their own. The individuality of Wales is the more remarkable owing to her proximity to England and her exposure to English influences. The country stands, however, in the most obvious contrast to the central plain of England on which it borders, and its individuality has, to a great extent, a geographical basis. Wales consists almost entirely of a mass of mountains and uplands, intersected by various streams and rivers, the largest of which, the Dee, the Severn and the Wye, are on the east. In the lower valleys and the more level districts of the country, there are tracts of good land, but the upper valleys in the mountainous districts are subject to very heavy rainfalls, and are of little value for agriculture. There are also many large upland tracts, which can only be used for sheep-grazing. The population of rural Wales varies in density, but, owing to the smallness of the farms, it is often larger in proportion than in some of the agricultural districts of England. In the last century the distribution of the population of Wales underwent a great change by the discovery (especially in the south Wales coal-field) of great mineral wealth; and the consequent attraction of large masses of people into the industrial districts. These economic developments, too, have had a great effect on the social evolution of modern Wales.

Social Evolution and History.—The available evidence as to the prevalent type of the Welsh people shows that they are on the whole less fair, tall and bulky than the farmers of the English plains. They are, as a rule, more wiry and hardy than muscular, and a certain predominance of the nervous over the muscular system gives them, in certain districts especially, an air of keenness, sensitiveness and vivacity. The freshness of the air and the beauty and variety of the scenery also contribute to this end, as well as to an appreciation of linguistic aptness and poetic imagery. The excellent voices of Welshmen, too, are mainly due to the purity of the air. Brachy-cephalic types are rare, but mesocephalism prevails. Though the extreme blonde type is uncommon, there is a fair proportion of light or reddish hair, and, in south Wales especially, a considerable admixture of pale-faced, black-haired and markedly dolicho-cephalic men, who look as if their type had been evolved in the shelter of the ancient forests of the country. Generally speaking, it may be stated that the prevalent types are the natural counterparts of the conditions of life of the Welsh farmer and his dependents, with its hard toil, careful calculation and plain fare. Out of doors there is abundance of fresh air, but indoor ventilation is often sadly neglected, and in some districts phthisis is common.

The necessary interdependence of the members of the scattered communities of rural Wales has produced a certain sociability, fluency and aptitude for coöperation in public affairs, though in religious matters there is considerable cleavage. The chief religious denominations are the Calvinistic Methodists, the Independents and the Baptists. In purely Welsh districts crime is very rare. The conditions of Welsh agriculture from the remotest times, under necessities of soil and climate which often frustrated man's best hopes, have created a deep-rooted sense of man's dependence on powers that are beyond his control, and beneath the markedly religious spirit of the Welsh people there lies this fundamental instinct, the traditional intensity of which at times finds vivid expression. To this feeling are also linked a sense of the pathos of life, which has found utterance in Welsh poetry, a deep attachment to the soil, a minimizing of the importance of human distinctions in the face of the powers of Nature, and a passion for a kind of natural justice, which has expressed itself in modern times mainly in a demand for religious equality and the disestablishment and disendowment of the State Church, and in the desire to correct by means of education the disabilities of birth and station.

The social evolution of the country has been largely conditioned by its geography. This is such that the economic value of land varies greatly. Until recent times, the stress of competition was almost entirely for the surface products of the soil. The discovery of mineral wealth, however, has now given the economic, social and political evolution new directions. In the hunting, pastoral, fishing and agricultural life of man in the Stone, Bronze and Iron Ages, right down to modern times, whether Wales was invaded by Iberian, Goidel, Brython, Belgian, Roman, Saxon or Norman, the motive of the struggle was essentially the same, namely, the possession of the good lands of the country, such as the river valleys and the flatter districts afforded. In Wales, the records of the ancient system of land tenure suggest that the weaker and stronger communities came to be interspersed, the better type of holdings being held by freemen in family groups, while the unfree villagers farmed their land mainly by a system of co-tillage. The basis of social life was mainly tribal, and the necessary social adjustments produced a correlative body of custom and law.

The successive invasions of the country have left numerous archæological traces, as for example, the fortresses of unmortared stone of which Trerceiri in Carnarvonshire is an excellent instance. This fortress is now assigned by archæologists to about 100–50 B.C. The Romans developed the road communication; and worked some of the lead mines of the country. After the departure of the Romans, the western coasts were harassed by invaders from Ireland, and Britons from the north appear to have been invited to assist in their expulsion. Some of these families, notably that of Cunedda Woledig, remained in Wales and became the founders of Welsh local dynasties. The struggles against the English and the Normans brought war into the foreground of Welsh life. The conquest of Wales by Edward I. led to the establishment of a network of castles and garrison towns, governed by English law and custom, while the country districts remained Welsh. This led to constant friction, and the revolt of Owen Glyndwr (Glendower) was essentially a struggle of the country against the towns. The reign of Henry VII. (a descendant of an Anglesea Welshman, Owen Tudor) was hailed with great enthusiasm in Wales, but it was this prince and his son Henry VIII. who finally assimilated the Welsh legal system to that of England. Wales maintained its attachments to the Crown even through the Civil War, and until the second half of the 19th century was mainly conservative in politics.

The discovery of coal, slate, lead and other minerals, as well as the industrial and commercial revolution generally, has given the life of Wales a new aspect. In Glamorganshire, Monmouthshire, East Carmarthenshire, East Denbighshire and the slate districts of Carnarvonshire there are thriving and progressive industrial communities, with corresponding facilities for communication by land and sea. The rapid development in question is well exemplified in the case of Cardiff, (q.v.) which has grown in a few decades from being a moderate sized market town into one of the leading coal-ports of Britain. New docks, too, for Irish and Atlantic traffic have been built by the Great Western Railway at Goodwick in Pembrokeshire. There is in Wales a considerable sea-faring population and in Montgomeryshire, Carmarthenshire and Merionethshire there are some woollen factories. The industrial districts of Wales and the large towns of England, as well as the United States and the colonies, have absorbed the superfluous population of the Welsh country districts, until depopulation has in several places been the result. The price of agricultural labor has gone up, and, owing to the greater possibility of finding employment elsewhere, there is a more independent attitude toward the governing classes in religion and politics. Local government has more and more fallen into the hands of Liberals and Nonconformists, and there are now no Welsh Conservatives in the House of Commons, but the landowners are mostly Conservatives. See Great Britain: Local Government.

Side by side with this development, there has grown up a desire for a measure of national self-government, especially in the sphere of education; and the first instalment of this was given in 1897 by the establishment of the Central Welsh Board for Intermediate Education, for the purpose of controlling the secondary schools founded under the Welsh Intermediate Education Act of 1889. These schools have made very rapid progress, and now contain over 10,000 children. The establishment of the University of Wales, federating the University College of Aberystwyth (founded in 1872), Bangor (1884), and Cardiff (1883) is a phase of the same movement. Royal charters, too, have been granted for the foundation of a Welsh national museum at Cardiff and a Welsh national library at Aberystwyth. Several private collections of Welsh MSS. have been already bought for the latter. The great difficulty, however, in the way of complete national development and unification is the absence of a metropolis within easy reach of all parts. The most convenient meeting-place for the whole of Wales is Shrewsbury (the ancient Pengwern), which lies outside the Welsh border.

In addition to the foregoing factors of modern Welsh development, it should be stated that in the summer months there is a very great influx into Wales of visitors from England and elsewhere, in search of health and pleasure, and that for their accommodation whole towns have grown up along the coast. This link with England has helped to bring Wales into closer and closer touch with the outer world, while still living its own life and maintaining its individuality. Of the fine arts music and poetry are the only ones that have received extensive cultivation.

Language.— The Welsh language (called in Welsh *Yr iaith Gymraeg*) is an Indo-European tongue belonging, together with Breton and Cornish, to the Brythonic branch of the Celtic family. The first form of Celtic speech introduced into Wales in the Bronze period was probably Goidelic (to which Irish belongs), and Prof. Rhys thinks, from the evidence of the Goidelic Ogam inscriptions, that Goidelic lingered in Wales into the 7th century A.D. Welsh has undergone far more changes due to analogy and the like than Irish, and its grammar, which is now in the analytic stage, has been greatly simplified. About 800 Welsh words were borrowed from Latin during the Roman occupation of Britain. There are several dialects and subdialects of spoken Welsh, but the literary language has a historical tradition of its own. The spelling is almost entirely phonetic. Some of the river-names of Wales may be pre-Celtic. The Welsh language has a vigorous life, though English is now almost universally known. See CELTIC LANGUAGES.

Literature.—Wales has produced a very considerable body of literature, and the literary instinct is very widely disseminated among the people. The poetry contains many gems, especially as the poetic expression of the common lot and destiny of man. The oldest extant poem belongs to the 9th century A.D., but its form and diction show that there was already behind it a literary tradition. The earliest manuscript collections of Welsh poetry are the 'Black Book of Carmarthen' (12th century), the 'Book of Aneirin' (early 13th century); and the 'Book of Taliessin' (14th century). Several of the poems therein contained are shown by internal evidence to be pre-Norman. The literature of Wales is best viewed as a social product, secular and ecclesiastical. The mediæval prose writings are developments from the oral narratives told at the courts of the Welsh princes, annalistic expansions, translations from Latin and French, lives of the saints, Arthurian legends (q.v.) and other literature popular in the Middle Ages, such as the prophecies of the Sibyl and Merlin and the Helen and Charlemagne narratives. The mediæval poetry consists mainly of elegies, eulogies and hymns.

The chief literary centres at this time were the courts of the princes and the monasteries. After the decline of Welsh independence, Welsh poets still had many social patrons, and many poems were dedicated to them. The poetry of love and nature, too, which succeeded the older poetry of war, found expression in the beautiful verse of *Dafydd ab Gwilym* and his imitators. Another phase of poetry which flourished, especially in the 15th and 16th centuries, was that of minute description and epigrammatic conciseness. The metres tended to be intricate and difficult. The Reformation and the revival of learning led to the translation of the Bible, the composition of Welsh grammars (two of which are in Latin), the study of Welsh history and the composition of metrical versions of the Psalms. In the 18th century Welsh poetry and literature generally expanded into new types, and the result was the institution of the National Eisteddfod and of various societies for the encouragement of Welsh literature. The Eisteddfod has also given a great stimulus to the music of Wales.

During the 19th century Welsh literature and Welsh studies of every kind have been greatly advanced, and, in addition to the Welsh books published, there is a flourishing newspaper and periodical press. The national quarterly journals ('Y Geninen,' the *Leek*, and 'Y Traethodydd,' the *Essayist*) often contain articles by Welsh scholars that are of high literary merit. The bent of the national mind at the present day is toward theology, philosophy, history, criticism and politics. The educational institutions of Wales are creating a public which demands critical thought and modern methods, but whose instinctive attachment to the main lines of Welsh life has preserved a love for those forms of literary expression in the Welsh tongue which are the inherited and natural correlatives of that life. Welsh literature tends to survive to-day, owing to the unwillingness of Welshmen to give up the language and forms of expression that are the psychical correlatives of the typical life of the land of which they themselves are the products. The prevalence of the Welsh language as the tongue of religion even in English towns, has its root also in the same instinctive feeling for the tradition of the life of the race. See CELTIC LANGUAGES.

For topography, climate, etc., see WALES, also the article GREAT BRITAIN: GEOGRAPHICAL ENVIRONMENT; for industries, commerce and trade see GREAT BRITAIN: AGRICULTURE; MINING; FISHERIES; INDUSTRIES; COMMERCE; BANKING AND CURRENCY; RAILWAYS; SHIPPING, etc.; for history, and further details on ethnology, language, literature, etc., see WALES; CELTS; CYMRY; CELTIC LANGUAGES; GREAT BRITAIN: THE CONQUESTS; MEDIEVAL ENGLAND; ENGLISH HISTORY OF THE 17TH CENTURY; THE 18TH CENTURY; THE 19TH CENTURY, etc.

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THE CONTROL AND MOVEMENT OF WEALTH.

17. Great Britain — National Finance. *National Debt.*— The National Debt of the United Kingdom, in the sense in which the term is understood in several official returns, amounted on 31 March 1906 to £743,000,000, but in addition to this there were various amounts outstanding which had been borrowed for military, naval, and other works and brought the "Aggregate Gross Liabilities" up to £789,000,000. Further, a sum of £71,000,000 had been borrowed and lent to local authorities, and another sum of £25,000,000 had been borrowed for the purpose of establishing occupying land-ownership in Ireland by the expropriation of the former landlords. The total £885,000,000 nominally consisted of £585,000,000 of consolidated 2½ per cent stock ("consols") redeemable at par at the option of the State only after April 1923, £49,000,000 of nearly similar stocks and permanent debt to the Banks of England and Ireland, £30,000,000 of 2¾ per cent war stock and bonds which the State is bound to redeem at par in 1910, £43,000,000 of treasury bills and exchequer bonds repayable at various dates, £82,000,000 of the capital value of terminable annuities, £71,000,000 of local loans 3 per cent stock redeemable at the option of the State only after 1912, and £25,000,000 of 2¾ per cent Irish land stock, half of which is similarly redeemable after 1921 and the other half after 1933. But most of the terminable annuities, nearly 80,000,000 of the consols, and about 50,000,000 of the other securities are not in the hands of the public, but are held by the State itself against its liability to the savings bank depositors, so that it would give a truer account of the real position to say that the total debt consisted of about £685,000,000 in the securities just enumerated, and about £200,000,000 in money payable on demand or at very short notice to savings bank depositors.

The main body of the debt is chiefly due to the wars in which the country was engaged between 1688 and 1815. During that period the debt grew from nothing (except a trifling sum which Charles II. had borrowed from the goldsmiths) to nearly £900,000,000. It then underwent steady diminution till in 1899 it had fallen to £628,000,000. The South African war brought it up again to £771,000,000 in 1903, since which year it has once more been diminishing. The £46,000,000 of works debt has all been incurred since 1890, and most of it since 1900, when it only amounted to £10,000,000. The amount lent to local authorities was only £8,000,000 in 1840, and £26,000,000 in 1887. The Irish land debt took its rise in 1891, but most of it is much more recent.

The interest and sinking fund of the Irish land debt is naturally provided for chiefly by the payments made by the new Irish landowners, who are paying for their land by instalments, but a portion falls on funds which would otherwise benefit Irish local taxpayers and another portion is defrayed by the taxpayers of the United Kingdom. The local loans debt is adequately provided for by the interest and repayments received from the local authorities. The works debt is made a charge upon the annual parliamentary votes for the departments concerned, in such a way that each loan will be extinguished in 30 years at most. For the main body of the debt the practice has been since 1876 to devote by legislation a certain annual sum, called the "permanent" or "fixed" annual charge, to interest and repayment taken together. As the sum thus devoted considerably exceeds the interest, this plan, if carried out without modification and without interruption owing to fresh borrowing, would practically convert the whole debt into a terminable annuity, and extinguish it in a very moderate length of time. But as a matter of fact the "fixed charge" was reduced from £28,000,000 to £26,000,000 in 1888 and by two steps to £23,000,000 in 1900, and it was only the fresh borrowings of the South African war which led to its restoration to £28,000,000 in 1905. The difference between the "fixed charge" and the interest is sometimes called the "New Sinking Fund." The "Old Sinking Fund" is any actual surplus realized in the year. The general law is that this also must be devoted to repayment of debt, but when any considerable surplus happens to be realized, special legislation usually interferes with the operation of the rule.

Expenditure.— The total expenditure on revenue account for the financial year 1905–6 is stated at £140,500,000, to which may be added £10,000,000, the yield of certain general taxes which is paid over to local authorities without being technically received into the Exchequer. The total may be classified conveniently as follows: Fixed annual charge for the main body of the debt, £28,000,000; army, £29,000,000; navy, £33,000,000; education, £16,000,000; miscellaneous, including the cost of collection of taxes, the administration of justice and the civil services not included under heads already enumerated, £17,000,000; post office, including telegraphs, £16,000,000; and amount handed over to local authorities, £11,000,000. The amount credited to education is chiefly made over to local school authorities, but only on conditions which give the central government a very large measure of control, not only over the expenditure of the money so granted, but also over what is raised from local sources. The £11,000,000 granted to local authorities, commonly called the "Exchequer Subsidies" or "grants in aid of rates," consist of sums which are either fixed or vary with the yield of certain taxes, and are not now directly connected with central control, with the exception that an amount equal to half the cost of the pay and clothing of a police force may be deducted from the grants due to an authority if it fails to maintain its police force to the satisfaction of inspectors employed by the central government. The method of distribution between the various authorities is extremely complicated, and differs in England, Scotland, and Ireland. Scarcely anyone professes to understand it, and it is based on no sort of principle except that it is largely dependent on certain proportions which prevailed in 1888. This plan was adopted as a temporary expedient, and has been continued not on account of its merits, but because it existed.

Revenue.— The total revenue, including the £10,000,000 of allocated taxes already mentioned, amounted to £154,000,000. The great heads were: Customs, £34,500,000; excise (internal duties on commodities), £35,600,000; estate duties (inheritance taxes), £17,300,000; income tax, £31,300,000; stamps, £8,200,000; house duty, £1,000,000; post office and telegraphs, £21,000,000; and miscellaneous revenue, £3,800,000. The customs included only one export duty, that imposed upon coal, producing £2,300,000, and this was abolished in 1906. The imports of tobacco brought in £13,400,000, tea, £6,800,000; sugar, £6,200,000; spirits, wine, and beer, £5,100,000. The excise drew in one way and another nearly £33,000,000 from taxes on the manufacture or sale of beer and spirits, so that nearly £38,000,000, or 30 per cent of the whole tax-revenue, was derived from intoxicating liquors. The inheritance taxes, christened by Gladstone and now commonly called the "Death Duties," consist of two distinct parts, one of which is graduated from one to eight per cent according to the aggregate value of the whole property left by the deceased; so that if a man dies worth £400, one per cent has to be paid, and if he dies worth over £1,000,000, eight per cent. The other part is graduated according to the relationship of the new owners of the property to the deceased, so that for example, while property bequeathed to descendants or ascendants is exempt, property falling to brothers or nephews is charged three per cent, and property falling to persons without any relationship to the deceased is charged 10 per cent. Thus, taking the two parts together, if a man leaving £400 bequeaths it all to his children, one per cent only will be paid, while on a millionaire's estate left to persons not related to him, the duties will together amount to 18 per cent. The Income Tax was levied at the rate of 1s. in the £ (*i. e.* five per cent), but incomes under £160 are exempt, and "abatements" are allowed on incomes between £160 and £700, which, when the rate is 1s., amount to £8 to persons having between £160 and £400, £7 10s. when the income is between £400 and £500, £6 when between £500 and £600, and £3 10s. when between £600 and £700. Much the greater portion of this tax is "collected at the source," or at any rate before the income actually reaches the ultimate recipient. For example, the tax on the income arising from lands and buildings is collected from the occupier, who then, if he is not the owner, has an inalienable right to deduct the tax when paying his rent; so too the tax on the income from stocks, shares, and bonds of corporations is collected from the corporation. But this practice does not defeat the right of the individual landowner or stockholder to exemption or abatement if his total income from all sources is under the prescribed limits; he makes up accounts with the collectors, declaring his whole income and showing how much has been deducted from its various parts, and if it then appears that too much has been paid, the excess is repaid to him in cash. So far as the portion collected at the source is concerned, the tax works with great efficiency. The amount of evasion which takes place in regard to the other part, for which personal declarations of the amount of income are required, is very variously estimated, but there is little doubt that it is in process of diminution owing to the greater publicity of modern methods of business and to the checks supplied by the death-duties, which are administered by the same department. Stamps consist mainly of duties on commercial and speculative transactions. The House duty is levied at the rate of 9d. in the £ (3¾ per cent) of the rental value, but there are lower rates for houses of between £20 and £60 rental value, and houses under £20 in Great Britain and all houses in Ireland are exempt. The Post and Telegraph receipts include a heavy tax of 10 per cent on the gross takings of the National Telephone Company, as well as the receipts of the Post Office from its own telephone trunk wires and its telephone service in London and a few other places where it competes with the National Company. The whole of the Post Office profit comes from the mails, the telegraph business being a losing one. In miscellaneous revenue the most important item is about a £1,000,000 from the Suez Canal Company's shares, which, it is well to remember, are a wasting property, the canal having been constructed on a 99-year concession.

Local Finance.— To give an absolutely accurate account of the finances of local authorities in the United Kingdom is impossible owing to the complicated relationship of the various local authorities to each other and to the central government, and also because the three kingdoms, England, Scotland, and Ireland, have entirely different systems and methods of account-keeping. The aggregate debt in 1904, including of course the £71,000,000 of debt to the central government mentioned above, is stated (after deducting accumulated sinking funds) at about £450,000,000, but about £40,000,000 of this consists of the debt of harbor and dock trustees which is secured only on the harbors and docks, and in no way upon the taxes of any locality, and therefore ought not to be reckoned as local debt. The remainder represents capital invested in (taking the larger of the various items approximately in order of magnitude) waterworks, street and road improvements, schools, drainage, gasworks, tramways, electric works, workhouses, asylums, and the innumerable other works and buildings required by modern civilized and especially urban communities. The aggregate annual repayments of debt and payments to sinking funds amount to a little over two per cent on the total, but the annual additions considerably exceed this amount, so that the debt increased nearly £200,000,000 in the 10 years before 1904. Since then there has been an exceptional increase owing to the conversion of the capital of the London water companies into debt of a board representing the various local authorities within the area of supply; this adds about £40,000,000 without much altering the liabilities of the inhabitants or owners of the area concerned. About half the total capital has been raised for purposes which are often provided for by private enterprise, such as waterworks, gasworks, docks, electric works, tramways, and cemeteries, and the other half for purposes which are seldom so provided for in modern communities.

The expenditure from revenue of the authorities, including repayment of debt, amounted in the year 1902–3 to about £111,000,000. About £15,000,000 of this was met by the allocated taxes and other national grants, chiefly for education, spoken of above, about £58,000,000 by "rates," and the rest by the special charges levied for commodities and services supplied, and all kinds of miscellaneous revenue. The accounts of subsequent years will show very large increases in the national grants for education received by the local authorities, not only because the grants for education have actually increased, but also, and in much larger measure, because under the Education Act of 1902, the local authorities now receive the grants for the "voluntary" schools handed over to them by the act. The amount raised by special charges for commodities supplied will also be very largely increased in consequence of the fact that Londoners' payments for water are now received by a local authority, instead of by a number of companies.

The "rates" are taxes levied by the local authorities at a rate of so many shillings or pence in the pound of the annual value of land and all things attached to the land in the concrete form of buildings or works of any kind. The idea of the Elizabethan rate for the relief of the poor undoubtedly was to assess inhabitants according to their ability, and down to 1840 attempts were frequently made to extend the system which long prevailed in some parts of the country of assessing stock in trade and other visible personal property. But experience showed that such taxation was utterly unsuitable for small localities, and when the law courts at last began to favor these attempts, legislation intervened. The tax is usually levied from the owner in the important case of small house property in England, but in almost all other cases from the occupier of the property. The occupier has no right of deducting rates paid from his rent unless he has so contracted with his landlord, and a contract of this kind is scarcely ever made. There is at present, under the Agricultural Rates Act, a rebate of 50 per cent in favor of agricultural land, and there are some other differentiations in the cities. The "rates" are elastic, certain, cheaply collected, and singularly free from disturbing effects upon production. The fact that they are unpopular is sufficiently accounted for by their enormous yield and their obvious character.

Financial Control.— The finance of the central government, according to the present theory of the British Constitution, is vested in the House of Commons. All financial legislation must originate there, and the Commons will not permit any alteration of their measures by the Lords. But in the House of Commons itself the power of initiation in matters of finance is now entirely in the hands of the Ministry. Estimates of expenses and receipts made up in the government departments are considered or amended by the Ministry in private. The result is then laid before the House of Commons by the Chancellor of the Exchequer in his "Budget Speech." A ministry will rarely submit to modify its proposals in any important respect, so that the House has to choose between acceptance of the budget and a change of government. No ordinary member of the House can directly propose an increase in taxes or expenses, the theory being that it is the King who asks his faithful subjects for money, but anyone may propose reductions. The estimates are put before the House in immense detail, but this very detail defeats its own end, as there is not and cannot be, time to consider the whole to any good purpose. The estimates are consequently passed without material alteration. This absence of real control by the House of

Commons is probably favorable rather than unfavorable to economy. The necessity of finding new taxes or increasing old ones is much more immediately before the eyes of the Ministry than of the House of Commons, and the Ministry has also more reason to fear popular resentment against any increase of taxation. It is, moreover, in immediate and constant association with permanent Treasury officers whose influence is generally cast against temporary expedients for staving off the day of reckoning.

In the councils which conduct the local government of the country there is nothing like the Ministry in Parliament, and the system of control consequently has a nearer resemblance, as has sometimes been observed, to that prevailing in the United States Congress. The committees charged with the various departments of the council's work, with the assistance of their executive officers, each prepare their own estimate of expenses for the coming year. These are then all added up and put before the Finance Committee, which usually hands them on with little or no alteration to the Council, merely adding its own estimate of receipts other than rates and a recommendation to the Council to make a rate of as many pence in the pound as is calculated to make up the balance required. The Council discusses the estimate of receipts and expenses thus put before it, and any member may move alterations in any item. Such motions are frequently made and sometimes, especially, of course, in the smaller councils, carried.

The local authorities have no power to contract debt without special authority. For most purposes this now means that sanction must be obtained either from Parliament by special act or from the department of the central government, called the Local Government Board. Loans must always be accompanied by provisions for repayment within the time for which Parliament or the Local Government Board's inspectors calculate the work on which the money is to be spent will last. That the prescribed sum is being set aside every year for repayment is ascertained by the Local Government Board in each case. Some authorities are forbidden by statute to borrow more than an amount bearing a certain proportion to the annual rateable value of their area, but these enactments are rendered practically inoperative by other legislation, and have no influence whatever.

Out of annual revenue the authorities may generally spend as much as they please, the unpopularity of rates being regarded as a sufficient safeguard against extravagance. In regard to one expenditure only, that for poor relief, the central government attempts to prevent too much being spent, at any rate in one or two directions, such as relief to persons not required to enter the workhouse and relief to the able-bodied. In other matters the influence of the central government, when exercised, is almost always in favor of increased expenditure. The threat of "withdrawal of the grant" in respect of a particular school is used every day by inspectors of the central Board of Education in order to compel a local authority to spend more. The central government appoints officers to audit the accounts of the greater number of local authorities, but the auditors of the municipal boroughs (which include all the great cities) in England are elected, under the Municipal Corporations Act of 1832, by the ratepayers. This election is almost always a farce, and the more important city councils have had to provide a proper audit in addition to the one thus provided by law.

Bibliography.— Information as to the actual position of British finance can only be obtained by piecing the facts together from a large number of parliamentary publications, usually known as "Blue-books." Among the most important of these are the annual returns entitled 'National Debt,' which shows the different kinds of debt existing at the end of each year from 1835 to 1906; 'Government Departments Securities,' which gives the amount of the State's securities held by the State itself; the Finance Accounts of the United Kingdom; the 'Postmaster-General's Report,' the 'Annual Local Taxation Returns for England and Wales,' and the same for Scotland and for Ireland. Besides the above, for historical purposes the following parliamentary papers may be found useful: 'History of the earlier years of the National Debt from 1694 to 1786' (C. 9010), and 'Proceedings of the Commissioners for the Reduction of the National Debt from 1786 to 1890' (C. 6539); Local Authorities Liabilities (No. 306 of 1905); 'Reports of and Evidence taken by the Royal Commission of 1897 on Local Taxation.' Among general works on finance dealing preëminently with British conditions C. F. Bastable's 'Public Finance' (3d ed. 1903), is the most complete and up-to-date and gives plentiful references to earlier works. For the history of taxation, consult Stephen Dowell, 'History of Taxation and Taxes in England' (2d ed. 1888), and Cannan, 'History of Local Rates in England' (1896).

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18. **Great Britain — Banking.** Banking in Great Britain as now carried on is the product of a continuous process of evolution; it owes very little to external influences, and can only be properly understood in the light of the study of its earlier developments. Its strength is the strength derived from long tradition founded upon experience, and its weakness is the weakness inherent in a system which has developed with the smallest possible amount of legislative control. This weakness is shown in a lack of logical coherence and in an occasional absence of proper definition.

There are few evidences of banking in the modern sense of the term in England before the 17th century. In the middle ages the bankers were mainly money changers and money lenders; they dealt in coin, not in credit. The Italian colony of the Lombards, however, who gave their name to Lombard street, seem to have been well acquainted with the use of bills of exchange, and the banking business of the country was chiefly in their hands after the expulsion of the Jews at the end of the 13th century. During the 16th century, however, the power of the colonies of foreign merchants in London rapidly declined, ending in the breaking up of the German colony in the Steelyard by Queen Elizabeth. In the 17th century it became customary for the wealthier classes to intrust their spare cash to the keeping of the London goldsmiths, a body of men whose occupation inspired the necessary confidence. The transition from goldsmith to banker was a natural and easy one, and the goldsmiths' "cash notes" gradually acquired a degree of negotiability. Some of the existing London private bankers find their origin in the goldsmiths of the latter half of the 17th century. Outside London the early type of country bankers was evolved from the class of substantial merchants. Thomas Smith of Nottingham, for instance, who is the earliest country banker of whom we have any record, and who certainly carried on business as early as 1688, originally combined the business of a mercer with that of a banker.

Owing to the unsatisfactory condition of the public finances under the Stuarts, there was no opening for a public bank such as existed in Amsterdam and other European centres of industry. But the Revolution of 1688 saw the control of the national expenditure pass from the Crown to Parliament. The national credit became, for the first time, an important factor in our economic development, and showed itself in the growth of a national debt. The use of credit spread rapidly and this led to the development of modern banking. To the efforts of William Paterson was due the establishment in 1694 of the Bank of England, founded under the wing of the Chancellor of the Exchequer, Charles Montague, with the object of lending the whole of its capital, £1,200,000, to the State.

The Bank of England.— The Bank of England is the pivot round which centres the whole of modern banking in the United Kingdom. In no other country, whether in Europe or America, does a bank occupy quite an analogous position. It is not a State bank in the strict sense of the term: its capital is held privately, and its management is not in any way directly or indirectly controlled by the State. On the other hand, during its whole history, it has been more or less under the protection of the State; its operations have been on occasion dictated by the State; its development has been marked by successive loans of its capital to the State in return for the confirmation or extension of its privileges, and it still continues to exercise powers and owe responsibilities delegated by the State.

The Bank of England is controlled by a governor, deputy-governor, and a court of 24 directors who are elected by the proprietors on the nomination of the directors. The selection is generally made from the members of leading mercantile firms, and the tradition is not to elect a member of a banking firm or a director of another joint-stock bank. The operations of the Bank are now regulated by the Bank Charter Act of 1844. This act divides the Bank of England into two departments, the Issue Department and the Banking Department. The former, as will be seen in a later section, is so strictly regulated by the act that its action is automatic. The latter is for all practical purposes as free from legal restrictions as any other joint-stock bank. Yet free as it is from special legal obligations, it has, by its action in the past as well as by its present position, assumed peculiar responsibilities, which, though ill defined, are well understood, and which the Bank does not attempt to disown. These responsibilities are due especially to the Bank's position as the Government banker, the bankers' banker, and the keeper of the country's reserves. The Government accounts are kept by the Bank of England, the national debt is managed, exchequer bonds and treasury bills are issued and paid, and many other incidental services of the kind are rendered by the Bank. With regard to the other banks, all the settlements at the London Bankers' Clearing House are made by transfers at the Bank of England, where each clearing bank is bound to keep an account. Those banks which do not possess a seat in the Clearing House find it necessary to appoint one of the clearing bankers as agent and to keep an account with that agent. Practically every banker in England can, therefore, draw either directly or indirectly upon the Bank of England, and the reserve of the latter has thus to be regarded both as the banking reserve of the country, and also as the gold reserve, that is to say, the reserve to insure the convertibility of the note issue.

Appended is a copy of a weekly return of the Bank of England.

BANK OF ENGLAND.

An Account, pursuant to the Act 7th and 8th Victoria, cap. 32, for the Week ending on Wednesday, the 13th day of June, 1906.

Issue Department.

Notes issued	£51,803,190
	£51,803,190
Government debt	£11,015,100
Other securities	7,434,900
Gold coin and bullion	33,353,190
Silver bullion	....
	£51,803,190

Banking Department.

Proprietors' capital	£14,553,000
Rest	3,251,045
Public deposits (including exchequer, savings banks, commissioners of national debt, and dividend accounts)	9,050,109
Other deposits	42,741,064
Seven-day and other bills	91,544
	£69,686,762
Government securities	£15,977,133
Other securities	29,125,443
Notes	23,169,450
Gold and silver coin	1,414,736
	£69,686,762

Dated the 14th day of June, 1906.

J. G. Nairne, *Chief Cashier.*

The Private Bankers.— During the 18th century, all the banks in England, with the exception of the Bank of England, were private partnerships, the number of partners being limited by an act passed in 1708 to six. Now, however, private banks are very few in number, and their influence is a diminishing one, though at one time that influence throughout the country was great, both socially and politically. The London private bankers ceased to issue notes toward the end of the 18th century, but the country private bankers attached great importance to their note issues up to the time when the Bank Charter Act of 1844 made further extension in this direction impossible. Many of these firms were under-capitalized; the banker was often a tradesman as well, and was too much at the mercy of fluctuations in trade. Consequently in time of monetary stress failures were frequent, especially during the early half of the 19th century. Except that their note issue is limited by the Act of 1844, the law imposes no restrictions upon private bankers, and they are not even compelled to issue balance sheets, though in most cases this has been voluntarily done of recent years. In spite of this absence of control, the existing private banks inspire a confidence which seldom proves misplaced. Most of them have been established for many years, for it has proved increasingly difficult for a new private bank to obtain a footing in the country. All banks possessing more than 10 partners must now register as a company under the Companies Acts.

The Joint-Stock Banks.— Owing to a clause in the Bank Charter Act of 1708, joint-stock banking was not possible during the 18th century, but in 1826 the Bank of England monopoly was so far curtailed as to allow joint-stock banks to be established, with the right of issuing notes, provided they had no office in London or within a radius of 65 miles. By an act passed in 1833, joint-stock banks were permitted within this radius, provided they did not issue notes, and under this act several of the leading joint-stock banks of to-day were founded. The legal disability to issue notes continues until the present day, and has had a marked effect on banking in England. The energies of the joint-stock banks have naturally been centred upon the development of deposit banking, with the result that the habit of keeping a banking account has spread more rapidly and more generally than in most countries, and the use of notes has correspondingly decreased. Practically all the existing joint-stock banks have registered under the Companies Acts with limited liability, and in most cases with a reserve of uncalled capital which cannot be utilized except in case of liquidation. During the last 20 years or so a decided tendency has shown itself, on the one hand, for the amalgamation of the private banks and the smaller joint-stock banks with the more powerful of the latter class, and on the other hand for the spread of branch banking. This has resulted in an increased centralization of the banking system in London, and to a lesser extent, in a few of the leading provincial towns, and in the evolution of a system which is in distinct contrast to that existing in the United States of America. The natural consequence is that the magnitude and importance of the individual bank has very greatly increased. Yet, large as the liabilities of the leading banks to the public are, their capital, both nominal and paid up, and their reserve funds, are sufficiently ample to remove any feeling of distrust which might otherwise be inspired by the volume of their obligations, as will be seen from the accompanying figures taken from the balance sheets of a few of the most important joint-stock banks.

Date.	Bank.	Subscribed Capital.	Paid up Capital.	Reserve Fund.	Current & Deposit Accounts.
1906		£	£	£	£
June 30th	Lloyds Bank Ltd	24,072,500	3,851,600	2,900,000	62,822,429
"	Union of London and Smiths Bank Ltd	22,934,100	3,554,785	1,150,000	36,642,368
"	National Provincial Bank of England Ltd	15,900,000	3,000,000	2,300,000	52,296,048
"	London City and Midland Bank Ltd	15,085,080	3,142,850	3,142,850	50,320,316
"	Barclay & Company Ltd	8,000,000	3,200,000	1,500,000	44,407,970

The *Economist* newspaper publishes a half-yearly statement of the capital, reserve funds, deposits, and other liabilities and assets of the joint-stock banks and those private bankers who publish accounts. The totals of these amounts as published in the issue for 19 May 1906 were as follows:

Joint-Stock Banks (including the Bank of England).

	No. of Banks.	Paid up Capital.	Reserve Fund.	Deposit & Current Accounts.
		£	£	£
Eng. & Wales	60	62,735,042	36,828,476	679,567,015
Scotland	11	9,316,070	7,929,940	100,642,554
Ireland	9	7,309,231	4,010,500	53,556,076
Isle of Man & Channel Isls.	2	80,000	91,500	1,067,808
	82	79,440,343	48,860,416	834,833,453

Private Banks of England and Wales.

Number of Banks.	Partners' Capital and Reserve.	Deposit & Current Accounts.
	£	£
12	4,393,905	27,775,019

Foreign and colonial banks having London offices are, it should be noted, not included in the above tables.

Note Issues.— The Bank Charter Act of 1844, which governs the note issues of English banks, aimed at the eventual extinction of all note issues except that of the Bank of England. This aim is in a fair way to be realized, for at the end of April 1906, only 31 banks possessed the right of issuing notes, the maximum authorized issues amounting to but £1,628,342, and the actual circulation being £577,864. By this act the Bank of England was authorized to issue from the Issue Department £14,000,000 of notes, covered by Government securities, £11,015,000 of which consisted of the Government debt to the Bank. This fiduciary issue could be increased by the addition of two-thirds of the authorized issue of any other bank which forfeited its right of issue or allowed it to lapse, and it amounts at the present time to £18,450,000. Any notes issued in excess of this total must be secured by the deposit of coin or bullion to an equal amount. Silver may form not more than one-fifth of this deposit, but the Bank has but seldom availed itself of this privilege. As the Issue Department is compelled to buy all standard gold bullion offered to it at the rate of £3 17s 9d an ounce, and always issues notes against the stock in hand, it can be seen that the amount of notes issued is controlled to a very small extent by the bank directors, and that it increases or decreases according to the amount of gold imported or exported. The Bank of England is, however, not prevented from offering a higher price than the above, should it find it advisable to compete for gold in the market; and in selling gold, if the demand is for foreign coin or bars, the Bank can fix its price according to the demand. Any notes not required in active circulation are held in the Banking Department and form the greater part of the Bank of England reserve. The active circulation is in normal times peculiarly steady, averaging from 25,000,000 to 30,000,000 out of a total issue of from 50,000,000 to 55,000,000.

Bank notes have been in England largely superseded by the general use of banking accounts by the public, and the demand for an elastic currency has never assumed such proportions as in the United States. In times of stress, however, the demand for notes has, in a few instances, exceeded the Bank's power of issue, and on three occasions, in 1847, 1857, and 1866, the Government has been compelled to intervene and suspend the clause forbidding the issue of notes beyond the fiduciary limit except against the deposit of gold. Bank of England notes, which it may be noted are legal tender in all payments except by the Bank and its branches, are not issued for any sums below £5, though proposals have frequently been made, notably by Viscount Goschen in 1891, to authorize the issue of £1 notes.

The Clearing System.— The system of collecting checks and settling balances owing between bankers, though to the uninitiated it may appear merely an administrative detail, has, in reality, exercised a very important influence on banking development in England. The problem of clearing checks is comparatively simple compared with the problem as existing in the United States or any other country occupying a large geographical area, because practically every English bank or branch bank is within a day's post of London. Consequently although local checks are cleared through local Clearing Houses in some of the larger towns, the great mass of checks is cleared through the London Clearing House, and this fact has very much accentuated the centralization of banking in London, which is the predominant characteristic of the English system. A seat in the Clearing House is a privilege jealously guarded and difficult to obtain, and it was not until 1854 that any of the joint-stock banks were admitted. Those banks which do not possess this privilege appoint a clearing agent, with whom an account is kept, and who in many cases acts generally as the London agent. By the rules of the Clearing House every clearing bank must keep an account with the Bank of England, and the daily differences are settled by means of transfers to and from these various accounts and a central account called the Clearing Bankers' Account.

The total amount of the checks and other articles cleared through the London Bankers' Clearing House in 1905 was £1,287,935,000, being the highest total recorded in the history of the House, and more than 16 per cent higher than the previous year. The largest weekly total was £345,370,000, and the largest daily amount £102,780,000. The number of banks possessing seats in the Clearing House is now eighteen.

The Money Market.— The London money market is the name given to the miscellaneous body of persons who borrow or lend money for short periods, their operations being roughly grouped around Lombard street, Threadneedle street, and the adjoining parts of the City of London. The money in which they are interested is sometimes described as the Short Loan Fund of the Money Market. On the one hand is the borrowing portion of the market, consisting largely of the bill brokers, the Stock Exchange, and an undefined group of financiers; on the other, the Bank of England, which is closely connected with the Money Market, and which, owing to its position as the guardian of the ultimate cash reserves, is also the ultimate lender when money cannot be easily borrowed elsewhere. In between these two extremes are the clearing banks and other banks having London offices, as well as various financial firms, whose surplus unemployed assets form the principal part of the Short Loan Fund. The British Government also plays a very important part as a borrower in the Money Market, and the Government of India, through the India Council, lends largely to the Market. Beside these, there is a group of foreign banks with London offices which exercise a growing influence in the Market, both as borrowers and lenders.

The index to the general condition of the Market is the Bank Rate, which is the official minimum rate at which the Bank of England discounts first-class bills offered to it. All bills so offered for discount must mature within not more than three months, and must be accepted payable in the United Kingdom and bear one other English signature. The Bank of England is actuated in fixing the amount of the Bank Rate by the state of the reserve and the prospects of an inflow or outflow of gold, and speaking generally, the Bank is interested in keeping the rate as high as expediency will allow. The borrowing portion of the Market is naturally anxious to keep the rate as low as possible. If, however, there is plenty of money to be lent outside the Bank of England, the Bank Rate cannot be effectively maintained at a much higher figure than the market rate, otherwise it would be merely nominal. Therefore, the other London banks to a large extent hold the balance between the Bank of England and the borrowing portion of the Market. They are actuated on the one hand by the necessity of employing as large a proportion of their surplus assets as prudence will allow, and on the other by the responsibility of keeping reserves well above the margin of safety. The relations of the Bank of England to the other banks are of the utmost importance and interest. It is possible that in seasons when money is plentiful, the enormous floating balances available for employment in the Money Market may expose the Bank of England to the danger of a drain of gold. This risk is accentuated by the fact that the funds controlled by the joint-stock banks are far larger than those of the Bank of England. The Bank must, therefore, be able to control the market rate should necessity arise, and it must do this by itself coming forward as a borrower (mostly through a broker) and by offering such a rate as to divert the loanable funds of the other banks away from the market. The latter, thus being denuded of funds, is driven to the Bank of England.

The Gold Reserves.— London is recognized as the only free market for gold in the world, and yet her central stock of the metal is, notwithstanding the enormous volume of her financial dealings, at times actually less than that of her principal rivals. It is one of London's most cherished traditions that she puts no obstacles in the way of the export of gold, except by making it more worth the while of its owners to keep it there. When it is remembered that the British banks owe some £900,000,000 sterling to their depositors, and that chiefly owing to the universal reputation of the London sterling bill of exchange as an international currency, London's obligations to the rest of the world are at all times enormous, it will be realized that her gold reserves have to be vigilantly watched and jealously guarded.

That London can work on such a small basis of gold is due in the first place to the fact that the English system of a single centralized reserve is a more economical one than the system prevailing in countries where centralization is less developed; secondly, to the smooth working and thorough organization of her banking system, and thirdly, to the excellent reputation of English credit among other nations, which enables her to attract gold from abroad with the least possible delay. But there is a growing feeling that there should be more gold held in reserve in the country; not that bankers are thought to be working below the safety limit, but because the necessity for incessant vigilance results in unstable rates of interest with a consequent derangement of the Money Market and an undue accentuation of the speculative element in business generally. This feeling has been especially prominent since other countries have adopted a gold standard, and many schemes for an improvement of these conditions have been brought forward. The settlement of the question is rendered more difficult by the dual nature of the Bank of England reserve, which is at the same time a currency reserve and a banking reserve. It is felt that the responsibility of keeping the former belongs partly to the State; that of the latter to the banking community; and the adjustment of the responsibility has not proved easy.

Banking in Scotland and Ireland.— Both in Scotland and Ireland banking has developed on slightly different lines from those of English banks. In Scotland especially the absence of any joint-stock monopoly like that of the Bank of England resulted in the early evolution of a type of powerful bank which crowded out the private banker. Consequently to-day there are only 10 banks in Scotland, all with a large number of branches, and the establishment of a new bank is practically impossible. The Scotch people were early in recognizing the advantages of a good banking system, and the use of "cash credits" had an important effect upon the industrial development of the country. In Ireland, banking has had a stormier history, but similar results have been reached, and there are now only nine banks of any importance in the country. Both Scotland and Ireland differ from England in enjoying a circulation of £1 notes, which have survived all attempts at extinction.

The note issues of the two countries are governed by Bank Acts passed in 1845, which bear a close resemblance to each other. All the banks in Scotland and six of the Irish banks are banks of issue, and each is allowed to issue an amount equal to the average circulation during the year ending 1 May 1845, together with an amount equal to the amount of gold and silver coin held at the head office or principal places of issue, the silver coin not to exceed one-fifth of the whole. The necessity for keeping coin against excess issues of notes brings the Scotch and Irish banks into close relation with the Bank of England. Neither the Scotch nor Irish banks clear their checks through the London Clearing House, but through the Clearing Houses of Edinburgh, Glasgow, and Dublin, hence the connection between these banks and the Bank of England is not necessarily so direct as in the case of English banks. But there are certain recurrent seasons of the year when an increase of the note issues always occurs in Scotland and Ireland, and this necessitates an increase in the stock of coin. As there is no central reserve of gold in Scotland and Ireland, this coin can only be obtained from the Bank of England, and therefore, at these seasons of the year, notably during what is called the Autumn Drain, the Bank of England reserve is always subject to a demand for coin from these countries, especially from Scotland.

Banking Methods.— British banking methods are distinguished by prudence and caution. The immense amount of their deposits repayable on demand forbids English banks to embark upon the general financial business which forms the principal function of some Continental bankers. English banks do not operate on the Stock Exchange except for purely investment purposes, and then only in what are termed "gilt edged" securities. Neither do banks directly interest themselves in the control or management of commercial or industrial undertakings. Furthermore the management of the large banks is singularly free from political interference of all kinds. On the other hand, English bankers have allowed to slip from their control many branches of business which belong legitimately to a banker. Much of the bill-discounting business is in the hands of the bill broker, who is an expert middleman between the banker and his customer. Again, few of the large London banks deal in foreign bills or interest themselves in foreign exchanges, and this branch of banking has also fallen largely into the hands of specialists, or of the branches of foreign banks established in London.

The liabilities of English banks consist almost entirely, first, of the current account balances in their hands, repayable on demand, on which it is not usual to allow any interest, and secondly, of sums deposited repayable at a fixed notice, usually seven days, on which London bankers allow interest at one and a half per cent below the Bank of England Discount Rate. Certain London bankers also accept, on behalf of their customers, bills drawn from abroad, proper security being deposited to cover the bankers' liability. It is, however, not the practice among English bankers to grant open credits in such cases. Their assets consist of cash on hand and at the Bank of England or their London Agent, money lent at call or short notice to the Money Market against security, bills being the acceptances of other bankers or leading merchants bought in the market investments in first-class Stock Exchange securities, and advances to customers, either in the form of loans, overdrafts upon current account, or bills discounted. It is not usual to make advances without some form of security.

During the middle of the 18th century, England was subjected to a series of acute banking crises, notably in 1847, 1857, and 1866, but if we except the grave situation created in 1890 by the liquidation of Barings, who, it must be noted, were not bankers, the country has been free from such disturbances since 1878. It is reasonable to assume that bankers have profited from the experience gained in such times of stress, and it must be admitted that English bankers as a whole inspire in their creditors the confidence due to sober and prudent management.

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Secretary of the Institute of Bankers, and of the Central Association of Bankers, and Examiner in Banking to the London Chamber of Commerce.

19 (a). Great Britain — Commerce — Eighteenth Century. English commerce of the 18th century is remarkable for the revolution in the methods by which it was carried on, for its growth under the great Whig system of protection and for its culmination in a tremendous expansion with the coming of machinery. English foreign trade had been largely opened out by merchant companies. The foundation idea was that English goods should be sold at a high price and that there should be no glut of goods, no undercutting, but a "well ordered trade." Hence rules as to quantities to be exported were a great feature of these companies. There was no idea of pushing trade or selling at a low price and getting quick returns. Moreover, the numbers admitted to the companies were limited by the high fees charged for entrance, while no one who did not belong to them could lawfully engage in the trade. The only open trades were those to France, Spain and Portugal. Hence a regular attack on the monopoly of the companies was carried on and this constituted the early free trade movement. It was successful: after the Revolution the entrance fees of the companies were reduced by Acts of Parliament; only the East India Company and the Hudson's Bay Company continued strict monopolies. With the throwing open of trade it was possible for an enterprising man to carry on commerce on any scale, to push his wares and generally increase his sales wherever he could without limitation of any kind. This amounted to a veritable revolution in commerce. Alongside of this opportunity for expansion came the emigration of the Huguenots into England. Besides introducing many new industries such as silk, cotton printing, paper and linen, there was no branch of English trade which they did not improve with their taste and skill. Hence England had a more varied assortment of goods with which to push her trade. Moreover the Huguenots preserved their old business connections, and England inherited in this way a great deal of the French trade.

At the revolution of 1689 the control of economic affairs definitely passed to the House of Commons, and the Whig party became the arbiters of national policy. The Tories were inclined toward "free trade." They believed in favoring the consumer and in removing restrictions on intercourse, especially with France, the chief industrial rival of England. The Whigs on the other hand held very decidedly to a policy of encouraging industry and in so manipulating commerce that it should react on the prosperity of industry. Hence they devised a system of bounties for encouraging the exportation of silk, linen and corn. Bounties were also given to the fishing trades. They tried to stop the growth of competing industries in both Ireland and the colonies, and when Scotland showed signs of becoming a rival the Union was brought about.

In their fiscal policy and in their trade treaties the same Whig ideas were carried out. We first see them applied in the commercial relations between England and France. England's great industrial competitor at the end of the 17th century was France. Colbert had been doing everything in his power to encourage French industry and had gone so far, in 1667, as to put prohibitory rates on English cloth. Englishwomen with (to the masculine mind) an extraordinary perverseness would insist on wearing French goods when they could get them. Hence, according to the opinion of the day, to shut out French goods was to assist English industry in the best possible way. To this the Tories were opposed, but the Whigs were successful, in 1678, in carrying an Act prohibiting trade and commerce with France. A system of high duties was substituted for prohibition under James II., but the Whigs returned to the earlier policy. In 1713 a clause was added to the Treaty of Utrecht to the effect that England should admit French goods as in 1664. This gave rise to a tremendous controversy. Again the Whigs were successful; the commercial clauses of the treaty were not carried out, and the policy of protecting English industry by cutting off trade with France was not reversed till the treaty concluded by Pitt in 1786. By that time England no longer feared French competition and English manufactures were so much sought after in France that there was a tremendous outcry on the part of French manufacturers.

The Whig desire to shut out competitors extended to another department of commerce, namely, the trade with India. The East India Company had been bringing back silks and muslin and cotton goods which were worn by the "greatest gallants" as well as by "the meanest cook maids" instead of good English cloth. Hence employment was being diverted from Englishmen to Hindoos, and in 1700 an Act was passed by which East India goods might be warehoused for re-exportation, but they might not be sold within the country.

But it was not enough to shut out possible competitors. Definite encouragements to English trade were given by the Methuen Treaty negotiated with Portugal in 1703, and by the Asiento Contract obtained from Spain in 1713. The Portuguese had prohibited the importation of English cloth, and in 1703 Mr. Methuen was successful in getting this prohibition removed on condition that Portuguese wines were admitted into England at two-thirds of the duty on French wines. The trade with Portugal thus opened up was reckoned to be a very large one, and was especially cherished since a large part of the returns was paid in Brazilian bullion, with which we could renew our depreciated coinage.

By the Asiento Treaty the Whigs got a large part of the slave trade with Spanish America into their hands. They obtained the right to import 4,800 negroes annually and to send one vessel of 500 tons to import goods into the Spanish colonies. The West Indies became a great depôt for this trade and under the cover of the one ship the English got possession of much of the Spanish-American trade. From every point of view the slave trade commended itself to the general opinion of the time. It encouraged shipping, promoted trade with Africa — which country took English cloth in payment for slaves — it supplied labor to the West Indies and Virginia and helped the agricultural development of the colonies. Moreover the slaves were a means of carrying on trade with Spanish-America. But from the English point of view the economic effects were still more important. As long as the colonies had slaves they would never take to manufacture, the negro being incapable of the necessary training. The colonies would continue therefore to grow the tropical commodities for England to distribute.

Sir Robert Walpole began to reform the fiscal system with the same object of stimulating industry through commerce. Accordingly he overhauled the book of rates between 1721–4 with the object, to use his own words, of making "the exportation of our own manufactures and the importation of the commodities used in the manufacturing of them as practical and easy as may be." He repealed or reduced the import duties on raw materials and arranged for manufactured exports to be duty free. He next began to try and stimulate the warehousing trade which the Navigation Acts (see GREAT BRITAIN — NAVIGATION ACTS) were partly designed to create. He hoped to make England "one general free port and a magazine and common storehouse for all nations."

This system of deliberately building up English industry was continued until the time of the younger Pitt, who, following out the Tory tradition of free intercourse, not merely reopened trade with France but tried to carry free trade between England and Ireland, unsuccessfully however, owing to the hostility of the English manufacturers. He also wished to allow American ships to trade freely with England and the West Indies in spite of the Navigation Acts. But this Tory reversal of the Whig policy was doomed to failure.

The French wars prevented any relaxation of the system for revenue reasons, and it was not until 1822 that the great breach with the Whig policy of the 18th century was definitely made.

During the 18th century English commerce steadily increased in almost every direction, especially with the colonies. In 1699 the exports had been estimated at £7,302,716. By 1720 they were £8,681,200 and by 1740, £11,469,872. In 1760 the figure had reached £15,579,073; in 1771, £17,161,146; while with machine products the total reached £34,381,617, in 1800.

The imports in 1699 were £3,482,586; by 1720 they had nearly doubled, being £6,090,083. In 1760 they were £9,832,802; and in 1771 had reached £12,821,995. In 1800 they were £28,257,781.

It is exceedingly difficult to say whether this increase was a result of the Whig policy or no, but the fact remains that while they held the reins of power English trade extended as they intended it should, and thus prepared the way for the introduction of machinery. It was no accident that the industrial revolution (see Great Britain — Industrial Revolution) occurred in England when it did. At the Restoration English industry was very backward; English agriculture undeveloped; and English commerce small. By the end of the 18th century England, in spite of the loss of her American colonies, was the greatest trading country in the world. Her goods, through sheer cheapness, were forcing their way into every country. She was the great carrier of the world, and the only people that could compete with her were the Americans, whose shipping had grown up under English protection. She was able to withstand, by her wealth, the great financial strain of the French wars, and to control the access of colonial produce to Europe.

That many mistakes were made is no doubt true, and Adam Smith did not hesitate to expose them; but the objects which the Whigs had at heart were attained to an extraordinary degree during their tenure of power.

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19 (b). **Great Britain — Commerce.** *Volume of Trade.*— It has been estimated that nearly a fifth of the working population of the United Kingdom depends for existence on the sale of its products in foreign markets: add to this the classes engaged in ocean transport, in market organization and financial settlements, and it is possible to arrive at some conception of the magnitude of the interests involved and the importance assigned in the United Kingdom to oversea commerce. Parliament and the Press never tire of the theme. Not merely the Board of Trade, but all other great departments of administration, whether concerned with defence, revenue, foreign and colonial affairs, or education, find themselves involved in one way or another in the consideration of the interest of international commerce. So far, indeed, has been carried this exclusive attention to external relations, that the existence of a home market is not seldom forgotten or ignored. Some ground for this forgetfulness may be found in the great value of the foreign trade — over £920,000,000 sterling in 1904 — in relation to a limited population and area; but its real importance in the economy of the United Kingdom appears only on a further analysis of the figures.

Of the imports, valued at £551,000,000, three-fourths must be credited to food and raw material, the rest to manufactures of various kinds. The exports are made up of £300,000,000 of British produce and £70,000,000 foreign and colonial re-exports. Manufactures constitute the mass of British produce exported, with one important exception — coal. The figures imply much that is interesting both in past history and present organization. A country of restricted area and resources obtained, through various economic and political accidents, a start in the industrial race a century ago. Some of the necessary raw materials of industry it cannot produce, of others the quantity is insufficient for its growing demands. Increasing specialization leads to greater dependence on certain types of foreign imports and greater need for a market abroad for the constantly increasing surplus of manufactures. Food, too, must be brought from more favored regions, and the very success of manufactures breeds a natural tendency to neglect the interest of agriculture; though native resources, utilized to the utmost, would still be insufficient, in the present state of agricultural science, for the needs of the growing industrial population. The basis of the present system, and the only home product, on a large scale, which is more than sufficient for the needs of the moment, is coal. Hence it is exported from those districts where it is not utilized in local industries, and where access to the sea is easy; its ultimate functions being to provide power for British and foreign shipping or for foreign factories.

The entrepôt business, in foreign and colonial produce, again represents a historical advantage. It is a relic of the partial monopoly of the carrying trade, and the control of the supply of tropical, eastern, and colonial commodities to continental markets, long enjoyed by the United Kingdom. Though aided by the principle of inertia, and the facilities of old-established commercial centres, such business has not increased at a rate proportional to the general movement of trade; in fact, for a long period it was stationary at about £60,000,000, though recent years have witnessed a great improvement. This slow rate of growth is due mainly to the development of continental shipping and the establishment of direct relations between the European consumer and distant markets, which have been conspicuous features in the elaboration of international commerce during the last generation.

The last point noteworthy in the general figures, is the vast difference between the value of imports and exports. Apart from minor questions of statistical method, the excess of imports represents two main facts: firstly, returns for the service of some 9,000,000 tons of foreign-going shipping, which carries nearly the whole trade of the United Kingdom and no inconsiderable portion of that of the rest of the world; secondly, payments of interest by debtor nations and foreign industries to the great creditor nation of the 19th century, or in some cases, perhaps, the redemption or creation of capital liabilities.

Classification and Distribution of Imports.— The close relationship between foreign commerce and internal organization is best seen by tracing commodities from their sources or following them to their destination within the country. For this purpose much of the United Kingdom can be removed from the map. A small fragment of Scotland, a single port in Ireland, the north and part of the midland and west of England, with London and its subsidiary ports, cover the whole region of industrial and commercial importance. London, including the minor ports from Harwich to Southampton, receives about 40 per cent of the total imports of the United Kingdom. Of this vast trade, food, in one shape or another, accounts for nearly half; fruit, eggs, vegetables, butter and other minor agricultural products, with large supplies of beet sugar, from the neighboring districts of Europe; grain and meat from more distant countries; tea, coffee, rice, and miscellaneous tropical and sub-tropical products; all are poured in to supply the needs of the dense population of the London area, or to be distributed over the lines of communication radiating northward and westward.

Apart from food, the most important items of note in the statistics of London and its subsidiary ports are the silk, woolens and other textiles consigned from France and other parts of the continent which are valued at over £25,000,000 sterling. In this matter, London appears as the great consumer of luxuries; on the other hand the receipt of raw wool from distant parts of the world to the value of some £17,000,000, and of large quantities of tin from the East, shows her as a controller of markets and distributor of commodities which she does not utilize herself. For the rest, the trade is made up of innumerable minor manufactured articles, chiefly from European countries, and of miscellaneous raw materials from every region of the world, partly for use in the many industries of the London area, partly attracted thither by facilities of transport and marketing.

The only group to compare with London consists of Liverpool, with the Mersey ports, now including Manchester. Together they take another 30 per cent of the total imports of the kingdom. Roughly, a third is staple food stuffs, mainly from across the Atlantic; Liverpool vieing with London as a distributer of these commodities; another third is raw cotton, nearly the whole of the supply needed for native industries; while in the miscellaneous group, the cane sugar and tobacco of the Indies, the palm-oil, nuts and rubber of the African and American tropics are interesting reminders of the intimate connection of Liverpool with the older colonial and plantation trade.

The remainder of the import business is divided between the eastern group of seaports, represented by the Forth, the Tyne with Middlesboro, and the Humber; and the western, represented by the Clyde, the Severn and Belfast. The main intercourse of the east coast is naturally with the continent of Europe, from the Baltic to the Black Sea; and, for the most part, it can be regarded as merely an extension of London for the receipt of continental goods. One commodity alone deserves special remark. Iron, in various elementary stages of manufacture, enters the Humber from abroad, while Middlesboro and the Tyne find it necessary to import more and more foreign iron ore for their smelting industries. The native supplies, for certain purposes, show a distinct and unpleasant tendency to run short. On the west coast, the Clyde and Severn, like Liverpool, need food for the population concentrated on their coal areas, and have a small share in the sugar and tobacco of the plantation trade. Glasgow must look abroad for iron ore, Cardiff and South Wales for iron, copper, and tin, while Belfast needs flax and linen yarn to supplement native supplies.

All ports alike, from London downward, absorb vast quantities of timber in various shapes. The native supply is a thing of the past; so northern Europe, North America and the tropics are called in to provide this necessary material for railways and mining, and above all for one of the greatest home industries,— building — an industry which does not figure in the export list but is none the less of vital importance in the general economy of the country. An annual timber bill of £25,000,000 is a fairly prominent item in the national balance sheet. For food, raw materials, luxuries, for nearly all the needs of civilized existence, the United Kingdom depends partly or wholly on supplies from beyond the seas; it is small matter for surprise that the question of safety of trade routes, on the one hand, and of the economic and political policy of the regions from which the necessary supplies are drawn, on the other, should loom larger and larger in the view of statesmen, as the economic dependence of the country steadily increases.

Classification and Distribution of Exports.— As an outlet for those districts which produce the chief British staples, London cannot compare with Liverpool. Over a third of the total exports of British produce goes by way of the Mersey, only about a quarter by way of the London group. At Liverpool, cotton goods provide half the export, then come iron and steel in all stages of manufacture, large quantities of woolens, with textile machinery, chemicals and earthenware. In fact the main industries of Lancashire, Yorkshire, Cheshire, and the *Midlands* are here represented roughly in order of their relative importance. With one or two qualifications, the foreign trade of Liverpool may be taken as a type of that of the whole Kingdom.

The export business of the London group is less easy to define, partly owing to the many minor industries of London and district, partly owing to the modifying effects of cost of transport from the great producing centres. Textiles still hold the first place in the customs list, but large quantities of leather, millinery and apparel, paper and stationery, provisions, confectionery, pickles, and medicines, suggest rather the minor activities of a great centre of population than the staple industries of modern life. In short, London may be regarded rather as a general store, handling every kind of goods and forwarding to all parts. The main activities are typical of commercial rather than industrial England.

The export trade of the east coast has certain peculiarities worth a moment's attention. Many million tons of coal leave the Tyne and Humber for European ports, while the textile industries are represented by yarns and machinery rather than finished goods. A certain amount of iron and steel, with ships and their machinery, completes the main features of the trade. The European markets, owing to their advance in industrial organization, tend to be accessible only to certain restricted groups of British industries; the changing conditions are reflected in the customs records of the eastern seaports.

On the west coast, a few million pounds worth of cotton, iron and steel, ships and machinery represents the industrial activity of the Glasgow district; while the linens of Belfast, the iron, steel, and tin plate of the Severn ports and £10,000,000 worth of steam coal from Cardiff complete the schedule of the chief British exports.

In the entrepôt business, London and Liverpool alone are worthy of notice. London is still the chief European market for wool, though her position has been affected by the increase of direct relations between Australia and the continent. But the supreme control of the world's tea trade has dropped from her grasp. The teas of China, whether destined for Europe or America, no longer fill her warehouses. In this, as in other less important departments of commerce, the development of commercial policy of the Powers in the Far East and more particularly the activity of their shipping, have gradually undermined those special advantages on which the great entrepôt trade was founded. London still remains a convenient market for miscellaneous tropical and colonial products, and this position she shares with Liverpool. Broadly speaking, the one looks to the east for imports, the other to the west; together they provide a collecting centre for minor commodities of the whole world. So long as British trade and shipping exist on their present scale, and London maintains its reputation in the financial transactions of commerce, this type of commission business is likely to persist, though it may represent a decreasing proportion of the total commercial activity of the country.

Changes in Character and Sources of Imports. — The ultimate destination of exports or the origin of imports may be a matter of indifference to the individual trader; but in a review of the whole movement of commerce, the question of sources of supply and markets for products, is of the highest interest. In recent years there have been great changes both in the distribution of British manufactures exported and in the sources of the national food supply. Raw materials for the great industries have been affected to a less degree. A generation ago, Europe vied with North America as an exporter of wheat and flour to the United Kingdom; at the close of the century her share had fallen from over 40 to less than 10 per cent. North America had annexed the trade, the larger share falling to the United States, though Canada was rapidly improving her position. India, the Argentine Republic, and Australasia merely supplemented the deficiencies of this supply. But the situation has changed radically, in the last three years, through the enormous deficiency in the supply from the United States, coupled with a corresponding rise in that from India, the Argentine and eastern Europe. Moreover, there are elements of permanence in the change. Apart from the fact that the United States may have considerably less to spare, in the near future, after the satisfaction of the needs of her own industrial population, there are evident economic advantages involved in the purchase of food supplies from those regions which, in their turn, provide an equivalent market for British manufactures. The imports of live cattle from Europe have also ceased, while a new trade in fresh meat with the most distant regions has been created under modern conditions of transport.

In spite of these changes, there has not been that decrease in west-European imports into the United Kingdom which might have been anticipated. Though staple foods for export are only available on a large scale in the non-industrial eastern districts of Europe, the neighboring countries of the west still supply, for British consumption, large quantities of the minor perishable food products. Superior organization and better facilities for transport enable the small grower abroad to supply the great consuming centres with much that could readily be produced in agricultural England. Compensation has also been provided by the enormous growth in the import of beet-sugar, stimulated by the bounty system — a growth of many hundred per cent in twenty years. Since the abolition of the bounties by the convention which came into force in 1903 there has been a considerable decrease in the supply of beet-sugar from Europe, with an increase in that of cane-sugar from tropical regions; but it is impossible to forecast the ultimate position of equilibrium. Further compensation is to be found in the increasing volume of the stream of those continental manufactures which find a ready market in the United Kingdom. The net import of foreign manufactured goods, more than half of which are ready for consumption, has doubled in the last generation and is now valued at upwards of £130,000,000 sterling annually. The greater part of this must be credited to the industrial regions of western Europe. Formerly one of the best markets for the British manufacturer, they are now reversing to some extent the earlier movement, and invade with success the British market, either supplementing or competing with the native industries.

In raw material the changes are less conspicuous. American cotton and Australian wool still dominate the market; but the tin for British industries is now largely imported from

Malaya and Australia, while even for iron ore it is found necessary to utilize more and more the Spanish, Scandinavian and other foreign supplies. The import trade in raw material and food has one characteristic common to all its branches, that is the vastly increased distance from which commodities can be gathered and to some extent the multiplication of possible alternative sources. In fact, the need of an alternative, particularly when no native supply is available, has so impressed itself, not merely on the individual importer but on the great manufacturing interests as a whole and on many responsible officials and politicians, that it bids fair to give rise to a new type of commercial policy, in defence of the national economic interests.

Foreign Markets.— The question of a foreign market for British manufactures raises more difficulties than that of the source of imports. As a general rule, the supply of the latter can be safely left to the foreign countries interested in their production; but British exports must seek out their market in the face of the world-wide competition. In this connection it is worth noting that the proportion of manufactures in the total exports of British produce to the chief protected foreign countries, fell in the last twenty years of the 19th century from 85 to 72 per cent. In the same period the total export of coal more than trebled, while the number of the population engaged in mining shows a heavy relative and absolute increase. These two facts, taken together, are not without significance; though a proportion of the coal exported is accounted for by the enormous increase in the tonnage of British steam shipping engaged in the trade of the world.

Apart altogether from the effects of fiscal policy, the development of the industrial activities of western Europe and the United States has necessarily narrowed the market for British manufactured staples. Both regions take a smaller proportionate share of British exports, while in the case of the United States there has been a heavy absolute fall, for which woolens and tinplate are largely responsible. The European trade has maintained its value and in some cases has shown a tendency to increase; but the type seems to be changing steadily; coal, yarn, and machinery for continental industries tend more and more to take the place of finished goods. The census returns provide a valuable comment on the statistics of exports. Among the greater industries, iron and steel and their manufactures alone show an increase in the proportion of the population employed, comparable to that in mining. Woolens and other textiles show a large decrease. Cotton shows a slight increase in the total number but not commensurate with the growth of population. But allowance must be made for more efficient machinery and labor; while the activity of Lancashire during the last two years, as evidenced by the building of new mills and the greatly increased import of raw cotton and export of finished goods, suggests that the next census will tell a very different tale.

The cry for new markets and the «open door» is not without good foundation. In the west, the United States has evident advantages; Germany, owing to her position and her land frontiers, is exceptionally favored for intercourse with the purely agricultural regions of Europe; while, in the Far East, Japan has started on an industrial career which compels her to import food and raw material rather than finished products. There remain as open markets China, nearer Asia, South America, and the British colonial possessions. The fact that staple British exports have found a rapidly expanding market in the self-governing colonies has masked the decline in other directions. How long the expansion will continue it is impossible to say; the colonies are not without their own individual aspirations, but it is likely to be long before their manufacturing capacity overtakes the demand of their vast agricultural populations.

The British exporter has to face a steady contraction of the world-markets freely open to him, with increased competition in these markets from regions formerly his customers, now self-supporting and rivals in his own line of business. He may change gradually the character of the products exported, though always within the limits set by the national resources of the country; he may find better outlets for miscellaneous articles than for the great staples, but export he must unless the whole economic system is to collapse. He is affected, not merely by the economic policy of foreign states, but by the rise of conditions in the world-market for manufactures, which were scarcely contemplated a generation ago; these conditions may concern more vitally a highly specialized industrial country than one which, either by policy or by natural advantage, is enabled to maintain a better balance of its productive energies and a larger independence of foreign supplies.

Hitherto the British producer and merchant have risen superior to difficulties; ground lost in one direction has been gained in another, while competition has served as a stimulus to greater exertion. In spite of fluctuations and temporary depressions, the volume of British trade has steadily increased; and the fact that the value in 1905 was easily the highest on record, gives strong support to the view that the energy and adaptability of the United Kingdom, alike in the spheres of industry and commerce, are as yet far from reaching a limit.

The following statistical tables give a general view of the progress of British trade for 50 years, though the conclusions to be drawn are affected by the great fall in prices in the latter part of the 19th century, and by changes in the statistical definition of the term «manufactures.»

The figures represent £ million and refer to merchandise only.

Annual Average.	Imports (gross).	Re-export.	Imports wholly or mainly manufactured.
1855-9	169	23	21
1860-4	235	42	31
1865-9	286	49	43
1870-4	346	55	55
1875-9	375	55	66
1880-4	408	64	77
1885-9	379	61	82
1890-4	419	62	90
1895-9	453	60	110
1900-4	533	67	132
1905	565	77	142

Annual Average.	Export of British produce.	Exports wholly or mainly manufactured.
1855-9	116	104
1860-4	138	125
1865-9	181	165
1870-4	235	210
1875-9	202	178
1880-4	234	206
1885-9	226	197
1890-4	234	199
1895-9	238	199
1900-4	283	226
1905	324	269

The figures for «manufactures» are in accordance with the revised classification now adopted by the Board of Trade. The differences between the new and old system are explained in the Parliamentary Paper, Ed. 2,337 (1904), page 325.

Bibliography — Volume of Trade.— The source of all ordinary information as to British trade is the 'Annual Statement of Trade with Foreign Countries and British Possessions', supplemented by the 'Annual Statement of Navigation and Shipping'. The chief defect in the series is that until 1904 the figures represented ports from and to which the goods are shipped, and not countries of origin or ultimate destination. In other words, British trade relations, particularly with certain European countries, are entirely misrepresented. A supplementary volume is now issued which attempts to get at the real facts of the case.

Exports and Imports, Distribution and Changes.— Much valuable information as to the historical growth of British trade can be gathered from the 'Report of the Royal Commission in Trade Depression' (1886), supplemented by Parliamentary papers C. 6394 (1891), C. 8211 (1896), and Cd. 1761 (1903), which bring down to date the statistical information as to British trade and production. The Parliamentary paper, 'Food Supplies Imported 1870-1902' (No. 179, 1903), gives in detail the changes in the sources of supplies in the period. The 'Report of the Royal Commission on Food Supply in Time of War' contains much miscellaneous information as to sources of imports, including raw materials. Consult also the Parliamentary paper Cd. 1199 'Memorandum on Comparative Statistics of Population, Industry and Commerce' (1902); Cd. 1761 'Memoranda and Statistical Tables on British and Foreign Trade and Industrial Conditions' (1903), and Cd. 2337 'Second Series of Memoranda', on the same subject, (1904).

These volumes contain a vast amount of miscellaneous information of the latest date on British trade in relation to industry and foreign competition. They are not without serious inaccuracies, but represent the best official information available. The statistics cover a long period of years.

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20 (a). Great Britain — Navigation Acts. In the 17th century the independence of the English nation as a nation had been secured. Spain had been conquered at sea, and henceforth maritime power became more than ever the great national ideal. Comparatively safe from the dominance of a foreign power, and her internal resources in process of rapid development, all the conditions were present for England to expand beyond the seas and to attempt to secure for herself that pre-eminent position in the world's commerce hitherto held by Holland. England's dominating purpose during the 17th century was to build up her foreign commerce, to outrival the Dutch at every point, to constitute herself the great warehousing and distributing depôt of Europe and to induce the colonies to contribute to the power of the mother country by growing commodities for her to re-export. When Scotland or Ireland seemed likely to encroach on the colonial trade they were carefully excluded.

All through the changes of dynasty from Charles I. to the time of the Whig predominance the same idea holds good; and the instrument by which all this was to be effected was the series of Navigation Acts or Acts of Trade.

The Navigation Acts were no new thing in the 17th century. There was one as early as 1381 (5 R. II. St. I. c. 23). It forbade goods to be exported or imported by Englishmen except «in ships of the King's liegance.» This Act was inoperative, however, owing to the lack of English shipping, but the idea of the statute was never lost sight of. A similar Act was passed in 1463 (3 Ed. IV. c. I) but was dropped after three years. Efforts were again made to enforce a monopoly for English ships under Henry VII. (I. H. VII. c. 8 and 4 H. VII. c. 10) and in 1540 the old laws were re-enacted, the freights defined, and inducements offered to aliens to use English ships. Elizabeth gave up the policy of confining English trade generally to English ships and by an Act of 1563 (5 Eliz. c. 5) merely reserved the coasting trade.

In the 17th century the Navigation Acts were revived. In the early part of the century they took the form of royal letters and proclamations, but in the latter part the policy was embodied in the statutes of 1651 and the series of Acts between 1661 and 1696.

From the 17th century till the final repeal of the Acts between 1822 and 1854, the policy of confining English and colonial trade to English ships was consistently pursued.

The novel feature of the 17th century Navigation Acts did not lie so much in their continuous enforcement as in their enlarged scope and their application to the colonial trade. The Dutch being the greatest traders of the time had got the bulk of the English colonial trade into their hands by making advances to the colonists on the security of future crops. These they duly received when grown and distributed from Amsterdam. This conduct the English regarded as directly contrary to the whole object of colonization, the general view at that time being that people should only leave the mother country in order to build up English trade and shipping elsewhere.

The feeling of jealousy with regard to the Scotch was almost as strong. It is true that they were not such formidable rivals, but they were said to sail cheaper than the English, and as they had close trade relations with the Dutch it was feared that the latter might get hold of the English trade through the Scotch.

"The Plantations are His Majesty's Indies" runs a report of the Commissioners of Customs (30 Oct. 1661) "without charge to him secured and supported by the English subjects who employ above 200 saile of good English ships every year, breed abundance of mariners and begin to grow commodities of great value and esteeme." Were the Scotch allowed to trade freely on the same footing as Englishmen it would "in one word overthrow the very essence and design of the Act of Navigation."

The jealousy of both the Dutch and the Scotch was keenly felt in the 17th century. As soon as the plantations showed signs of development measures were taken, primarily against the Dutch, in order to secure the growing trade for England.

In 1621 we get the first of a series of orders and letters sent out by the King to the Colonial Governors with the object of having all colonial goods brought to England and brought in English ships. In 1624 a proclamation ordered that no tobacco should be imported in foreign bottoms. In 1629 another proclamation re-enacted the old Navigation Laws as to English trade generally. In 1633 the question of the colonial trade was referred to a committee who reported strongly in favor of confining such trade to English ships, and an order was accordingly issued to this effect. In 1637 letters were sent out to the governors in America and the West Indies ordering them to "strictly and resolutely" forbid all trade and traffic with the Dutch.

During the civil war the Dutch seem to have got more and more of the trade of the English colonies into their hands, and it became necessary to revive the policy which had been pursued under Charles I. This was done in the Act of 1651. The commonwealth wished to do a popular thing by appealing to the English hatred of the Dutch, and they no doubt also intended to give the ship owners some compensation for the overwhelming misfortunes which the civil war had brought on them. The restrictions of the Act were not new, nor was it enforced any more effectively than previous Acts had been. Cromwell indeed did not believe in the policy, and so great was the danger to English shipping from the Spanish and Royalist privateers that the government were only too glad to see trade kept alive in neutral ships. In the colonies the statute seems to have been generally disregarded. In 1660 (12 C. II. c. 18) the Act of 1651 was re-enacted with certain additions. The Act of 1651 had declared that no goods "of the growth, production or manufacture of Asia, Africa or America" should be imported into England except in English or colonial ships. Goods from Europe might come either in English vessels or in the ships of the country which produced the goods. As Holland was not a producer she would be particularly affected by this provision. In the 1660 Act the various clauses were made more precise. Both the import trade and the export trade of the plantations were to be carried in ships, English built, English owned, and manned by a crew of whom three parts were English. By a later statute (14 C. II. c. 11) colonial shipping was put on the same footing as English for all the purposes of the Navigation Acts. Goods from Europe were subject to the same restrictions as in the Act of 1651, *i. e.*, they might be imported either in English ships or in ships of the country of origin. No attempt was made to restrict the export of English goods to English ships except in so far as the plantation trade was concerned.

The policy of developing the warehousing trade through the Navigation Acts as outlined by Charles I. was again taken up by his son. A number of commodities — sugar, tobacco, cotton, wool, indigo, ginger, fustick and dye-woods — were "enumerated," and could only be exported from the colonies either to England or to another English colony. Rice and naval stores were added to the list in 1706, and copper and beaver skins in 1722.

The Act of 1663 (15 C. II. c. 7) further extended the policy of making England a great entrepôt by enacting that commodities of the growth or manufacture of Europe that were needed by the colonists should be shipped from England in English or colonial vessels.

Thus, according to the Navigation Acts, the bulk of colonial produce had to be brought to the mother country, and the colonists were bound to take their manufactures from her or through her.

It should be observed that by these Acts the Scotch were shut out from the plantation trade and were not even reckoned as English for the purpose of making up a crew (13 & 14 C. II. c. 11) until the Act of Union. They petitioned to be allowed to trade with the colonies, but a Commission reported strongly against it because such liberty would bring infinite loss to His Majesty's customs and "much prejudice" to the English.

As to Ireland, enumerated goods could be imported there, according to the Act of 1660, and it seemed as if an Irish warehousing system might have developed since food was so cheap that many ships engaged in the colonial trade went into Irish ports to victual. English jealousy of Ireland was, however, too strong for her to be allowed to encroach on a province which England regarded as the foundation of her prosperity. An Act was passed in 1670 (22 & 23 C. II. c. 26) by which the staple colonial commodities were henceforth brought to England only. In 1695 Ireland was prohibited from receiving even non-enumerated commodities as the Bristol merchants complained of the injury done to their trade.

After the Restoration, English shipping increased rapidly; but it is not easy to estimate the precise effect of the Acts in building up the maritime power of England. The English mercantile marine doubled between the Restoration and the Revolution and continued to grow all through the 18th century. Petty, writing in 1699 ('Political Arithmetic,' pp. 258–9), said that shipping had increased three or four fold in the last 40 years; and Child ('Discourse of Trade,' 1695), chronicles the great increase of "Wharfs and Keys" to accommodate the growing trade. It is exceedingly difficult to estimate the extent to which this increased prosperity was due to other factors as well as the Navigation Acts. The English had been pushing trade in all directions after 1660; Charles

II. had concluded a series of trade treaties which gave great openings to English merchants; the banking system was developing with increased facilities for traders; the old system of a steady but restricted trade carried on by merchant companies was giving way to the new principles of pushing trade anywhere and by all means. All these things contributed to increase the demand for shipping. But without the Navigation Acts it might have been Dutch shipping that would have profited, since Holland carried at much cheaper rates than any other nation. At any rate the Acts did secure that the increase of trade should benefit national shipping, although in the Baltic trades the results were at first disastrous. The English had not sufficient shipping for the trade, hence they could not get timber, and accordingly English ship building was hampered. It indeed became necessary to relax the restrictions as far as Norway and Sweden were concerned for three years (7 & 8 W. III. c. 22) to get in naval stores.

The policy of the Acts was attacked as tending to increase prices and limit trade. But the answer always was "that this kingdom is an island the defence whereof hath always been our shipping and seamen," and that therefore "profit and power ought jointly to be considered," and Child, who thus anticipated Adam Smith in his doctrine that defence is more than opulence, added "I think none can deny that the Act of Navigation hath and doth occasion building and employing three times the number of ships and seamen that otherwise we should or would do." Decker in 1766 referred to it as "that most glorious bulwark of our trade." ('High Duties,' p. 21.) Lord Sheffield called it in 1783 "the guardian of the prosperity of Britain," and even Adam Smith says "National animosity at that particular time aimed at the very same object which the most deliberate wisdom would have recommended."

Thus contemporaries seem to have believed that the policy of the Navigation Acts was effecting its object and that it did actually build up the maritime power of Great Britain. To that policy Parliament held steadily till the end of the 18th century.

The result of the Acts on the colonial system is also a matter of dispute. They have been unjustly blamed as being the cause of much friction between the colonies and the mother country. Indeed they have been alleged to be one of the primary causes of the loss of the American colonies. It must, however, be remembered that the Acts were by no means strictly adhered to in the 17th century either in England or the colonies. Especially was this true in the case of New England where smuggling seems to have attained the dignity of a profession. In 1696 it accordingly became necessary to reorganize the Board of Trade, and Courts of Admiralty were established in the colonies to see to the more stringent enforcement of the law. A period of lax administration, however, began again with Walpole and lasted till the time of the Seven Years' War, when an attempt was once more made to stop evasions. After 1763 the Acts were to be worked so as to afford a revenue by which the colonies should contribute part of the cost of their own defence. Before that year the Acts do not seem to have inflicted any great hardship on the colonists, and the commercial monopoly the statutes sought to enforce was scarcely resented. "Whenever the Act pressed hard many individuals indeed evaded it," was Burke's dictum, and this was certainly true as regards the trade between New England and the French West Indies and Newfoundland. The colonists obtained from those places the French manufactures which according to law they were bound to get from England, but no serious attempt seems to have been made previous to 1763 to stop this illegal trade.

Again, the bringing of the "enumerated" commodities to England involved no very great hardship. England was the natural market for those goods, she being best able to undertake the distributing business in Europe with her old established connections. Where the "enumerations" worked hardly they could be relaxed, as was done in the case of rice in 1730. Moreover, in return for the restrictions thus imposed bounties were given to the colonists on the production of naval stores and copper. The growth of tobacco was put down in England so as to give the colonists a monopoly of the market. Another compensation was afforded to the colonies in the great development of shipbuilding and the carrying trade due to the protection given by the Acts to colonial shipping. Massachusetts not merely sold ships in Europe, but in England itself. The causes of the loss of the larger part of the first English Empire do not lie in the trade policy of the Navigation Acts.

In the 18th century the Dutch were outdistanced and England at last attained the position at which she had aimed of being the great carrier of the world. There is, however, no evidence to prove that the Dutch were injured vitally by the English Navigation Acts. The English colonial trade even at the end of the 17th century was only a small trade in the aggregate, and could not have been any very great loss to Holland at the time. The ultimate loss to the Dutch was no doubt great, since they were shut out of a branch of commerce which was capable of great development. The Dutch decline did not begin till 75 years after the passing of the Act of 1651. It was the increase in the volume of English trade while the Dutch trade remained stationary that raised England to the predominant mercantile position.

Between 1796 and 1822 many minor relaxations of the Navigation Acts were placed upon the statute book. Between 1822 and 1826 England's policy was materially changed. Reciprocity in matters of navigation took the place of monopoly. This involved also an alteration in the relations between the colonies and the mother country. To retain for the mother country the bulk of the colonial trade a system of preferential duties was established within the Empire. Between 1849 and 1854 the restrictions on foreign shipping and the colonial trade which were embodied in the Navigation Acts were wholly swept away.

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20 (b). Great Britain — British Shipping. To an island people, and especially to a nation which has necessarily to import four-fifths of the wheat it consumes, and fully one-half of the total amount of its food from countries beyond the sea, a large and efficient mercantile marine is a vital need. To such a nation, from a national point of view, the shipping and shipbuilding trades must be the most important of all trades.

At the present time the shipping trade is not only the most necessary, but in point of magnitude, it is the greatest of British trades. It is impossible to state with precise accuracy its total volume in terms of money, but the Board of Trade, in the careful and cautious calculation they published in 1903 (Cd. 1761) estimated the earnings of British ships in international trades, for the carriage of cargo alone, at $450,000,000 per annum. If to this sum be added the earnings of the passenger and mail services, and of the coasting vessels at home and abroad owned and controlled by British subjects, the total, in the opinion of those best qualified to judge of the question, cannot be less than $550,000,000 — an amount greatly exceeding the entire product of the largest British manufacture, that of cotton, which is estimated at $450,000,000, and is about equal to the total gross revenue of all the British railways. Deducting a small percentage for the port dues and charges of the ships in foreign ports, the whole of this sum is distributed among British industries. Unlike the cotton manufacturer who must pay away half his total receipts for his imported raw material, the British ship and her engines are built of British materials in British shipbuilding yards, the officers, engineers, and more than four-fifths of the sailors are British subjects; the vessel is repaired and provisioned in British ports, is coaled at home, and generally abroad with British coal, and insured by British underwriters. It will be seen that British shipping is emphatically a national industry. About one man in 36 of the population is directly employed in some capacity upon the sea, but those indirectly employed in the trades ancillary to, and created by, the shipping industry are many times greater.

The latest returns issued by the Board of Trade, those of 1904, give the total tonnage of the merchant vessels registered under the British flag as 12,156,101 tons net register, of which 10,554,520 tons belonged to the United Kingdom, and 1,601,581 to the self-governing colonies and other British possessions. Of the British tonnage, 8,751,853 tons consisted of steamships, and 1,802,667 tons of sailing vessels, that is to say five-sixths of the tonnage of the shipping of the United Kingdom is that of steamships, while of the colonial tonnage 674,640 tons was that of steamships, and 926,941 tons that of sailing vessels; that is to say little more than two-fifths was that of steamers. It is impossible correctly to appreciate the value of these figures except by comparison with those relating to other nations, and here the disparity is so great between the magnitude of the shipping tonnage of Great Britain engaged in international trade, and that of any other country, it would appear the only useful comparison is that between the mercantile fleet of the United Kingdom and those of all other nations, of which record exists, put together. These nations are Germany, France, the United States, Russia, Norway, Sweden, Denmark, Holland, Belgium, Portugal, Spain, Italy, Austria, Greece, China, and Japan. The latest published returns for these countries give the tonnage of their combined ocean merchant shipping as 11,894,853, a figure slightly below that of the whole British Empire, but exceeding that of the United Kingdom taken alone by some 12 per cent. A mere statement of total tonnage, however, is an incomplete statement of relative commercial efficiency. The best authorities calculate three tons of sail as being equal to one ton of steam, the latter at the low speed of 10 knots per hour. Of the combined fleets of the other nations of the world, 7,502,156 tons is that of steamships, and 4,392,697 that of sailing vessels. Thus, while five-sixths of the tonnage of British shipping is that of steamers, more than one-third of that of other countries consists of sailing vessels. Further, an analysis of the character and speed of the relative fleets gives still further proof of the superiority of the British marine. A high shipping authority, the editor of the 'Shipping World' (of London), after long and careful research has made and published as accurate and impartial an estimate as it is possible to make of the comparative efficiency of the British and foreign mercantile fleets. Taking a 10-knot steamer as a unit, and adding and deducting from tonnage in proportion to the departure from this standard of speed, to obtain the potential carrying power, he finds that the potential carrying power of British shipping is represented by the figures 16,445,000 against 13,061,000 for that of all other countries combined; while, if steam tonnage alone is taken, the figures for potential efficiency for the United Kingdom, and all other countries taken together, are 15,834,000 and 11,555,000 respectively.

The progress and prospects of this great trade appear to be satisfactory from the British point of view. The last Board of Trade Return, that for 1904, shows an increase of 352,000 tons in the British register, or more than tenfold that of Germany, France, or Norway the nations which rank next in point of increase.

The British demand for new ships is entirely supplied by the shipbuilding establishments of the country, which in addition have built for other nations during the last 10 years an annual average of about 200,000 tons, exclusive of ships of war. The mercantile fleets of other nations also consist, to a considerable extent, of the vessels discarded and sold by the British shipowners. The tonnage of the vessels so sold and transferred to the registers of other European nations has amounted to an annual average of 360,000 tons during the last 10 years.

To this remarkable concentration of a great trade, one of a specially international character, and one greatly desired by all, in the hands of one nation, many causes have contributed. History shows that it cannot be attributed to commanding geographical advantage in the position of the British Islands, nor to any supreme aptitude of the British people for the life of the sea, and for conducting the oversea trade of the world. In the art and the science of shipbuilding the French have always been well to the front. In the Napoleonic wars Nelson's best ships were those he had captured of French build. In our own time the French have more than once given a lead in naval construction; the first armored ship was French; it was the French who introduced the water-tube boilers, and constructed the first submarines. The coasts of Normandy and Brittany have always furnished hardy and courageous sailors and fishermen, and yet to-day France stands low in the scale of mercantile maritime powers, notwithstanding the extravagant subsidies she pays to her shipbuilders and shipowners. America contests with Great Britain the honor of the successfully applying steam to navigation. Fulton's experimental boat in 1798 was four years earlier than Symington's *Clermont* on the Forth and Clyde canal. The *Savannah* in 1819 was the first vessel with auxiliary steam to cross the Atlantic. Both in the construction of sailing ships and in the improvement of the early marine engine America led. Yet her tonnage of ships Registered for Oversea (Foreign Trade) (1904) stands within 1,000 tons of the figure of 1840. The supremacy of the British mercantile marine, therefore, cannot be attributed to the possession of superior inventiveness or aptitude of the British men for the command of the sea. The phenomenon itself is a very modern phenomenon. «It may be assumed,» says Mr. Cunningham, an authority on economic history, «that in the Middle Ages the shipping of the Italian Republics and the Hanse League excelled that of England.» The chance of England did not come in fact until the discoveries of Columbus and Vasco di Gama opened the Western and Eastern Oceans to commerce, which, until that time, had been confined principally to the Mediterranean and other inland seas. In later times we find that Spain and Portugal, and afterward, Holland took the lead in the new ocean traffic, so much so that in 1603 Sir Walter Raleigh wrote, «The merchant ships of England are not to be compared with those of the Dutch.» The English position, however, was improving, and in 1666 Sir Henry Petty estimated that the Dutch shipping tonnage amounted to 900,000 tons, English to 500,000, French to 100,000, Hamburg, Dantzig, Denmark, and Sweden to 250,000, and Spain, Portugal, and Italy to 250,000. At this time English shipping was subject to the celebrated Navigation Act of Oliver Cromwell (1651), the principle of which, broadly speaking, was to confine foreign trade with European countries to the vessels of Great Britain or of the country with which the trade was carried on; and all trade with any of the more distant continents, or with any of the plantations of Great Britain, entirely to British ships. The Navigation Laws of other maritime nations were framed in a similar spirit on similar lines. In the international race all competitors were pretty equally privileged or handicapped. Although the whole system had become riddled with exceptions and exemptions and suspensions, due sometimes to necessity, and sometimes to reciprocal treaties, the principle of the legislation of Cromwell remained in force until the Navigation Acts were finally repealed in 1849. The great expansion of the trade of the world in the first half of the 19th century together with the improvement in the size, speed, and cost of building and operating the new steam fleets, had rendered it generally impossible to maintain the mediæval system of the old Navigation Laws, and although other nations did not, like Great Britain, emancipate themselves from these fetters at a stroke, they have found it impossible to maintain them, and the relics of the ancient system survive in the present day chiefly in the form of the reservation of their coasting trades by many, though not by all, the civilized nations of the world, certain restrictions on their colonial trades, and in addition to this, in the case of the United States, the restriction of the privilege of the American register, with its exclusive right to the coasting trade, to ships built in America of American materials. The mediæval system in its old barbarous form has universally passed away, and for more than half a century Great Britain has carried on her oversea trade in the atmosphere of free competition.

In all the previous centuries she possessed no marked superiority as a shipowning and seafaring community, and at the time of the Free Trade revolution she might only with some doubt be placed first among the mercantile maritime powers. She was then making no marked progress in comparison with other nations, and in some respects was declining. For example, although, after the great war in 1815, the shipping tonnage of the United States was not half that of the United Kingdom, in 1850 the American mercantile marine had grown to be very nearly equal to that of England in total tonnage, if coast and lake and river steamers be included, and greatly exceeded it in efficiency, for it included more than half a million tons of steam shipping against less than 200,000 tons of British shipping of the same class. Although the tonnage of all American ships registered for oversea (foreign) trade was at that time only about one-third of that of Great Britain, it was superior in quality, and was increasing with greater rapidity. The Americans excelled in the speed, efficiency, and beauty of their sailing ships, and the celebrated «Baltimore Clippers» and «American Liners» almost monopolized the carrying trade between Great Britain and the United States. In the middle of the 19th century it may be said that Great Britain and the United States were worthy and well-matched rivals in the race for leadership upon the ocean.

It is an interesting question to ask what are the causes to which this modern phenomenon, the supremacy of Great Britain in the trades of building, manning, and operating ships, is to be attributed; and especially those which have led to the decline in the mercantile marine of the United States registered for foreign trade, almost to the point of extinction. It would be erroneous to attribute this commercial revolution to any one cause. The substitution of steam for sailing ships does not appear to have been of any particular advantage to Great Britain, for during the first 30 years of the existence of sea-going steamships America kept the lead in this class of shipping, and her engineers contributed largely to the earlier development of the marine engine. The later substitution of iron and steel for wood as the material for the construction of ships undoubtedly gave a great temporary advantage to England, which was at that time and remained for many years the largest and cheapest producing country of iron and steel, but it does not explain the fact that while the production of iron and steel in America now greatly exceeds that of the United Kingdom, this country has not been able to regain any considerable portion of the trade of building and operating ships for international commerce. Undoubtedly the American war had a disastrous temporary effect upon American shipping, shown by the decrease in the tonnage of ships registered for oversea trade from 2,546,237 tons in 1860 to 1,516,800 tons in 1870, but this does not explain the failure of the United States to recover this single trade in succeeding years; still less does it explain the continuous reduction of American tonnage to 898,768 tons in 1904. The principal explanation of this phenomenon is undoubtedly to be found in the opposite fiscal policies pursued by the two countries. It would not be proper in this place to enter into an argument as to the general results of the British policy of Free Trade, and the American policy of Protection upon the two countries, but it is a fact admitted alike by free-traders and protectionists, that the control of this particular trade of international shipowning and shipbuilding has been determined by their mercantile policy (see GREAT BRITAIN — FREE TRADE). The growth of the shipping supremacy of Great Britain, a supremacy becoming more marked each year, dates from the adoption of the policy of free imports in the years 1840–50, coupled with the abolition of the Navigation Laws in 1849. The process of the absorption of international shipping by British shipowners has undoubtedly been assisted by the protection policy of other nations. By restricting their importation of British material goods, the inexorable economic law which compels each trading nation to pay its debts and balance its international accounts, has rendered it more convenient for Great Britain to pay for her great imports of food and raw material to the nations which refused her cotton goods or her iron, in the form of shipping services, which form at the present time the largest of British exports. The result has been that while the total volume of British trade amounts to not more than one-seventh of the trade of the world, British ships carry more than one-half of the trade of the world. The volume of purely foreign trade, that is of trade between foreign port and foreign port — trade which does not touch the ports of the United Kingdom, carried by British ships — largely exceeds that of the direct trade to and from British ports. In contrast, the gradual decline of the American trade is well set out in a statistical table prepared by Mr. Meikle, Secretary of the Seattle Chamber of Commerce, and published in the Report of the Merchant Marine Commission at Washington in 1905. It showed that in the year 1821 the percentage of the import and export trade of the United States carried in American bottoms was 88.7. This proportion, which remained fairly steady until 1850, had shrunk in 1860 to 72.5 per cent. From that year onward the decline became increasingly rapid until in 1900 the percentage carried in American bottoms was only 9.2; and at about this figure it remains to-day.

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21. Great Britain — Railways. *Comparisons and Contrasts Between the Railway Systems of Great Britain and the United States.*— "The plastic American instinct has introduced the wholesale principle into regions where the slower-witted nations of Europe have never thought of applying it. The factory life of England is new, and British manufacturers fully appreciate the economies to be effected by turning out pins by the million gross, cotton yarn by the million pounds, and steel rails by the tens of thousands of tons. But the Americans have applied the principle to businesses which have existed since the dawn of civilization. Their hotel-keeping is wholesale; their farming is wholesale; and, most of all, their transportation system is wholesale. The English farmer still looks upon the railway train as only a slightly magnified carrier's cart, and persists in sending his basket of eggs or his hamper of vegetables to market, as his grandfather did when George III. was king. The American farmer does his business in carloads."*

The writer, in a book written by him 15 years ago, after his first visit to the United States, pointed out in these words what seemed to him then, as it seems to him now, the essential differentia between English and American railroading, and suggested that the difference is not accidental and specific, but part of the generic difference between the two countries which naturally arises from their different historical and geographical position.

But there are other important differences between the railways of England and the United States. England is an island, and a small one; America is a great continent. The maximum possible haul within the British Isles is just

* "The Railways and the Traders." (London, 1891.)

about as far as from New York to Chicago. In fact there is practically no traffic here requiring to be carried any such distance. If it did, it would probably go by water, for there is no place in Great Britain more than 80 miles from a sea port. Any thing over 100 miles is referred to in England as a long haul; in the United States the average haul of freight is 133 miles. The average passenger journey in the United States is 30 miles; in Great Britain it is probably — accurate statistics do not exist — about 10 miles.

Again, Great Britain is densely populated; the United States is the reverse. On one-thirtieth of the area of the United States, England has half as much population. Naturally, therefore, while the United States has fewer miles of railway per square mile of area, Great Britain has fewer miles per thousand of the population. Roughly, the United States has one mile of railway per 18 square miles of area; Great Britain, one mile for every six square miles. But in Great Britain there is a mile of line for every 2,000 of the population; in the United States a mile of line for every 400. The population of Great Britain, and therefore, its intercourse, per mile being so much greater, it is also natural that a mile of railway is a much more elaborate thing than in the United States. For every route mile in the United States there are one and one third miles of track, while in Great Britain there are well over two miles. In equipment the contrast is even greater. With only one-tenth of mileage of railway in the United States, Great Britain has half the number of locomotives, more passenger cars, and nearly as many freight cars.* Put another way, a mile of English railway represents an expenditure of almost as many pounds as a mile of American railway represents dollars; a mile of English line earns five dollars for every two dollars that an American mile earns.

It must not, however, be assumed that a mile of English railway does work as compared with a mile of American in the same ration in which it earns revenue. How much work American railways do is known. In the year 1905 they carried over 22,000,000,000 passengers and 174,000,000,000 tons of freight one mile. The railways of the United Kingdom in the same period — according to the best estimate that, in the absence of precise statistics, it is possible to make — carried about 14,000,000,000 passengers, and 150,000,000,000 tons one mile. In other words the railways of the United States dealt with over 700,000,000 passengers, carrying them on the average 30 miles each. English railways dealt with double that number, but only carried them on the average of 10 miles each. In freight service the railways of the United States handled thrice the tonnage of English railways — 1,300,000,000 against 450,000,000 tons, and carried it nearly four times as far — 133 miles against an estimated 30 miles. The average mile of railway therefore in America carried in the year (in very round figures) 100,000 passengers and 800,000 tons of freight. For the United Kingdom the estimated figures are 600,000 passengers, and 670,000 tons of freight. Less freight service but six times as intense a passenger service. It would be wearisome to pursue the statistical contrast further. We may sum it up by saying that, whereas in the United States the typical passenger travels for a considerable distance at pretty long intervals, in Great Britain the railway occupies in great measure the place of the street car of the United States, and is the means by which large sections of the population move daily to and from their work and whereas the typical freight consignment in the United States is a "straight" carload of produce carried for a long distance, the typical consignment in Great Britain is a single box, or bag, or bale, or other package of manufactured articles, carried from one town to another closely adjacent.

The service required of the railways by the public of the two countries being so entirely different, it is only natural that the method of performing it, and the charges made for it should show equally wide differences. In the United States the railways receive two cents per mile on the average for every passenger, and at this rate find passenger traffic barely profitable. In Great Britain the railways receive hardly, if at all, more than one cent a mile on the average. Yet they can make a handsome profit, spite of the fact that they give a much more frequent and a faster service, with accommodation certainly not inferior in comfort. The mainstay of railway prosperity in the United States is in the carriage of freight at a rate of, roughly, five miles for four cents. English companies' receipts average, it is estimated, not less than two cents for each mile. Yet the prevailing opinion of those best qualified to judge is that much of the freight traffic in Great Britain is unprofitable, while not a little is done at an actual loss — for the irony of fate has decreed that England, with freight rates undoubtedly on the average the highest in the world, shall also have certain rates undoubtedly the lowest. For instance, for eight cents the Great Eastern Railway Company will bring from any of its country stations, say between 50 and 130 miles off, and deliver to the consumer's door in London a box of farm or garden produce of a gross weight of 20 lbs. See AMERICAN RAILROADS; RAILWAY SYSTEMS OF THE UNITED STATES; RAILWAY CONSOLIDATION.

Similarity.— England and the United States are the only great countries where the railway system has been provided by practically unaided private enterprise, and still remains in the hands of practically independent private companies. In both countries the state has found it necessary to interfere at many points, and an interesting essay might be written comparing the methods of government control adopted in each. But here it can only be very briefly pointed out that in both countries the Anglo-Saxon tradition has prevailed, and such governmental control as exists has taken in the main a legislative and judicial form. Executive interference — which in France descends to the minutest details of every-day operation — is of relatively small importance. On the whole it is safe to say that English railways are and always have been more closely supervised by public authority than the railways of the United States. On paper it is true some States of the

* Of course in Great Britain the locomotives and cars are smaller and freight cars only one-third of the size of those of the United States. The comparison includes freight cars privately owned (believed to be not less than 500,000 in number) which are ignored in English official statistics.

Union — Texas more particularly — appear to interfere more than does the English government. But the operation of the Constitution and the rival state and federal jurisdiction secure even for railway corporations in Texas a considerable degree of practical freedom, while there is no possibility of escape from the supreme and final authority of an English Act of Parliament.

Laws Governing the Railway Systems.— According to the English code of railway law, which took practically its present shape as long ago as 1845, no company can come into existence, no new line can be constructed, no new capital can be raised without the authority of a special Act of Parliament, which lays down with great detail the constitution of the company, the route of the line and its method of construction, the amount of the capital and the purposes to which it shall be applied. Maximum rates and fares for goods and passengers are also prescribed. The authorized railway cannot be opened for passenger traffic until an inspection by public authority has secured that every possible precaution for safety has been taken. Once opened, however, the operation of the company is in the main in its own hands. Not so, however, the commercial management. A special court, the Railway Commission, exists to watch over the observance of the law of undue preference. Its powers are, it is true, seldom invoked, but that is the best proof of their real efficacy. Further, the same tribunal has power to forbid the increase of any existing rate for goods, and does in fact refuse to permit any such increase unless under exceptional circumstances. See Railway Consolidation: *England.*

Finances.— Regarded as financial investments, the relative position of English and American railway stocks has been completely inverted within recent years. Formerly English railways were the most popular investments for English capital. To-day they are quite out of favor. The stock of one leading company, quoted a few years ago at 230, has recently been sold at under 150, though the dividend has remained practically unchanged. In cases, and they are very numerous, where the dividend has fallen, the drop in the capital value has been even more marked. It would probably be safe to say that the market value of English railway securities has fallen by at least a thousand million dollars within the last decade. In the year 1900, for the first time on record, the average earnings of all English railway capital fell below 3½ per cent. And this at a time when trade was booming, and when the valuation of American railway capital was advancing by leaps and bounds. The explanation is simple enough. The cost of working has been steadily rising owing to the more exacting demands of the public, the increased cost of materials, and the higher wages and shorter hours of the railway employees. The operating ratio rose steadily from 52 per cent in 1889, to 63 per cent in 1901. Moreover, with net receipts stationary, the railway capital has grown with alarming rapidity. For, it has been the traditional policy of English railway companies to divide half year by half year the whole of its profits among the shareholders, and to charge all additions and improvements to capital. This has been done perfectly openly and deliberately. But it has proved to be short-sighted finance. For it has resulted in swelling capital accounts to a size on which the earnings of the line can hardly pay more than a very modest dividend. And, in this staid, old-fashioned country, no railway company can hope to wipe out its past and start afresh with a reorganized capital account, as did some of the greatest and most famous railroads of the United States after the financial collapse of 1893.

One other point of contact between England and the United States may be noted in conclusion. Between them they are responsible for the original invention of railways, and for every important improvement in railway methods and practice that has been introduced since. There are some students of railway history who, spite of the fact that the nations of continental Europe are more and more going over to state ownership of railways, believe that this is no accident, but rather a natural result of the Anglo-Saxon habit of leaving to private enterprise the utmost freedom which practical experience shows to be compatible with the welfare of the nation at large.

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THE PRODUCTION OF WEALTH.

22 (a). Great Britain — The English Land Law. *Sources and General Characteristics.*— The law of land, or "real estate" bears the traces of the different streams of influence that have made English history. It derives its main characteristics from the feudal organization of society but these characteristics have been superimposed on other systems, or combined with other elements, which may be of early Germanic, Celtic, or in some instances even of Roman origin. Again, the land laws have been the subject of frequent legislation; in the usual English method, particular evils have from time to time been remedied without any logical recasting of the body of the law and without the removal of mere anomalies which could not rank as grievances. But the main principles of the law may still be called feudal.

The modern law may be compared to a chalk cliff in which are many fossils; a cliff pierced by works and tunnels for such useful purposes as railways or mines, but left, where modern necessities have not interfered, to the slow decomposing action of the elements. The chalk is the feudalized common law, the fossils are pre-feudal survivals, such as land of "copyhold" tenure, the works and tunnels are Parliamentary Statutes, and the elements are the forces of public opinion acting by judicial exposition and construction. Compared to the law as it was in the early years of the 19th century, the modern law of real property is simple, but if it be tested by any more severe standard it still retains many intricacies for which it is easier to find a historical than a logical explanation.

Land on feudal principles is the subject of tenure and not ownership. No man owns English land unless he be King of England. Land is always "held of" some one — either the King, or a tenant in some degree of the King. Land was thus originally looked on rather as the means of fulfilling a duty than as so much property, and for the comparatively simple conception of ownership was substituted the more subtle idea of "estates," *i. e.*, parts of and interests in ownership. Some of these interests were not recognized in the Courts of Common Law but only in "Equity," *i. e.* the extraordinary jurisdiction of the Chancellor. In time the feudal idea of tenure ceased to express the real state of things, and a tenant in fee simple became and has for many centuries been an absolute owner. But the inherited complications remained and indeed grew, being constantly developed so as to evade and even counteract Parliamentary Statutes which landowners and the legal profession viewed with disfavor. In 1832 the English land law was a vast metaphysical system requiring and developing great acuteness of intellect among practitioners but utterly unintelligible to a layman.

The feudal theory of tenure gave to English land holding a certain social character which in many country districts has never been lost. To this day land in rural England is looked on less as a means of livelihood or source of income than as giving a certain social status to which rights and obligations are attached. Indeed it would be difficult even now to give a better definition according to received ideas of the English upper social class than to say that it consists of the owners of the country estates of England.

The legal position of the possessor of land may be considered in three main aspects: his relations to his predecessors and successors, including what may be called family law; his economic and social relations, including the law of landlord and tenant; and his relations to the community as a whole, including his liability to taxation and generally the rights and powers of the State.

Family Law: (1) *Settled Land.*— England is a country of large properties, and most large properties are, to use a legal phrase, "Settled Land." The meaning of this is that by the terms of some deed or will (called for this purpose "a settlement") the land is not at the disposition of a living person to sell, mortgage or give away; the apparent owner is only what is called a "tenant for life," and on his death the land will pass to some other person, generally his eldest son, if he has children, but if he has not, then to some collateral relative, without any effort and without any power of interference on his part. A "settlement" of this kind may be looked on as a temporary and conventional "entail"; it originates in the voluntary act of some tenant in fee simple, and its duration is limited by law to the life or lives of some person or persons in being when the settlement is made and a further period of 21 years afterward. The practical effect of an ordinary English settlement is to preserve the land for two or even three generations to the eldest living male of the senior line as head of the family to the exclusion of females and younger sons. In most land-holding families as soon as the person who will succeed to the land not merely as a life tenant but with absolute power of disposition, is next in succession and is 21 years of age, he joins with the existing tenant for life — usually his own father — to resettle the land for another two generations. Thus one settlement succeeds another, and a tenant in fee simple is rarely, if ever, in possession. Provision is usually made for a widow of a tenant for life by giving her an annuity known as a "jointure," and younger children are given comparatively small sums of capital known as "portions" which are made charges on the estate. This practice of settlement is permitted but not enjoined by the law; it came into fashion about the middle of the 17th century. It is thought by some observers that the practice now (1906), shows some signs of being on the wane, but no direct evidence is available; certainly it still affects nearly all large properties, and therefore the greater part of English land. Its result has been to make each eldest son in turn the proprietor of one or more family estates, to prevent the dispersal of land into many hands, and to keep for the head of a family a social prestige and preëminence among both relations and neighbors. If there happens to be a peerage or baronetcy in the family, the land practically always goes with the title. In fact it is not uncommon even in cases where there is no title or honor in the family for the settlement to provide that any person succeeding who does not already bear the family name — *e. g.* a married daughter, or a daughter's son — shall take the name and armorial bearings of the author of the settlement on pain of exclusion from the property. Younger sons, on the other hand, after a boyhood spent on the family property are left with slender portions to make their own careers; thus in their case class distinctions tend to be obliterated; younger sons of the land-holding class may be found in almost every branch of activity, in the navy, the army, in orders in the Anglican Church, in commerce, and in the learned professions.

British colonial development owes much to the adventurous disposition fostered by the outdoor life and the economic necessities of the younger sons of the land-holding classes.

Formerly the main economic objection to the legal fetters imposed on land-holders by settlements, was that during a settlement the land was taken out of commerce as it had no proprietor who could sell. This difficulty has now been removed as the result of an important Act of Parliament (The Settled Land Act

1882). Every English tenant for life may now (1906) be considered as a kind of plenipotentiary agent for the whole family, born and unborn. Subject to certain not onerous restrictions, he can sell or lease for long periods on the recognized terms as he pleases; indeed he can do almost anything which a prudent and honest owner would do, but always on the terms that the property or the proceeds of sale are kept to descend in due course of settlement. But the real fetters on an English tenant for life are not those which the law imposes, but the fetters of tradition and family sentiment which no legal power or ingenuity can remove.

(2) *Land not Settled.*— Apart from this liberty of terminable settlement the English law does not favor restrictions on the powers of a landholder. No entail can by English law be created which cannot be destroyed as soon as some person unborn at the date of its creation attains 21 years of age. In the 15th century English lawyers, more daring than their Scottish brethren, with public feeling behind them, went so far as in substance to defeat the provisions of a Statute of Edward I. (*De Donis Conditionalibus*, A.D. 1285), by which Parliament had sought to make entails perpetual. Where land is not settled, in the case of the death of a landholder without a will, the common law on feudal principles gives his land to his eldest son; prefeudal customs are, however, not left entirely without witnesses; in parts of the county of Kent the older custom of equal division, known as gavel-kind, still prevails, and in a few ancient boroughs under the custom known as "Borough English" the youngest son alone succeeds. But cases of intestacy are not common among the wealthy classes.

Wills.— A tenant in fee simple has, contrary to feudal principles, been gradually empowered by successive Acts of Parliament, culminating in the year 1662, to dispose of his land by will after his death in the same absolute manner as during his life. He can disinherit totally or partially all or any of his children and can at his pleasure give the land to strangers or, since the year 1891, even to charity. But the charity as a rule is bound to sell the land and not retain it.

Landlord and Tenant. (1) *The Town.*— There is a sharp contrast between the land system in the towns and in the country. In and near towns the proportion of settled to unsettled land is probably smaller than in the country; but even in the case of settled land the tie between landlord and tenant is purely economic. A town landlord may often be of inferior social standing to his tenant; further, urban and suburban land is often owned by commercial companies formed for dealings in land. But both in town and country, England is a land of large properties and it is the exception to find that the actual occupier of land is, in the popular phrase, "his own landlord."

On all land in or near towns, building is usually done on the lease-hold system. By this system the land is let, usually to a builder, for a long period, from 80 to 99 years. The lessee contracts to build and keep his building in repair; to pay an annual "ground rent"; to discharge all taxes levied on the land, and in fact to bear all possible burdens connected with it. At the end of the lease the land and the building on it revert to the successors of the original landlord. The long lease thus granted may usually be sold or mortgaged at the pleasure of the lessee, and the building itself is frequently sublet by the lessee as landlord to the actual occupant as tenant, who pays to the original lessee or his successor a full or "rack" rent for building and land together.

Until recent years the whole tendency of the law was to favor the landlord as against the tenant, and even now the law can hardly be said not to lean in the landlord's favor, particularly in allowing him the right of distress for rent. In the exercise of this right, contrary to the general principles of English law, a landlord whose rent is in arrear can without the judgment of any Court seize and sell any chattels of any person, whether his tenant or a stranger, that he can find on the premises, and thus pay himself his rent. Recent legislation (The Conveyancing and Law of Property Act 1881) has, however, interfered against the landlord, who, whatever the terms of the lease, can now no longer forfeit a lease for a casual breach of covenant not deliberately persisted in by the tenant.

This leasehold system in and near towns, though frequent, is not by any means universal, especially in the north of England; there, a common plan is to sell land for building purposes out and out, in consideration of a perpetual rent reserved to the vendor. Further, the simple plan of the sale of building plots for a lump sum is probably growing in favor, particularly in suburban districts developed by land companies. A company of this kind has no family pride in the preservation of its estate, nor does it wish to realize an improved value after three generations.

(2) *Country.*— In the country districts the long leasehold system is unknown. The ordinary English farmer usually does not hold a lease for any fixed term of years, but has merely a tenancy from year to year determinable by 12 months' notice. As a rule all the farm buildings have been supplied by the landlord. The tendency of modern legislation is to give the agricultural tenant security for the value of his improvements, but the old law, which treats whatever is built or planted on land as an accretion to the land, and therefore the property of the landlord, still governs in the main the relationship of landlord and tenant.

The tie of landlord and tenant in the country districts is for good and for evil, not merely economic. The landlords are the social magnates of the countryside. As unpaid magistrates they have had up till now (1906) practically a monopoly of the ordinary dispensation of all minor criminal and some civil justice. On the other hand, in bad years they are expected by the common opinion of the countryside to allow and do allow considerable reductions on the agreed rent. A "good landlord" is the man who is always ready to aid his tenants in sundry ways. On well-managed estates, the system works easily. The system, however, is one which for its success depends on the peculiar social conditions which have hitherto prevailed in rural England, and its transplantation to Ireland, where these conditions did not exist, had results disastrous for both countries.

Sporting Rights.— In England the love of sport has been a prominent characteristic of the landholding class throughout all history; it is practically the universal custom for a landlord to reserve the sporting rights over agricultural land. If he does not exercise them himself, he lets them to some other person. Where sporting rights are reserved the tenant has no right to kill pheasants or partridges, but the Ground Game Act of 1880 empowers the tenant himself, and one other person authorized by him in writing, to shoot hares and rabbits on his land whether sporting rights are reserved or not, and whatever the terms of the tenancy agreement.

Land and The State; Taxation.—The taxation of land is a question that is complicated by some historical anomalies. (1) *Land Tax.*— The burden commonly known as Land Tax represents historically the surviving portion of a general tax in the nature of an income tax imposed both on real and personal estate in the year 1692; but it has for many years been a mere stereotyped incumbrance redeemable by the landholder, and charged on the value of the land as in the year 1692. On most urban land the tax has been redeemed. (2) *Income Tax.* — Incomes derived from land, *i. e.* the net rent of land, are liable to income tax equally with incomes derived from other sources. (3) *Death Duties.*— Before 1894 land escaped the greater part of the death duties imposed on personal property, but since the Finance Act of that year all species of property are in this respect on an equality. (4) *Local Taxation.*— On the other hand a man's liability to local, as distinct from imperial, taxation is estimated by the value of the real property (*i. e.* land and buildings) which he occupies, no account (in spite of some earlier statutory provisions to the contrary) being taken of his personal property. On agricultural land, by an Act of Parliament passed in 1896, only half the ordinary rate is paid. But no contribution is made to local taxation in respect of the capital value of land, or of land which is not occupied, however high may be its value.

Other Rights of the State.—The feudal principle of the ultimate ownership of the King has produced little or no effect in giving to the State which the King personifies, rights over English land. The modern State has practically no mineral rights. The precious metals, gold and silver, which for commercial purposes are practically not found in Great Britain, are in law Crown property and can only be worked under license from the Crown. But all other minerals belong to the tenant in fee simple of the soil who leases or works them for his own private benefit. The Crown lands in England are small in extent; ownership by local authorities is still in its infancy. There is no prairie land to grant to railway pioneers or new settlers. When land is wanted for the purpose of some undertaking of a public nature — such as a railway, waterworks, or the site of a post-office — it has, as a rule, to be purchased by the company, or authority concerned, under statutory machinery, by which the fair value of the land has to be paid, plus 10 per cent. compensation for compulsory sale. In the year 1887 the principle of compulsory acquisition was, subject to many safeguards, extended to the acquisition by a local authority of land to be let in very small quantities, called allotments, to agricultural laborers or others for cultivation. The Irish Land Purchase Act of 1903 proceeded on the principle of a loan by the State to a tenant who wished to purchase his holding from his landlord, and agreed with him as to the price. It did not directly involve either public ownership or compulsory acquisition.

Transfer.— In recent years several attempts, culminating in the Land Transfer Act 1897, have been made to induce English landholders to abandon the present system of private transfer of land for a system based on a Land Registry. Under the present system whenever land is sold or mortgaged, it is necessary for the purchaser or mortgagee to satisfy himself as to the title by going into all dealings with the land for a period which may be as long as 40 years. This is an expensive process, but it has been endeared by centuries of experience to English landholders and lawyers. At the present time, a public Land Registry has been substituted for the old system only in London. The principle of the new system is to enter the name of the proprietor of (or rather the person entitled to sell) every piece of land on a register and to make land transferable by the person registered by means of a fresh entry on the registry, as if it were so much stock in the funds. The extension of this system to the rest of the country is a question of time; but in legal matters time moves slowly.

Trend of the Law.— Recent developments of the law have in nearly all cases tended to restrict the freedom of the individual in relation to land. Neither in town nor country are landlord and tenant allowed to make what bargain they choose; it is assumed that the economic inferiority of the tenant places him at too great a disadvantage for it to be possible for him to make a contract fair to himself, and so beneficial to the community. Men are no longer allowed to settle their land in such a way as to make it unsalable, and the community has asserted the right to dispossess the individual, not only for definite works of a public nature, but in order to provide its poorer members with an interest in the land. It has also compelled land owners in the Metropolis to abandon the old system of private conveyance and mortgage for a system which is in a sense public, as it is worked by public officials, and which may thus be regarded as a kind of reversion to the old method of public transfer. The same system will also in time form — what is badly wanted — a new and more accurate 'Domesday Book.' Finally, modern legislation has put an end to the former advantage of land in respect of taxation and so claimed a larger share in real property directly for the State. The simplification of the land laws may be said to be one aspect of this change; intricacy and subtlety of phrase and interpretation may be tolerated by a private owner as the price of the liberty of complicated dispositions and of secrecy, but these niceties are inconsistent with the uniformity which must accompany public control.

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22 (b). **Great Britain — The Eighteenth Century — Agriculture.** Between 1700 and 1815 English agriculture changed its whole character. England became a great corn exporting country and continued so up to 1773. Great agricultural improvements were carried through, stock breeding became scientific, waste land was broken up, large portions of the fens were drained, big farms with enterprising up-to-date farmers became the object of every landlord and the agricultural system which had come down from Anglo-Saxon days, and which still prevailed over large parts of England, was given up. English farming became intensive in character instead of mainly extensive. The social effects of the change involved the disappearance or degradation of the landowning peasantry or yeoman class. On the other hand it was only by means of the great increase in agricultural produce that England was not starved into submission during the Napoleonic wars. The changes in agriculture of that century meant ultimately nothing more nor less than national independence.

One of the main objects of English policy had been for centuries the encouragement of agriculture. A sufficient food supply raised at home deprived the enemy of the power of cutting off supplies from abroad. Moreover agriculture was considered the best breeding ground of good soldiers. Corn also was an excellent commodity for ships to carry, and the encouragement of corn export formed part of the Navigation policy of the realm. The great attention bestowed by successive governments upon agriculture was the most original part of English policy. Her seamanship she copied from Holland, her industrial protection from France; but while every other country aimed at preventing the export of corn so as to have a sufficient food supply, England deliberately stimulated export believing that thereby farming would be best encouraged.

This policy reached its most complete expression in the Corn Bounty Act (I. Wm. and Mary, c.12) of 1689, by which, when the price of wheat was at or below 48 shillings (and proportionately for other grains) a bounty was given on export.

The result of this law was to attract capital into farming. Men who sunk money in improvements were assured of a price which should not fall below 48 shillings and under the stimulus of this certainty a great agricultural revolution began. There grew up gradually a class of capitalist farmers and "spirited landlords" who were willing to carry out experiments. The result was that by 1770 England not only produced food for a population that had doubled itself, but was the granary of Europe.

One of the great improvements of the 18th century was, for example, the manuring of land, by which Arthur Young calculated that three or four hundred thousand acres of waste were turned into gardens. A revolution in fodder was brought about by the introduction of turnips and clover, while careful attention to grass seeds resulted in good hay on which cattle could be kept in condition in winter. Previous to the introduction of winter roots the majority of the beasts had to be killed in the autumn and salted down, while the remainder declined in weight through sheer starvation. This annual loss was now averted and a supply of fresh meat secured all the year round.

It therefore became worth while to improve the breed of the animals themselves. Bakewell of Dishley and Coke of Holkham wrought a revolution in English life with their Leicester and Southdown sheep and Devon cattle. Animals were now raised primarily for food instead of for their wool or hides, they were ready for the market sooner and the average size of cattle doubled and trebled. Thus a larger food supply was secured, and the great stockbreeders wrought a change the effects of which were as far reaching as those of Watt and Arkwright.

Before however this scientific farming could become general it had to become known. Roads were undeveloped, people in one county could not know what was passing in another, there was no agricultural newspaper — no machinery to make this knowledge common property. Moreover with the inherent conservatism of the agricultural class it needs something more than mere knowledge to make a farmer change his ways.

The necessary diffusion of information was carried out largely by Arthur Young and the Board of Agriculture, while the stimulus of the great wars and the shortage in the food supply provided a powerful incentive for improvement by means of high prices. Moreover, the growth of the iron and coal trade had led to the cutting of canals, and internal communications of all kinds were improved. People could get about; great towns began to grow up, providing an ever increasing market for food stuffs. It therefore became more and more worth while to effect improvements, and scientific agriculture became a patriotic hobby. The King himself wrote articles for agricultural newspapers and the great agricultural meetings and cattle shows put a spirit of emulation into farmers.

The chief obstacle to betterment lay however in the fact that much of the land was owned by small farmers who simply had not the capital to get good stock, implements, seeds and manures. Moreover, the system of farming among the peasantry was that of farming in strips, each man having about thirty strips of land but no two lying together. These strips were separated from one another by turf balks, and after the hay and corn harvest had been gathered all the animals were turned indiscriminately over the open fields. The system was most wasteful. It was quite impossible to adopt improved methods of cultivation on half acre strips. No winter crops could be grown because the cattle ranged all over the fields from September to February. No improvements in breed could be carried out when good cattle were exposed to the infection of the mangy village herds with their foot and mouth disease. No drainage could be attempted since the outfall would be on some neighbor's strip. The loss of time involved in going from piece to piece, and in carting little bits of hay and corn from different places, to say nothing of the waste of numerous footpaths and the endless disputes over real or fancied encroachments, made the system one which in the interest of good farming it was highly desirable to displace. It was established by the Board of Agriculture that tenants lived comfortably on enclosed land rented at 10/6 an acre who had starved on open farms at 2/6 an acre and that enclosed land at 20/- an acre was cheaper than open land at 8/-.

The famine years of 1795, 1800 and 1801 made the prosperity of agriculture a pressing national question. Enclosures were pushed on rapidly, partly by the agreement of the parties concerned, but mainly by private Acts of Parliament. The general result was that the scattered strips were given up and each farmer received an equivalent in a compact little holding all in one place.

Between 1770 and 1799, 1,375 enclosure bills were passed, between 1800 and 1819, 1,700. Altogether it has been calculated that over 2,500,000 acres were affected by the Acts prior to 1801.

The result meant better farming, but it also involved great loss to the peasant and the laborer. The fees of the commissioners for redistributing the lands, the legal expenses of getting a private Act, the cost of hedging the new farm, all bore hardly on the yeoman. Even when he had survived the actual enclosure he found it hopeless to compete with the capitalist farmer. The stuff he could raise would not bring a remunerative price in competition with that of the large producers. He was moreover hard hit by the loss of the bye employments of spinning and weaving which were tending to become more and more factory industries. Many of the yeomen sold their little farms to large landowners who were only too anxious to throw them together into big ones in order to realize the high prices during the war period. Moreover the new men who were making their money in cotton were glad to buy land for the sake of social position. With an increasing struggle for existence on the one hand and the prospect of a good sale on the other the small farmers sold their holdings and disappeared. Those that held on were so hard hit by the great depression in agriculture after 1815 that they too were forced to succumb. Hence England between 1770–1815 became predominantly the land of the capitalist farmer.

The laborers, too, suffered considerably, since when the land was enclosed they lost many little perquisites such as turning out a cow on the waste or gathering fuel. But more important than all was the fact that the laborer lost the chance of rising in the world. The small farmer had ceased practically to exist and the laborers never could hope to get together capital enough to take a big farm.

But without the improvements of those years England could not have held out against Napoleon. She would simply have surrendered from famine when the Baltic corn was cut off.

The stimulus of the Corn Bounty Act started the agricultural revolution, the great wars completed it. The result was an enormous advance in farming but great social distress; the extinction of the peasant proprietor, but the ultimate safety of England.

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22 (c). **Great Britain — Agriculture.** *History.*— The close of the 18th century saw the English system of farming fully established, with its characteristic division of the landed interest into the three classes of landlord capitalists, tenant farmers, and laborers. Agricultural improvement had indeed made great strides during the 18th century, and in some parts of the country, as in Norfolk and Herts, the change from the old open field system to large enclosed farms had already been accomplished, but it was the high prices for food, prevailing at a time when the rapid growth of a manufacturing population coincided with the Napoleonic wars, which finally swept away the village-community style of farming and replaced it by the large tenant holdings as known to-day. The old system, while it supported a good many poor men on the land, was a very inefficient method of feeding the nation. The first condition of agricultural improvement was the investment of capital in the land, and the most economical way of doing it has proved to be to allow the landlord to use his money on the permanent amelioration of his property, leaving the whole of the tenant's resources free to be employed in his business of farming. It should perhaps be explained that on an ordinary Scotch or English estate, the landlord bears the cost of all the work which may be supposed to permanently increase the letting value of the farm. He, for example, erects all the buildings required by the tenant, and supplies the latter with timber and other materials for their repair; he finds wood and gates for fencing, tiles for draining; in many cases he even provides the fruit trees that are to be planted, and the seed for land that is to be laid down in permanent grass. The advantage of this system lies in the fact that the tenant's capital is kept in a liquid condition; he becomes a manufacturer of meal and corn, who hires land and buildings as tools in his business, and how well it has succeeded may be learned by comparing the results attained by British farming with those of other countries. In Great Britain the average yield of wheat for the last five years has been 31 bushels per acre, as against a world's average of about 12 bushels, a French average of 20, a United States average of 13; the only countries with a similar large yield being Germany and Belgium with 28 bushels per acre. A comparison of other crops would be even more favorable to Great Britain. The development of improved breeds of live stock and superior strains of crops, as will be recounted in a later section, has been made possible by the existence of a race of tenant farmers with both the means and the temperament to speculate in the development of their industry. The system has of course its drawbacks; it demands that the landlord should possess capital and some understanding of the agricultural situation; it lacks flexibility when a great economic change takes place like the fall in prices after 1876; it encourages too conservative a style of farming, for it checks the initiative of tenants by giving small security that they will reap the benefit of any increase in the value of the farm due to their improvements. Its intense individuality, from which so much has been gained in the past, becomes a drawback now that the farmers of a country are no longer competing with one another, but have to be organized to maintain their position in the common market of the world.

The agricultural history of the 19th century in Great Britain may be divided into four epochs, beginning with the period of inflated war prices which lasted up to 1810, during which time the great work of enclosing the common lands and forming large farms was practically completed. This was also a period of great activity in the improvement of farming; the foundations of most of the British breeds of live stock were then laid; machinery began to be applied to agriculture, and the reclamation of the wastes, practically the creation of good arable soil out of barren sands and intractable clays, proceeded with vigor. The value of marl on the light sands, and of chalk and lime upon the clays had long been known, but at this time such ameliorations were being carried out wholesale and with a thoroughness of which the British farmer is still reaping the benefit. There followed a period of 20 years of unexampled depression when the great break in prices, consequent on the end of the war, was aggravated by a succession of bad seasons. Little by little this depression was removed as the obligations incurred during the time of inflation became void, as the weaker farmers and small holders became squeezed out, and particularly as the consuming population in the manufacturing towns grew in number and wealth. The forty years from 1836 to 1876 may be described as the Golden Age of British farming. The making of the soil by marling, claying, chalking, etc., went on apace; something like 3,000,000 acres were tile-drained in England alone between 1830 and 1870; simultaneously also science and the industries put at the service of the farmer nearly all the modern range of fertilizers and feeding stuffs — guano, nitrate of soda, phosphates, and the oil cakes. The modern breeds of live stock became clearly defined, and had their herd and flock books established during this period, and amongst the best practitioners farming became a fine art attaining the polish characteristic of a well-kept garden. Rents rose steadily with the competition for farms among not only the farming classes but also the tradespeople of the country towns, who saw in agriculture the road to wealth and an easy life; indeed, on the great estates where the tradition was against rack-renting the sound farmers were realizing very considerable fortunes.

The crowning period of this prosperity was the time of the Franco-German war of 1870–72. By 1875 the depression was beginning to make itself felt. Freights were low and foreign imports, especially American, of grain, wool, cheese and butter were beginning to grow rapidly. A run of bad harvests had also set in, culminating in the black year of 1879, when the lowest cereal yields on record, due to continuous wet weather, coincided with an enormous crop and corresponding importations from the United States. From this time the yield of corn in England ceased to rule its price, which has in the main been set in Chicago. The great change that then came over agriculture would have been less fatal had its permanent character been recognized earlier; as it was, on very many estates rents were not lowered rapidly enough, with the result that the old tenants were ruined and new ones could only be attracted by comparatively enormous reductions. Up till 1894 the gloom was unrelieved, the prices of corn and wool dropped year by year, although wages were rising, nor were there any new factors in sight which promised a change for the better.

It was the arable land farmers who suffered the most, particularly the cultivators of heavy land in the eastern counties and the midlands, where the land was expensive to work and only profitable when wheat and beans made a good price. This land gradually got laid down to grass; much of it went wholly out of cultivation for a time and was only reclaimed again as grass land by a new race of farmers who got it almost rent free. The western side of the country, which had always been in the main devoted to grazing and dairying and where rents had never been excessive, suffered comparatively little, nor did the highly farmed Lothians show the same fall in rents as the arable lands farther south. The change which came over the farming of the country may be seen in the acreage under wheat, which from 3,600,000 acres in 1874, fell to 2,500,000 acres in 1885, and 1,400,000 in 1904; at the same time the area under permanent grass increased about 4,000,000 acres.

Since 1894 the drop in prices has been arrested, and an upward turn has manifested itself for nearly all the products of the farmer, meat only excepted. At the same time, a new race of farmers has grown up, who have discovered methods and openings by which a living may still be made out of the land. But though the agricultural situation may now be said to be comparatively stable and even improving, it is still full of difficulties. The British farmer is now competing with every country that has any agricultural produce to sell; the British market is the one open market of the world, and the price of any commodity is fixed by whichever country has a great surplus crop in that year. The proximity of the town, while it creates a market for certain products, also increases the farmer's expenses; in the end the manufacturing industries set the standard of wages and draw off the energetic and the able among the laborers. At the same time the farmer has to conform to the urban standard of life; he has to pay for roads, sanitation, and education of a style unknown to his competitors in a primitive country. Again, as a capitalist, he expects a return for the money he has invested in his business, whereas his competitors are, in most cases, content if they extract a living out of their labor, without taking into account the capital they have accumulated on their small holdings. Even the proximity to the great population, which ought to be the saving factor, is nullified by high internal railway rates, which compare unfavorably with the assisted freights of most competing countries.

During the period we have under review the British tenant farmer may be credited with two characteristic steps forward; the perfecting of a system of high farming and the fixing and improvement of a number of races of live stock. As regards the first matter — high farming — three contributing factors may be noticed. Owing to the changeable climate and the diversity of the soils the preparation of the land for crops has always required some nicety in management, and the British farmer in virtue of his long experience became something of an artist in the treatment of his soil. And though since prices have fallen some of his practices are no longer very remunerative, however desirable from the point of view of securing the "best" even if not the most paying crop, yet British farmers are still in the main more skilful than those in any other country, as far as the actual cultivation of the soil goes. Secondly, the British farmer early learnt the value of a good rotation of crops, which should not only provide something to sell, but which would also furnish a continual supply of food for his stock. Though turnips, clovers and other artificial grasses were well known in England before 1700, it was not until the 18th century was nearing its close that their employment had been organized into such rotations as we know to-day. The British farmer was also the first to appreciate the possibilities which artificial manures put at his disposal; and the early exportations of guano, nitrate of soda, bones, etc., were in the main to the United Kingdom: Liebig even denounced England in no measured terms for her greed and wastefulness in drawing bones from all other civilized countries, and then squandering the phosphoric acid thus obtained by letting her sewage run into the sea. With the more intensive farming, due to better cultivation and the addition of manures, came improvements in the varieties of seed sown, mode of progress taken up with great energy both by individuals and certain firms of seedsmen. Though the results are not so noteworthy as in the case of live stock, yet most of the heavier yielding varieties, both of corn and of green crops, are of British origin, *e. g.* the "Squarehead" wheats, the "Chevalier" type of barley, the "drumhead" cabbage, all of which are widely spread over the world. Progress in all these directions made British farming the general model up to 1870 or so, and how real the superiority was, may be judged from the table in which the yields per acre in Great

	Yield per Acre, Mean, 1901-05.			
	Wheat, Bush.	Barley, Bush.	Oats, Bush.	Potatoes, Tons.
Great Britain....	30.7	32.6	39.3	5.9
France	10.4	22.4	27.2	3.2
Germany	28.2	33.2	38.7	5.3
United States....	13.2	26.5	31.2	2.2

Britain are compared with the corresponding figures for France, Germany and the United States. Had the same comparison been made twenty-five or thirty years earlier the superiority of the United Kingdom would have been still more manifest, for while it has been reducing expenses to meet the depression in prices, the other countries have been working up to its level.

Live Stock.— But the special excellence of the British farmer has been his success in improving and fixing certain breeds of live stock, which have now become the standard breeds all the world over. Up to the middle of the 18th century there were a number of types of cattle and sheep to be found in the different districts of the British Isles, as in any other old farming country; but these types were ill-defined and there was no common or conscious action toward fixing them in any desirable direction. Robert Bakewell, of Dishley (1725–1795), working on Leicester sheep and Longhorn cattle, first showed how a breed could be improved and fixed. Bakewell aimed at an animal which would mature earlier and would put on its increase in the most profitable places. Carrying a type in his mind, he selected a number of animals approximating to his ideal and bred only from them; then by a period of close inbreeding among such of the progeny as conformed to the type, he was able both to advance rapidly in the desired direction and also to eliminate a good deal of the tendency to fall back toward the old unimproved class of animal. At the same time it was found that this close inbreeding resulted in sires which had great power of stamping their character on their offspring, even when the dam is of a different or common strain. Thus Bakewell's Leicester sheep have been employed to give quality to almost all the other local races, and there are nowadays few breeds of sheep in existence who do not possess a strain of Leicester blood in them. Bakewell's Longhorns have not had a like success, but the same principles were applied to the native cattle of Teesdale, the Durhams or "Shorthorns" by the brothers Colling, who died in 1820 and 1836, respectively. Their work, continued by the Booths and by Bates, resulted in the modern Shorthorn, the typical beef-producing cattle of the world, with which, in the main, all the newer countries have been stocked.

The same progress was applied to other local breeds of cattle; the Herefords and the Devons in England, and the Aberdeen Angus in Scotland, have in the same way attained to far more than a local reputation, as also have several of the breeds of sheep, like the Southdowns or the Lincolns. Notwithstanding the existence in all old-settled countries of indigenous races, stock of British breeds are to be found all over the continent, either kept pure or more generally used for grading up the local type; while in the newer countries, which have become the great food producers of the world, none but breeds of British origin are to be found, with the exception of the Frisian or Holstein cattle, the Merino sheep and the Percheron horse. And the United Kingdom remains the great fountain from which these countries find it necessary to replenish their breeding stock, so that the production of pedigree animals of high quality continues to be one of the most lucrative items in British farming.

Agricultural Districts.— Farming, at the present time, has become by force of circumstances a highly specialized business, showing great adaptation to the diversities of soil, climate and markets in the British Islands. To review the condition of the industry it will then be necessary to consider the country, district by district. Beginning with the southeastern counties; Kent, Sussex, Surrey, and Hampshire form a fairly defined area, possessing in general a warm and dry climate. Here, but particularly in Kent, may be found the greatest development of market-gardening, fruit growing, hop cultivation, and other similar highly intensive forms of farming. As far as regards the production of very early crops this district cannot compete with the Channel Islands or Cornwall, but as main crops the standard green vegetables are grown in great breadths. This district is also noted for its hardy fruit growing; near Southampton on one hand and later in North Kent the greater part of the strawberries for London are produced. The best cherries have long been a special feature of East Kent, which country is also the largest producer of plums, apples, currants, and nuts. East Kent from Canterbury to Rochester, and the Medway Valley to Tonbridge, show without doubt the best kept orchards in the country. Hop cultivation is also another leading feature of this district; no other farming industry is carried on so intensively or spends more on labor during the growth of the crop. The best of the hops march with the fruit in East and Mid Kent, but Sussex is also a large grower, as also is a belt of rich land stretching from Farnham in Surrey as far as Petersfield in Hampshire. The district under review has not perhaps the same reputation for general farming as it has for fruit and hops; it possesses, however, several distinct and valuable races of stock. The Southdown sheep are natives of the open chalk downs of Sussex; small, fine-wooled, and models of symmetry, they have been extensively used for improving the mutton of other breeds and form a great element in the foundation of such breeds as the Hampshire and Oxford Downs, the Shropshires and the Suffolks. Kent possesses in the "Romney Marsh" sheep one of the older breeds of the country; big, hardy, and long-wooled, which have lately proved valuable for crossbreeding in all parts of the world. The Hampshire Downs constitute a large framed, rapidly-growing breed that has been formed from a local coarse sheep by crossing with the Southdown. It exists in large numbers on the light arable lands of the great chalk area of which Hampshire forms the centre. Sussex also possesses a local breed of cattle; a horned, all-red, typically beef-producing breed, which has not spread greatly beyond its proper borders. Hampshire passes insensibly into the West Country — Wiltshire, Dorset, Somerset, Devon, and Cornwall — a typical stock district, showing less and less arable land toward the west. This is one of the chief dairying countries, milk being sent to London; while Somerset, in particular, is the original home of the "Cheddar" cheese, the typical cheese turned out nowadays on such a large scale in the United States and Canada. The cattle are mainly Shorthorns, though Devon possesses a dairy breed of its own, the South Hams, which have been raised from the true Devons by an infusion of Guernsey blood. The true Devons are an all-red, beef-producing breed, doubtless of common origin with the Sussex, but which has gone all over the world as among the thriftiest and most profitable of grazers. The Dorset horned sheep are characteristic of this area, a short-wooled, horned breed valuable for the production of early lambs. Somerset and Devon are also great apple-growing counties, though the fruit does not receive the care which is to be found in Kent, and much of the product is only useful for cider-making. The southwest of Cornwall possesses an extremely mild climate, frosts being few and of no great severity; it has therefore become an important market-gardening district for the production of the earliest green vegetables and potatoes. The Channel Islands share the same advantages of climate, and, thanks to the skill and industry of their inhabitants, form perhaps the most prosperous agricultural community in the Kingdom. The land is divided into small holdings and is highly rented, but the farming is intensive and the crops valuable. In Jersey early potatoes, followed by green vegetables, form the staple crops: in Guernsey there has been a great development of farming under glass; cucumbers, tomatoes, grapes, early beans and flowers being the chief products. Each island possesses a special, though closely-related, breed of cattle, which by law has been kept pure and unmixed from any foreign blood for more than a century. These Channel Island breeds represent the descendants of an original Celtic race of cattle and are distinguished by the tendency to a yellow skin and black hair; they are small in frame, and produce large quantities of milk far richer in butter than that of any other breed. The Jerseys, in particular, have been largely exported to America as milk and butter producers.

The West Country shades off into the west Midlands — Gloucester, Hereford and Worcester, counties growing much hardy fruit and typical producers of cider. Here also is situated the other hop-growing area in the British Islands, the acreage under hops in the valley of the Teme and its tributaries tending to increase, while it diminishes in the southeast. This district is the original home of the Hereford cattle, red with white faces, which have become one of the great cosmopolitan races, famous all the world over as hardy stock fattening readily upon grass.

The Midlands proper are almost wholly laid down to grass; the broad belt of strong pastures lying on the Lias and other Jurassic clays, and stretching from Devon to Yorkshire, forms the great milk and meat-producing area of England. The cattle are mainly Shorthorns, as being valuable for both meat and milk, but many Herefords, Galloways and Welsh black cattle will also be found fattening on the richer pastures. While these Midland pastures largely send new milk into the great towns, a good deal of cheese is made, the best known variety being the "Stilton," which is as typical of the English soft-curd cheeses as "Cheddar" is of the hard curd. Eastward the land comes more under the plow, Essex, Suffolk, Norfolk and Lincoln being typical arable counties. Lincoln possesses a large area of "warp" land composed entirely of alluvial sediment, and this, of great fertility for all purposes, is very largely given up to the growth of potatoes. On the strong soils of Essex and Suffolk the best English wheat is grown, wheat being still a profitable crop in this district; while Suffolk and Norfolk enjoy a great reputation for the growth of high-class malting barley. These counties are still, though not to the same extent as formerly, great centres of stall-feeding of cattle. Welsh "Runts," Shorthorns, and Aberdeen Angus stores are brought in and rapidly fattened on the turnips drawn from the arable land. Norfolk possesses a native breed in the Red-Polled cattle, valuable for both their flesh and their milk-producing powers, and which are rapidly establishing a reputation outside of England. In Suffolk also is to be found a special breed of heavy horse, the Suffolk Punch, a compact, thick-set animal of great value for farm work. All the low-lying country forms a fine breeding ground for horses, which is one of the staple industries of the eastern counties. The fen country indeed is the original home of the typical English "great" horse, the Shire horse, the most powerful animal of its kind in the world, particularly adapted to heavy work in cities. Bay, brown, and black are the commonest colors, and the feet and legs are heavily feathered with white hair; the breed probably owes its origin to an influx of Flemish blood into the old English draught horse. Lincoln also possesses the chief of the English long-wooled races of sheep; heavy, rapid-growing animals, with a great fleece of long slightly lustrous wool. The Lincolns have been exported in large numbers to Australia, New Zealand and the Argentine for crossing with the Merino to yield a sheep equally valuable for both mutton and wool.

Turning to the west again, Wales is a country almost wholly in permanent grass; dairying and the raising of store cattle to be fattened in the midlands and east of England being the prevailing industries. The Welsh black cattle are good milkers, and, in addition, have long been esteemed, under the name of "Welsh Runts," as hardy, thrifty grazing cattle, producing beef of high quality. Like all mountainous countries, Wales has a race of hill sheep, but on the lower lands, and especially in the border counties, the "Shropshire" breed will most commonly be seen. The Shropshire sheep is a short-wooled, small-framed animal, rather larger and hardier than a Southdown, but otherwise fulfilling the same purposes, as a symmetrical, rapidly growing sheep, producing mutton of the highest quality upon grass land and the lower hill pastures. On the Welsh borders also is to be found one of the native breeds of hill ponies, very slightly different from the two other breeds living upon Exmoor and in the New Forest, but quite distinct from the Shetland ponies, which are doubtless of Scandinavian origin.

Yorkshire provides perhaps the most varied farming in England; on the one hand there is the rich warpland adjoining the Humber, and the elevated arable sheep-farming land of the Wolds, then the highly-farmed general purpose land of the central plain which merges into the upland sheep walks of the limestone country in the northeast. Horse breeding, stock raising and dairying are the mainstays of Yorkshire farming, and though no breeds of great note are associated with Yorkshire, except the white Yorkshire pigs and the Cleveland Bay Coach horse, it should not be forgotten that the original home of the Shorthorn was just as much the North Riding of Yorkshire as the Durham Tees-side, with which their name is always associated.

In the Northern Counties generally may be seen some of the best arable farming in England; a four-course rotation is generally followed, the foundation of the whole system being a good crop of Swede turnips, part of which are fed on the land to sheep, part carted off for fattening stock in the yards. Barley is the money-making crop in the rotation, oats being the other cereal usually grown. The typical cattle of all this district are Shorthorns; in Cumberland, which is more of a grazing country, they are of the milking type, the beef strains predominating in the eastern side. The sheep are the Cheviot breed for the hill pastures, and the Border Leicester, which was originally produced by crossing the Cheviots with Bakewell's Leicester breed.

Scotland and Ireland.— Crossing the border in the Lothians of Scotland will be found the most highly-farmed general-purpose arable land in the British Isles. Here the management of the land, the utilization of labor-saving machinery, and the application of skill to intensive cultivation, reach a higher pitch than anywhere else in the world. The cropping is much the same as that of the other northern counties, but potatoes form the most remunerative crop; in the famous Dunbar district they are often sold standing in the field for £30 per acre.

The southwest of Scotland is preëminently a grazing district; it is the home of two of the most distinct breeds of cattle, the Ayrshire, a typical dairy cow, yielding milk particularly suited for cheesemaking, and the Galloway, a polled black animal, characterized by its great hardiness and the fine quality of its beef. For generations the Galloways, either pure, or in the well-known "blue gray" cross, have been exported to be fattened in the Midlands and east of England. The more northern counties of Scotland naturally, in the main, consist of grazing land. They have their typical race of Highland cattle and also carry the Scotch blackfaced sheep, both slowly-maturing hardy breeds, producing meat of high quality. The eastern counties, particularly Aberdeen, show some highly-farmed arable land, noted for the magnitude and high quality of its turnip crops, on which the cattle are stall-fed through the winter. For this purpose another race of cattle, now of cosmopolitan distribution, has been evolved, the polled black Aberdeen-Angus, massive animals noted for their rapid growth, symmetry, and quality of flesh.

Irish agriculture is of two classes; on the one hand there exists, especially in the west, a great number of small holdings, worked entirely by the single family, producing potatoes for home consumption and a little oats for sale, in addition to the milk or butter from a few cows on the rough grazing attached to the holding. The farming of these peasant proprietors is naturally of a primitive character, but the efforts of the Irish Co-operative Organization Society and later of the Irish Board of Agriculture have, during the last ten years, done much to ameliorate the conditions under which they are working, particularly by the introduction of co-operative creameries. The Irish peasant farmer has quickly learnt to work on co-operative principles, so that the movement toward co-operation, which has been headed by Sir Horace Plunkett, has enormously improved the character of Irish butter, a staple article in the English market, and must have nearly doubled the returns to the producer. On the other hand, Ireland possesses large farms of the richest grazing land on which are bred great numbers of store cattle of the Shorthorn breed for the English market, as well as light horses of the best strain, wholly or nearly thoroughbred. The high quality of the pastures give these animals a foundation of bone and vigor of constitution which makes them respond freely to richer conditions in later life.

Science and Education.—Any survey of British farming for the last century would be incomplete if it did not take some account of the scientific and intellectual resources which have been at the service of the British farmer. Of these the Rothamsted Experiments form the main, practically the only, British contribution to the world's stock of agricultural science. The foundation of these field experiments dates back to 1843, in which year J. B. Lawes, a Hertfordshire landowner, obtained the co-operation of J. H. Gilbert to carry out experiments upon field crops upon his own estate. This partnership in investigation lasted for nearly sixty years, the continuity of the work being secured by a Trust founded and endowed by Lawes. The main feature of the Rothamsted investigations has been field experiments with the various farm crops, conducted on a large scale and over a great period of time, and to them the farming community owes its knowledge of the principles of the nutrition of our domesticated plants. Rothamsted was the forerunner of the many agricultural experimental stations which have been created in other countries; the first German Station at Möckern dates from 1852, the first American station at Middletown, Conn., having been founded in 1875. It is noteworthy that though agricultural research has in every country become the business of the State, Rothamsted remains the only institution of its kind in the British Islands and enjoys no assistance from public funds.

From about the same period as the foundation of the Rothamsted Experiments, dates the establishment of the Royal Agricultural Society, which, by its institution of national agricultural shows held year by year in different parts of the country, has done much to foster the improvement of English live stock. For a long time also this society by its 'Journal,' by its appointment of consulting scientific advisers, by undertaking analyses for its members, was a great educational factor in the country, but the work of the society in this direction has of late years been largely taken over by other and more widespread agencies, while the society has no longer found fresh pioneer work to do but has more and more confined its energies to its annual show.

Agricultural education in Great Britain was for a long time restricted to private enterprise, the Royal Agricultural College at Cirencester being the first, and for a long time, the only institution giving a systematic training in agricultural science. Edinburgh was the first university to give any instruction in agriculture, until in 1890 the allocation of certain excise revenues for technical instruction enabled the country generally to make a start with agricultural education. The last decade has in consequence seen the establishment of a number of schools and colleges for agricultural instruction, so that at the present time practically the whole country is in touch with some institution of secondary or university type, which, as a rule, aims both at educating the future farmer and at providing expert assistance for the current generation.

Summary.— From this brief survey it will be seen that the characteristic feature of British farming has been its individuality; its great advances have been made by individuals; its good qualities and its visible weakness are alike the result of solitary work and internal competition. Despite the apparent diversity of their interests landlord and tenant have, in the main, pulled together; the landlord has always been the spokesman and has represented agriculture in the legislature. But there the farming interest has been wholly ineffective; the State has never recognized any responsibilities toward the industry, either in the way of protection against competition or in the provision of intelligence or education.

Whether this policy will continue to answer in the face of the State-trained and State-directed competition for the English market of all the other agricultural communities, will be settled during the coming generation; it may then turn out that the much belauded "principle" of *laissez faire* is but a cloak for lack of knowledge and slackness in the governing class.

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23. Great Britain—Fisheries. The great extent of seaboard in proportion to the area of the United Kingdom combines with the wealth of the surrounding seas in food fishes to render the fisheries a very important branch of British industry, as may be seen from the following table compiled from the returns for 1904.

—	Regular Fishermen Employed			Fishermen Occasionally Employed			Total
	In Trawling (except for Shrimps)	In other modes of Fishing	Total	In Trawling (except for Shrimps)	In other modes of Fishing	Total	
England and Wales	16,499	16,870	33,369	1,396	7,245	8,641	42,010
Scotland	2,379	25,560	27,939	59	10,061	10,120	38,059
Ireland	1,315	7,105	8,420	291	17,770	18,061	26,481
Isle of Man	128	497	625	....	231	231	856
Channel Islands	100	410	510	25	167	192	702
Total	20,421	50,442	70,863	1,771	35,474	37,245	108,108

This table does not include the persons engaged in the secondary occupations connected with fishing, such as boat-builders, coopers, packers, curers, net-makers, etc. These were estimated in 1904 to number 48,562 in Scotland alone; if the ratio may be assumed to be the same in the other parts of the United Kingdom, the total number of persons deriving a livelihood from the sea fishing industry, exclusive of salmon fishing, cannot be far short of a quarter of a million.

The total weight and value of fish (not including salmon) landed in the United Kingdom during 1904 is shown in the following table:

	England and Wales	Scotland	Ireland	United Kingdom
	cwts.	cwts.	cwts.	cwts.
Wet fish { weight	11,3[illegible]5,484	7,947,829	951,836	20,264,749
Wet fish { value	£[illegible]	£2,231,102	£344,154	£9,065,180
Shell fish, value	£[illegible]09,063	£76,800	£49,476	£416,339
Total value	£[illegible]	£2,307,902	£393,63[illegible]	£9,481,519

This result, which may be taken as being above the average of recent years in weight, but considerably below the average aggregate value, was attained by the employment of 26,074 vessels and boats, of which 8,962 were registered in English ports, with an aggregate tonnage of 162,431; 10,891 in Scottish ports, aggregating 140,396 tons; and 6,221 in Irish ports, of which the total tonnage is not recorded.

A notable change in the character of the British fishing fleet has been in progress during recent years, owing to the substitution of steam for sailing power. The result has been a great extension in the fishing grounds. The North Sea, of course, remains a most productive source of supply, and five-sixths of the steam trawlers working there are British. Thus in 1904, while foreign steam trawlers registered at North Sea ports numbered 202, there were 1,282 registered at English and Scottish North Sea ports. But, outside the North Sea, powerful steam trawlers and liners from the east coast of England and Scotland now carry on their operations off Iceland and the Faroe Islands, in the Bay of Biscay, and off the coast of Portugal. In 1904 a new trawling ground in 70 fathoms was opened off the coast of Morocco. Much of the catch in these distant waters never finds its way into the British market, and consequently does not figure in the returns above quoted. "For instance, one English trawler fishing off the French coast, near Brest, in 70 fathoms, too 300 kits of fish, which, in the Lisbon Market, some 600 miles distant, realized £444. On the next day the same vessel commenced fishing off Cape Finisterre, in 120 fathoms, and in four days returned to Lisbon, and sold some 200 kits for £378." *

The rapidity with which steam is taking the place of sails in the larger English and Scottish boats may be seen by comparing the statistics of different years:

England and Wales	1[illegible]		1904	
	Steam	Sailing	Steam	Sailing
First class boats....	564	3,270	1,4[illegible]8	1,755
Second class boats..	2	4,099	1[illegible]	4,2[illegible]5

Scotland	18[illegible]		1904	
	Steam	Sailing	Steam	Sailing
All classes..... ...	158	12,940	474	10,417

* Board of Agriculture and Fisheries: *Report* 1904, p. xxii.

In Ireland, out of a total of 6,221 vessels actually engaged in sea-fishing during 1904, there were only one steam beam trawler, and nine steam otter trawlers against 168 sailing boats employed in the first and 255 in the second method of fishing. There were no steam line fishers.

Steam power, at first employed only in trawling vessels, is becoming annually more common in drift net and long line fishing. Drift nets are employed for the capture of herrings, mackerel and pilchard, of which the relative importance as articles of food and commerce may be inferred from the quantities of each landed in British and Irish ports during the year 1904:

	England and Wales	Scotland	Ireland	United Kingdom	Total value
	cwts.	cwts.	cwts.	cwts.	
Herring	3,196,303	5,4[illegible]2,4[illegible]4	[illegible]86,49[illegible]	8,918,293	£1,870,[illegible]10
Mackerel	518,569	16,49[illegible]	502,501	1,037,563	417,070
Pilchard.	175,552	....	....	175,552	47,450

The development of mackerel fishing on the west coast of Scotland has been retarded hitherto owing to want of curing stations. Thus in September 1904, one boat landed 60 crans of fine mackerel at Kyle of Lochalsh, of which 40 crans were sold fresh at 8s. a cran, and 20 crans had to be thrown overboard because there was no means of curing them. A cran of mackerel contains an average of about 400 fish.

While the local herring fishery is actively pursued from almost every creek approached by the fish, powerful boats from Yarmouth, Lowestoft, Grimsby, and 10 other principal English ports, and from Eyemouth, Leith, Fraserburgh, Buckie, and 14 other Scottish ports seek out the most productive waters irrespective of vicinity or distance. In this respect, men of the east coast are far more enterprising than those of the west, owing, no doubt, in great measure to their proximity to the excellent fishing grounds in the North Sea; but it appears that, of the three main races contributing to British ethnology, men of Anglo-Saxon and Scandinavian descent take more readily to maritime pursuits than do the Celts. A considerable portion of the fish landed on the west coast of Britain and in Ireland are taken by east coast fishermen; and those places on the west coast where the local industry is most active, such as Stornoway in Lewis and Peel in the Isle of Man, and Morecambe Bay in Lancashire, remained long under Norse dominion, and contain a strong Norse element in the population. Roughly speaking, the Saxon and Scandinavian blood is stronger in the east, the Celtic in the west, throughout Great Britain, which may account in some measure, at least, for the great disparity in fishing enterprise among the local population on the respective coasts.

The British export trade in cured herrings is very large, amounting to 2,543,873 barrels in 1904. Germany and Russia have long been the chief customers. Notwithstanding that the German import duty is 3s. per barrel, and the Russian 13s. per barrel, the number of barrels consigned to Germany in 1904 was 1,649,144, valued at £1,656,921, and to Russia 526,050, valued at £547,417, being together upwards of four-fifths of the whole export. About 50 per cent of the herrings landed in Germany are sent over the frontier into Russia. The United States took 57,291 barrels in 1904, valued at £104,883, and that country is the principal importer of pickled mackerel from the Irish fisheries.

Pilchards, which are taken only on the south and southwest coast of England, find their best market in Italy, which in 1904 took 18,381 hogsheads, valued at £53,953, out of a total export of 19,272 hogsheads. It requires from 560 to 600 lbs. of cured pilchards to fill a hogshead.

It is a singular fact that, notwithstanding the large export trade in fish from the United Kingdom, amounting in 1904 to the total value (including salmon) of £3,555,066, the total imports go far to balance it, amounting in the same year to the value of £3,332,656, of which cured and salted fish to the value of £925,793 was re-exported.

Next to drift net and trawl fishing, the chief branch of sea-fishing is conducted by long lines. The relative importance of these different methods varies very much in the three Kingdoms. Thus in England, out of 33,369 *regular* fishermen, 16,499 are employed in trawling (not including shrimp trawlers); whereas in Scotland only 8 per cent. and in Ireland only 15 per cent of regular fishermen were so employed. Considerable friction has arisen in the past between trawlers and line-fishers, owing to the destruction of lines laid upon ground over which trawlers worked. Deeming it undesirable that the more ancient and local industry of line-fishing, often pursued by men of humble means, should be sacrificed to the interest of persons of capital and residing at a distance from the fishing grounds, and also actuated by a desire to prevent the destruction of undersized fish within favorable nursery grounds, Parliament has conferred powers upon the Fishery Boards of the three Kingdoms to schedule certain areas within which trawling is prohibited. But, whereas the territorial waters of Great Britain and Ireland are circumscribed by a line drawn at a distance of three miles from the nearest coast, which line passes within parts of some of the prohibited areas, such as the Moray Firth, the jurisdiction of British courts cannot apply to foreign trawlers working in such areas, provided they keep outside the three-mile limit. Consequently, fish may be and are taken by foreign trawlers upon ground closed to British trawlers by the act of their own legislature; and such fish may be landed in British ports to the natural indignation of those fishermen upon whom the prohibition is effective. Meanwhile, disinterested scientific opinion remains sharply divided upon the question whether the protection of these areas has any appreciable effect upon the general stock of fish in the adjacent seas, though it is undoubtedly in favor of the line fishermen, to whom the prohibition does not apply.

The fish taken by trawl and line are technically divided into round and flat fish: the principal round fish being haddock, cod, ling, whitings, saithe, torsk, conger eels, gurnards, catfish, anglers and hake; the principal flat fish being flounders, plaice, brill, halibut, soles, lemon soles, turbot. The English and Irish fishery returns do not show the amount of the total catch of these fish taken by trawl and line respectively, but the proportion in Scottish waters is indicated in the following table for 1904:

	Line		Trawl		Total	
	cwts.		cwts.		cwts.	
Round fish	628,8[illegible]8	£279,428	1,520,949	£618,687	2,140,847	£8[illegible]8,115
Flat fish	120,211	80,703	130,709	[illegible]21,212	300,920	301,915
Unclassified (skate, squid, etc., the squid being taken in nets)	4,631	1,054	1,910	425	6,541	1,480
	753,741	£370,185	1,703,568	£840,334	2,447,308	£1,201,519

The importance of the fishing industry as a nursery and reserve of practised seamen can hardly be overrated in a maritime nation, nor is it to be feared that the steady displacement of sails by steam in the fishing fleet will impair its value in that respect. The same qualities of mind and body which distinguished seafaring men of the old school are those which best fit their descendants for handling and managing modern warships and trading vessels; and the greater distance from port at which the more powerful class of vessel now employed enables men to follow their calling, requires competent knowledge of navigation as well as skill in seamanship. Upon the social system of regular fishing communities the effect of the change is considerable.

"Fishing," wrote Professor Mackintosh about the Scottish fishers of the east coast, "was to be carried out no longer by more or less independent crews, bound together by blood relationship or other ties, and whose working hours were largely regulated by the weather and tides, or their own convenience and necessities. Yet their whole domestic life was interwoven with the time-honored pursuit. Their wives and daughters laboriously baited the hooks and arranged the lines in the baskets for 'shooting'; they gathered the bent-grass for separating the layers of the line, and, with the sons, dug lob-worms or procured the mussels for bait. . . Now (1883) active and powerful vessels, propelled by steam, and thus more or less independent of weather, manned by a captain responsible to owners or their manager, a crew bound together only by discipline and pay, and whose fishing apparatus required no bait, appeared on the field. . . . Capitalists took up the question, and fitted out powerful ships in both England and Scotland, and sent them into Scottish waters, so that liners met with most formidable rivals." *

The stern realities of their calling have imparted a gravity of demeanor upon the class of sea fishermen on all parts of the coast; statistics, were it possible to obtain them, would probably reveal them as among the most orderly and law-abiding of the community. Among the fish-wives of Newhaven and Musselburgh is preserved almost, if not quite, the sole survival of national costume. The short, heavy-pleated, dark skirt, the woollen hose and serviceable shoes, the striped "bed-gown" or blouse, and the thick pilot coat are probably identical in form and material with those which Queen Mary may have seen on landing at Leith in August 1561. In those days, and for long afterward, the fish-wives used to trudge up to Edinburgh market, with the heavy "creel" on their backs supported by the leathern band across the forehead. They come up by cheap trains nowadays, but their presence in the streets in their picturesque dress and archaic equipment affords a welcome note of local color in the monotonous uniformity of a modern metropolis.

Notwithstanding this severe competition, the line-fisher's industry continues to be fairly remunerative. In the 'Official Report' of the International Fisheries Exhibition, 1884, the late W. Spencer Walpole, Inspector of Fisheries, combated the idea that the average fisherman's lot is harder or his earnings smaller than that of agricultural laborers. "I do not think," said he, "that anyone who has any acquaintance with the fishing community will endorse that statement. If you examine an ordinary fisherman's dress, you will find it warmer and more costly than the laborer's . . . he consumes a larger proportion of animal food than the laborer. . . . You will find rows of cottages not merely occupied, but owned, by fishermen, built or purchased out of the profits of the fisheries. . . . Many of them own their own nets and lines, and some of them have a share in the boats in which they sail. . . . Many of the masters are boat owners, with £250 to £1,500 of capital, who have begun their lives as ordinary fishermen." If steam has invaded the industry of local fishermen on the one hand, it has extended his opportunities on the other by giving him access to more distant markets.

Commercially the salmon fisheries of the United Kingdom are of considerable value, but the nature of that industry is not such as to affect the character of the population in different localities in such a marked manner as do the seafisheries. Some idea of the extent of the fishery may be had from the consignments of fresh salmon to Billingsgate (London) market. These have averaged annually during the eight seasons, 1896–1903:

English and Welsh	1,435 boxes
Scottish	13,117 "
Irish	4,2[illegible]2 "
Total average	1[illegible],[illegible]14 b[illegible]xes

Each of these boxes weigh about one hundredweight.

There remains to be noticed the institution in British water of a new branch of the fishing industry, technically, so called, although the object of pursuit is not a fish, but a mammal. Previous to the invention some twenty years ago of the bomb-harpoon, the mighty rorqual or finner whale, which abounds in the North Atlantic, was too powerful a quarry for whalers to attack. Now, however, steam whalers armed with this formidable artillery, are sent regularly in pursuit of rorqual, and during the present century three whale fisheries have been established by Norwegian companies in the Shetland Islands.

Bibliography.—'Annual Reports' of the Board of Agriculture and Fisheries (England), the Fishery Board for Scotland, and Department of Agriculture and Technical Instruction for Ireland; 'The Resources of the Sea,' by Prof. W. C. McIntosh, F. R. S. (in which the idea that steam trawling is unduly injurious to the general fishing industry is warmly denied) (1899); 'Official Report,' International Fisheries Exhibition (1884), containing a vast amount of detailed description of the various modes of fishing and kinds of gear; 'British Fisheries, their Administration and Problems,' by James Johnstone (1905); 'Sea and Coast Fishing,' by P. G. Aflalo (1901), dealing with the sporting aspect of sea-fishing; 'Report' of the Royal Commission on trawling (1878).

Herbert Eustace Maxwell,
Lord Lieutenant of Wigtownshire; President of the Society of Antiquaries of Scotland; Author of 'British Fresh-Water Fisheries,' etc.

24. Great Britain — The Mining Industry. When it is considered that mining enterprise in Great Britain and Ireland accounts, at the present time for the employment of no less than 974,634 persons directly engaged in the production of 249,021,651 tons of minerals estimated to be worth, at the mines and quarries from which they are drawn, the sum of £97,477,639, the vastness of the industry, and its effect on the economic life of the country will perhaps be more fully realized than by the recital of detailed descriptions of the various branches of mining. Indeed it may be said that the wealth of Britain is mainly due to the unique position, mineralogically, that it occupies relatively to other nations; for no country contains, proportionately to its area, so great or so varied a store of mineral wealth.

Mining in the United Kingdom is usually treated as coming within one of two categories,* viz.:[1] metalliferous mines, and[2] those which are governed by the Coal Mines Regulation Act, the latter comprising chiefly coal and stratified ironstone mines, and being by far the

* 'The Resources of the Sea,' by Prof. Mackintosh (1899).

* For reference see end of article.

most extensive and important section, though a development of later growth, having expanded through seven centuries to what, as judged by some, is believed to be its zenith.

Of the metalliferous deposits[3] mined in the United Kingdom, the most important are, and have always been, the ores of tin, copper, lead and iron. Native silver has never been worked, and it is doubtful whether it occurs in Britain or Ireland, although Strabo writing about 19 A.D. mentions silver as well as gold as being among its products.[4] Tacitus also makes reference to it indirectly.[5] Gold is very sparsely disseminated, occurring in mineral veins, found chiefly in Merionethshire[6] (North Wales), Lanarkshire (Leadhills, Scotland) and Cornwall; and in some alluvial deposits in Sutherlandshire (Scotland) and Wicklow (Ireland).

Probably the earliest mining on commercial lines in Britain was that of tin. The "cassiterides,"[7] whence the Phœnicians obtained their British tin, were, in all probability what are now known as Scilly, the Channel Islands, and, more particularly, Cornwall. The industry is and always has been restricted to Cornwall and, to a very small extent, to the contiguous part of Devon, and as early as 60 B.C. we find Diodorous Siculus describing the tin trade of these parts. In the early years of the 19th century (1817) Cornwall was the chief source of production of the world's supply of tin, now it stands fifth on the list of tin producing countries, contributing only 4.7 per cent of the total production.

What has been written of tin is also largely true of copper. Carew[8] said, writing about 1600, that he could not find that it was being profitably worked in the west of England, yet nearly two centuries later, the production[9] (during the dicennial period 1766–1775) was abnormally large, and as late as 1888 we find no less an authority than the late Mr. D. C. Davies[10] stating that *for their size* the British Islands constitute the greatest copper producing country of the world, but the production has greatly dwindled since the time he wrote. Cornwall and Anglesea are the chief copper bearing districts in the kingdom, and very remarkable profits have, in times past, been derived from some of the mines.[11]

The production of lead far exceeds that of tin and copper,[12] and as in the case of tin and copper, signs of a revival are not wanting, still, it is very doubtful whether this branch of mining in the United Kingdom will in the near future attain to a similar state of prosperity as that experienced about the year 1877. Lead mining in these islands is of considerable antiquity; we know that lead ore was mined in Shropshire in the days of the Emperor Hadrian from the fact that "pigs" of lead were some years ago discovered in the refuse heaps of the Roman gravel mines in that county, one of which is preserved in the Geological Museum in Jermyn street. It may be mentioned of this district that, though possibly the smallest mineralized area in Europe, it was believed by so great an authority as the late Sir Roderick Murchison[13] to be probably unequalled for its size, in point of wealth in lead ore.

In Shropshire, North Wales, Cornwall, Isle of Man and the Pennine Chain are situate the chief lead mining areas of the kingdom. Lead mining in general, however, is not being very profitably conducted at the present time in the United Kingdom. Though far from being ex-

FIG. 1 SHEWING THE FLUCTUATIONS IN THE PRICES OF COPPER, LEAD, TIN AND ZINC IN THE LONDON MARKET FOR EACH YEAR SINCE 1873.

NOTE: The thick lines shew the highest prices and the thin lines the average prices

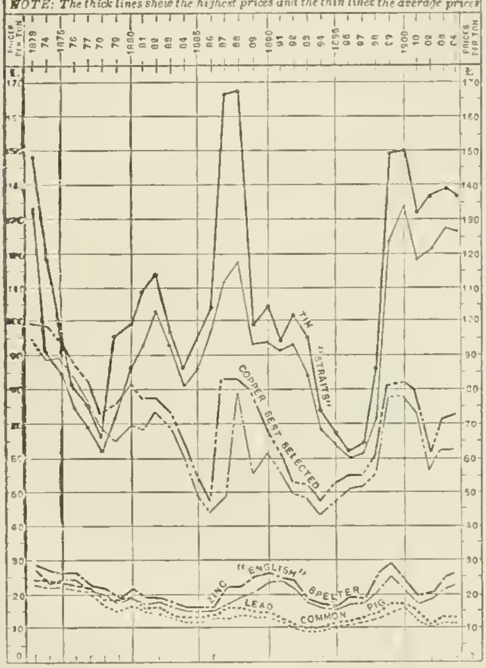

FIG. 2 SHEWING THE FLUCTUATIONS IN THE PRICES OF COAL AND IRON FOR EACH YEAR SINCE 1873

NOTE: The thick lines shew the highest prices and the thin lines the average prices

hausted, except in few instances, the mineral veins are not of such a character as to allow of their being as cheaply exploited as the richer deposits of Spain, Australia, and some other extensive lead-producing countries. As these more bountiful districts become exhausted, prosperity will return to British lead mining.

Fig. 1 shows diagrammatically the fluctuations in the prices of copper, lead and zinc in the London market for each year since 1873 to 1904 inclusive.

The iron ore deposits of Great Britain[14] are of two kinds, viz., stratified iron ore — the mines of which come under the control of the Coal Mines Regulation Act and the "mass" and "veined" deposits of hæmatite which come within the jurisdiction of the Metalliferous Mines Act. Cumberland and North Lancashire which yield an output of nearly one and a half million tons, are the source of the famous red hæmatite which chiefly occurs in the form of huge irregular masses in the carboniferous limestone and is the richest iron ore of the country, yielding

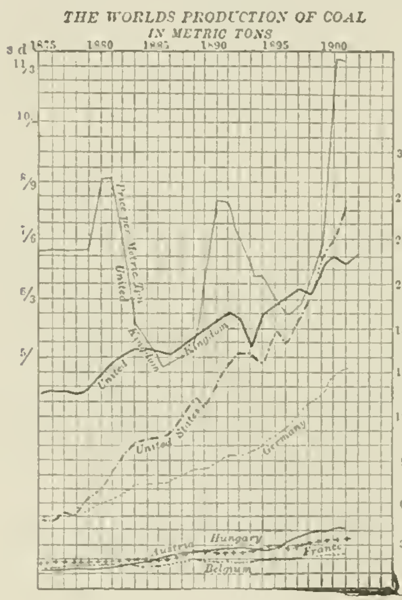

Fig. 3.

on the average over 50 per cent of metal. Working one of these masses is probably the most extensive iron mine in the world — the Hodbarrow mine.[15] The other principal iron producing districts are Cleveland (N. Yorkshire), which accounts for nearly five and three-quarter million tons annually, Lincolnshire, Northamptonshire and Leicestershire together supplying over four and a half million tons, the total production being nearly fourteen million tons annually, valued at over three million sterling.[16] The Cleveland clay ironstone (carbonate of iron) is chiefly worked from a bed about 10 feet thick, in the Middle Lias, containing on the average about 30 per cent of iron. The ore from Lincolnshire, Northamptonshire and Leicestershire is derived from open workings in a bed of brown iron ore in the Inferior Oolite, and averages about 33 per cent of metal. The Scottish ore and that from North Staffordshire is largely worked from the Black Band ironstones (carbonate of iron) in conjunction with the coal in the collieries of those districts and varies considerably in richness of metal.[17] Fig. 2 is a graphic representation of the fluctuations in the price of coal and iron (London market) for each year since 1873 up to last year.

A description of British mining would be incomplete without some reference to the production of slates,[18] as in no country are there yielded slates of a quality equal to those of North Wales. The mines proper are mostly in Merionethshire, whereas the quarries are worked in Carnarvonshire, the Penryhn quarry, near Bangor, being the largest open working in the world, the underground workings of the Oakley Slate Quarry Company, Ltd., at Festiniog, Merionethshire, being the most extensive slate mine. The output of finished products from the individual mines and quarries constitutes only a part of what is drawn from the workings, it being calculated that there is a loss of about two-thirds in the "dressing" (cutting and shaping) of the slates.

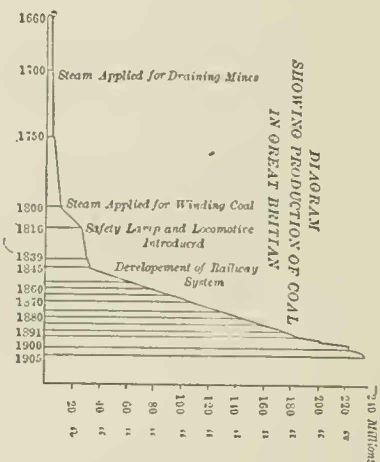

Fig. 4.

No description is given in this review of the production of building and other stones derived chiefly from quarries, as space does not permit of allusion to other than the more purely mining part of this subject.

The chief sources of the mineral wealth of the United Kingdom is in the coal and iron deposits. Of the latter mention has already been made. The former far outweighs in importance all other branches of mining classed together.

Until the year 1899 the United Kingdom was the largest producer of coal in the world (see Fig. 3); it now stands second, the United States having outstripped it in the race for supremacy in this respect.

When coal first came to be worked in this country as a merchantable article, authorities are not agreed. It may have been worked in a desultory and uncertain fashion in very remote times, but the first substantial mention of coal mining is that contained in the records of Holyrood and Newbattle Abbeys,[19] in which it is shown that coal was dug on the south shore of the Firth of Forth in Scotland about 1200 A.D.; further, we know that coal was imported into London from Newcastle about 1257. Indeed, Novacastrians may justly claim the banks of the Tyne as nursery of the coal trade, and to the present day the inhabitants have more than maintained their heritage of skill and foresight, for there is no field in which the mining industry rejoices in better management, both in respect of the mining operations themselves and in the conduct of labor affairs, than the Great Northern coal field. The systems of "joint committees" of representatives of owners and men, and the respective associations of mine owners and of the workmen in Northumberland and Durham constitute a pattern to be studied and an example to be followed by every other mining district wherever it may be, conducing, as they have done in an eminent degree, to the equitable conduct of the trade and the harmonious relations existing between employers and workmen.

There is, perhaps, no trade, excepting the iron-making industry, more subject to variations of prosperity and depression than coal mining. It is often remarked that it is the first to prognosticate a cycle of general depression and the last to recover therefrom. Be that as it may, the words of the old chronicler[20] have a strangely modern ring about them, when read in the light of recent experience. "Many thousands of people," he remarks, "are imployed in this trade of coales: many live by working of them in the pits: many live by conveying them in wagons and waines to the river Tine: many men are employed in conveying coales in keeles from the stathes aboard the ships; one coal merchant imployeth five hundred or a thousand in his works of coals: yet for all his labour, care and cost, can scarce live by his trade. * * * Nay, many of them hath consumed and spent great estates and dyed beggars." The conclusion of the whole matter appeared to him to be that "their Collieries is wasted and their monies is consumed; this is the uncertainty of mines — a great charge, the profit uncertain."

It is not proposed to follow the history of development of the coal trade in detail. The rate of this expansion and how it has been affected by various improvements in mining and facilities of transport are marked in the accompanying diagram, Fig. 4.[21]

One of the most remarkable characteristics of the carbonaceous deposits of this kingdom other than the number of the separate fields and their extensive area is the great variety in the fuel itself. The coal fields may be divided into groups as follows:

I. ENGLISH COAL FIELDS.

Midland Group.— (1) North Staffordshire; (2) South Staffordshire; (3) Leicestershire; (4) Warwickshire.

North Midland Group.— (1) Yorkshire; (2) Derbyshire and Nottinghamshire.

Great Northern Group.— (1) Durham and Northumberland; (2) Cumberland.

Northwestern Group.— (1) Lancashire and East Cheshire; (2) Coalbrookdale (or Shropshire); (3) Forest of Wyre.

Western Group.— (1) Bristol and Somersetshire; (2) Forest of Dean.

II. WELSH COAL FIELDS.

(1) South Wales; (2) Denbighshire and Flintshire.

III. SCOTTISH COAL FIELDS.

(1) The Clyde basin; (2) Midlothian and Haddingtonshire; (3) Fifeshire; (4) Ayrshire; (5) Lesmahagow; (6) Canonbie.

IV. IRISH COAL FIELDS.

(1) Northern Group; (2) Southern Group. These are of small importance and little worked.

The thickness of the seams worked in the fields varies from 11 or 12 inches to 30 feet, but the latter is restricted to South Staffordshire; this seam and the thick coal of Warwickshire being quite exceptionable. Cannel coal in Scotland has been worked, in some instances, when only six inches thick.

The variation in the character and quality of the coals within the different fields themselves is remarkable: for instance, first class coking coal is mined near the banks of the Tyne, yet only a few miles east of Newcastle the world-famed Wallsend household coal is produced, and by far the greater part of the Northumbrian output is exported as steam coal. Again, coke unrivalled in quality, is made from the coal mined in the western and south-western part of Durham, whereas good gas and very superior house coal is raised from the collieries situate in the central and eastern part of the same county.[22] The principal steam coal-producing areas, other than Northumberland, are South Wales (pre-eminently), and parts of the Scottish fields — notably that of Fifeshire — to some extent Lancashire, North Staffordshire and Yorkshire; the other fields chiefly supplying manufacturing, iron smelting, gas and coking coals. Of all the districts, the variation in character of coal is most marked in the great South Wales field, the seams in Monmouthshire being bituminous, but toward the south-west they become less and less so, until in central Glamorganshire the fuel mined is the world-renowned smokeless steam coal so much in request by the navies of this and other nations, and toward the northwest (Carmarthenshire) the seams pass into anthracite.[23]

A factor that must largely affect the future commercial prosperity of the country, indeed is vital to it — is the duration of its iron and coal supplies. The stores of iron ore, owing to the nature of the deposits, cannot be estimated with the same degree of accuracy as is possible in the case of coal, but it may be safely prophesied that their exhaustion will long precede that of coal. Working on the figures arrived at by the late Royal Commission on Coal Supplies, the time which would be taken to exhaust the coal fields at the present rate of output may be taken as about 600 years;[24] whether the present rate of output will be long maintained is, however, somewhat doubtful. For the last 30 years, the average increase in the output has been 2½ per cent per annum, and that of exports (including bunkers) [illegible] per cent per annum, but it is highly improbable, owing to physical reasons, that these rates of increase will be long continued. Some districts, indeed, have already attained their maximum, and decadence has set in, as for instance in the "exposed" part of the South Stafford coal field. The developments in the new coal fields will possibly increase the total output for some years, but the Royal Commission, just alluded to, "look forward to a time, not far distant, when the rate of increase of output will be slower, to be followed by a period of stationary output, and then a gradual decline." Nor do they hold out any hope that the resources may be husbanded by the utilization of any other source of power; they are convinced "that coal is the only reliable source of power and that there is no real substitute, though there are some sources which may slightly relieve the demand for coal." [25]

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[1] These figures are derived from the 'Mines and Quarries Statistics,' published annually in four parts by the Home Office as a Blue Book, comprising District Statistics, Part I; Labor, Part II; Output, Part III; Colonial and Foreign Statistics, Part IV.

[2] Final 'Report' of the Royal Commission on Coal Supplies. This commission was appointed in 1903, and published its final report in 1905.

[3] The limited extent of metal mining is evidenced by the fact that only 29,504 persons were employed during the year 1904 in producing 3,246,336 tons of metalliferous minerals, *vide* Part IV. of 'Mines and Quarries Statistics.'

[4] Book IV., Cap. 279. Clearly some process of extraction of silver from rich silver-lead ore (galena) must have been in vogue.

[5] In the life of his father-in-law—'Vita Agricolæ.' Agricola in an oration to his soldiers before the battle, near the Grampians (84 A.D.) exclaims: *"Fert Britannia aurum et argentum et alia metalla, pretum victoriæ."*

[6] 'The occurrence of gold in Great Britain and Ireland,' by J. Malcolm Maclaren, B.Sc., F.G.S., in the 'Transactions' of the Institution of Mining Engineers, vol. xxv., pp. 435-508. Hence, "cassiterite," or oxide of tin, the commonest ore of that metal.

[7] 'Tin Deposits of the World,' by Sydney Fawns, F.G.S. For a clear statement of the present position of Cornish tin mining, the articles which appeared in the Engineering Supplement of the 'Times' (Sept. 27, Oct. 18, 1905) should be consulted. Tin *mining*, in the strict sense of the term, probably dates from the 11th century, before that time the whole of the tin being derived from "Stream Works." In 1884 the British output of tin ore amounted to 15,117 tons of tin ore (black tin), worth about £40 a ton; the produce has year by year decreased, until during 1904 the output was only 6,742 tons, worth about £72 a ton. The price has been steadily rising, with occasional fluctuations, during 1905-06, tin being dearer now than ever recorded in the history of the world, and many old mines are being reopened in Cornwall.

[8] Carew, Richard, of Antoine, 'Survey of Cornwall.'

[9] William Pryce in his 'Mineralogia Cornnbiensis' gives the output as 264,273 tons of copper ore during this period, averaging in price £6.14.6 per ton.

[10] 'A Treatise on Metalliferous Mines and Mining,' p. 125. Davies instances the fact, drawing his information from Hunt's 'Mineral Statistics of Great Britain and Ireland,' that in the year 1877 there were 101 copper mines at work in the kingdom, producing an aggregate of 79,252 tons of ore, valued at £317,186 7.7d; of these mines 65 were in Cornwall. The output of copper ore (and copper precipitate) during the year 1904 was only 5,465 tons, valued at the mines at £17,952.

[11] Pennant's 'Tour in North Wales.' The Parys Mine, in the northern corner of Anglesea, worked for a long time and in a century and a quarter returned profits estimated at over £7,000,000. The copper at present derived from the mines in this district is obtained by precipitation of the copper in the waters pumped from the mines.

[12] The output of lead ore for 1877 was 80,850 tons, valued at £1,123,952, whereas during 1904 it amounted to but 26,707 tons, valued at £206,238, to which should be added 36 tons of so-called silver ore, valued at £1,782. Vide 'Mines and Quarries Statistics.'

[13] Sir Roderick Murchison, F.R.S., director of the Geological Survey of Great Britain, 'The Silurian System' (1839, p. 282). He says, "we shall find there are few tracts of given extent in any part of the world which are veined to a greater extent."

[14] 'The Iron Ores of Great Britain and Ireland,' by J. D. Kendall, F.G.S., affords much reliable and valuable information on this subject.

[15] The output of ore from this mine during 1904 was 408,637 tons.

[16] The figures of 1904 give a total production from all classes of mines and quarries of 13,774,282 tons, valued at £3,125,814. 'Mines and Quarries Statistics.'

[17] The output of the various kinds of ore may be roughly proportioned as follows: Clay ironstone, 42 per cent of the output; black band, 12 per cent; hæmatite (red), 11 per cent; brown ore, 29 per cent.

[18] The total production of slates during 1904 was 563,170 tons, valued at £1,678,726. Of this 427,730 tons were contributed by North Wales, in the proportion, roughly speaking, of three-fifths from open workings and two-fifths from mines. The Oakley Coy's mines alone produced 40,192 tons.

[19] For an exhaustive and admirable history of coal mining in Great Britain, the reader cannot be referred to a more interesting and accurate record than the 'Annals of Coal Mining and the Coal Trade' (2 vols.) by R. L. Galloway.

[20] Grey, '*Chorographia, or a Survey of Newcastle-upon-Tine*,' published 1649.

[21] After J. B. Simpson, M.I.C.E., *vide*, Address on the 'Rise and Progress of Coal Mining' (1896), the diagram has been further extended and brought up to date thus:

	Long tons, 2,240 lbs.
In the year 1660, it was estimated by the Royal Commission on coal (reported 1871) that the output of coal was........	2,148,000
And that in 1770 it had risen but little, being but	2,612,000
Between 1770 and 1750, however, steam was applied to draining mines, and gunpowder came to be used at underground operations, so that it was estimated that by 1750 the output had advanced considerably, being for that year	4,773,828
Later steam was applied to hoisting the coal up the shafts, and between 1760 and 1800 the development of the canal system took place, which gave a great impetus to the trade. So that for 1880 the output had increased to	10,080,300
In 1803 coal came to be used for the manufacture of gas, and in 1815 the safety-lamp was invented, which would further assist coal mining. Mr. Samuel Salt computed the output for 1816 to be...	27,020,115
For 1845 Mr. J. R. McCullock puts the output at	34,600,000
The introduction of steam in navigation and the development of the railway system took place shortly before and about this time.	
The (1871) Royal Commission on Coal, sometimes called the Argyll Commmission, the Duke of Argyll being its chairman, calculated that in 1855, the output had risen to the considerable figure of.......	64,307,000

The first year of which we have official returns is 1860. The following figures show the increase:

1860	84,042,698
1865	98,150,587
1870	112,875,575
1880	146,969,409
1890	181,614,288
1900	227,084,871
1905	236,111,150

[22] Professor Hull's 'Coal Fields of Great Britain' (sixth edition) should be consulted by the reader interested in further pursuing this subject.

[23] The extent to which the different fields contribute to the total production may be roughly proportioned as follows:

		Million Tons.
Scotland	East Scotland	17½
	West Scotland	....
England	Northumberland and Durham	54¼
	Yorkshire and Lincolnshire........	30
	North and East Lancashire........	11½
	Midland	30
	Staffordshire	14¼
	Southern District	13
Wales	Liverpool and North Wales......	15½
	South Wales	....
Ireland	....	under 1/10th

[24] The annual output of anthracite is nearly 3,000,000 tons, practically derived entirely from this region.

[25] 'Reports' of Royal Commission on Coal Supplies. Final Report 1905. The Commissioners computed that there were yet remaining to be worked in the "proved" coal fields adopting 4,000 feet as the limit of practical depth in working and 1 foot as the minimum workable thickness, an *available* quantity of coal equal to 100,914,668,167 tons, and that the quantity supposed to exist outside the "proved" areas, *i.e.*, in the "concealed" fields, would amount to 39,483,000,000 tons. In calculating the period of duration there has not been taken into consideration the coal existent at a depth below the 4,000 feet limit, which in the "proved" coal fields alone is placed at 5,239,433,980 tons.

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25 (a). Great Britain—The Industrial Revolution. Between the years 1770 and 1840 England became the workshop of the world. She changed radically in character; from an agricultural nation she became primarily a manufacturing one. She became dependent for her raw materials on foreign nations and on markets abroad for the sale of her goods. Her international position, therefore, was vastly affected and her prosperity became dependent on the state of trade. No less remarkable was the change in the relations of persons. A new middle class of manufacturers arose and the moneyed interest permanently overtopped the landed interest in social importance. Alongside of the employing class grew up the class of factory hands, and the business relations of the two classes had to be settled afresh and not without considerable friction. The industrial revolution involved, therefore, industrial reconstruction with all the disintegration and suffering that drastic reconstruction always causes.

Not more striking than the alteration in the character of English industry and in English social relations was the remarkable shifting which took place of centres of importance, for suddenly the North sprang into prominence and the South correspondingly declined. In this new industrial region huge masses of people were congregated on certain spots, and the problem of the large towns arose, with all the sanitary housing and other questions connected therewith.

Then came the problem of feeding these agglomerations of people and of getting rid of the goods they made, which questions were answered by the great revolution in the means of transport and the changes in the English fiscal system.

The industrial revolution is generally dated from the coming of machinery and is usually connected with the invention by Arkwright of a cotton-spinning machine in 1775 which was worked by water. It was the application of mechanical power to industry that constituted the novelty, for it was the invention of a substitute for man himself.

But events had been preparing for more than half a century for the introduction of manufacturing on a large scale in England. Inventors had always been numerous, but the conditions were present about 1770 which enabled an inventor to bring his ideas to a successful issue. In the first place there was in the England of that time an abundance of capital, owing to the development of the banking system, so that an enterprising man could get money to try experiments. Arkwright's machine is said to have cost £12,000 before it was perfected. Then, too, there was every prospect of large sales without which machine production would have been unnecessary. England's markets were developing steadily in the 18th century both at home and abroad. At home the revolution caused by smelting iron with coal had given rise to canals to transport the fuel and the result was a general quickening of intercommunications. New centres rose up and a greater demand for goods was created. The export of English goods was steadily rising in value and there was every chance of increasing the sales if goods were cheaper. Moreover in the 18th century the capitalist employer had become prominent. There was, therefore, a class of men trained to production on a large scale. The old mercantile companies with their rules as to limited sales had lost their power to dictate as to quantities and prices and there was no hindrance on that side to the enterprising man.

Yet although these forces were all making for a great change in the methods of industry the England of 1760 was an agricultural country. The leading branch of trade was cloth; cotton goods and muslins were imported from India and re-exported; fine cotton goods could not be made in England as the warp was too weak and linen had to be used. The iron trade had been threatened with extinction owing to the lack of timber and was only just beginning to revive when coal could be utilized for smelting owing to the invention of the Darbys about 1740; but much remained to be done, and it was not until Cort's invention of a means of puddling iron in 1784 that the iron trade made great advances.

In 1760 the Duke of Bridgwater was cutting the first canal and the turnpike roads were beginning to facilitate internal travel.

The majority of the work-people were either small manufacturers who bought the wool, wove it, and disposed of the cloth themselves, or worked on commission for some big dealer. Nearly all of them had a by-employment in the shape of a small farm, while the women and children practically all over England were employed in spinning or carding. The incomes of the day were family earnings. As English cloth had almost a monopoly value the demand was steady; England grew the bulk of her own wool and was not mainly dependent on importation from abroad. The characteristic of the whole period was stability. If the orders for cloth fell off then the man had his bit of farm to fall back on — the one helped the other. Agriculture was not divorced from industry nor the workman from country employment, nor was there any marked distinction between town and country. It is probable that according to our notions the life was sordid and the standard of comfort low, and there is no reason to think that the parents were the easiest of taskmasters for the children. But the problem of the unemployed was absent, and the domestic workmen at all events decidedly preferred the life to that of the factory.

When machinery came it was curiously enough first of all applied to the languishing trade of cotton. The reason seems to have been that the supply of raw cotton was unlimited, while England was already on the verge of a wool famine. Sheep growing had not been started in Australia and there was no reason to anticipate that even if machinery came in the output could be largely increased. Moreover wool being more brittle than cotton it was found at first very difficult to adjust it to the strain of the machine without constant breakages. Hence wool is affected by machinery much later than cotton. Arkwright, a barber, revolutionized the cotton trade by his water frame, patented in 1775, which spun a yarn firm enough for the warp. Crompton followed this up by inventing the mule in 1775 which created the muslin trade; and Cartwright, a clergyman, brought out the power loom for weaving which was first used in 1801. Power spinning in the woollen trade did not become general till the first decade of the 19th century.

The effect of the cotton machines was to create a new trade. The great manufacturing centres had hitherto been Norwich and Devizes, but the new machinery needed water power, and hence the trade settled in the North in country districts where water was available. The first machines were small and simple and were made of wood and necessitated a good deal of bending over by grown-up persons but could easily be worked by children, but such labor was difficult to obtain in the country in large quantities, hence the massing of pauper children in these factories. There seem to have been grave abuses in the system and a new era was inaugurated by Sir Robert Peel's Health and Morals of Apprentices Act of 1802 which limited the working hours of apprentices to 12 per day.

The problem, however, was altered when steam came in owing to Watt's invention. It was only substituted gradually for water power, coming in more and more after 1815 and becoming the prevalent type altogether in 1840. The important thing now was no longer water but coal, and to get coal the factories had to settle in the great centres where coal could easily be brought by canal, as the cost of dragging it over country roads was prohibitive for cheap production. Hence we get a second great migration of industry to the towns near the coal fields. Here child labor was readily available, and a new Act had to be passed in 1819 to meet the case of children who were not apprentices. As steam became more regularly applied the machinery got more complicated and less suitable for children of tender years, and there was a tendency to discontinue them in certain branches. They were still retained in the old water mills and the Factory Acts were never really effective till the invention of the government factory inspector in 1833.

There were practically no people dispossessed by machinery in the cotton trade; instead there were increasing opportunities of employment, but other trades suffered. The demand for both light woollen and linen goods fell off as cotton was substituted. Still the weavers prospered. They continued to work up the yarn in their own homes, and it was not until the dislocation of trade brought about by the Napoleonic wars that they fell upon evil days. Gradually machinery was applied to weaving, and the race of hand-loom weavers died out amid great privations.

It was when machinery was applied to wool, that the real social upheaval came. It destroyed the by-employment of spinning throughout the whole of the country districts, and an elaborate system of relief from the rates had to be devised to assist people over the crisis. This pauperized the whole of the south of England and degraded the agricultural laborers as a class.

The radical change in English life came from the fact that the factory system destroyed the old stability. A man had to follow his work to the towns and lost his little farm. Even when the factories were situated in the country he had to work regularly and could not take time off to attend to the garden as he could when working for himself. The regularity of the life, the tyranny of the factory bell, and the loss of independence were the things of which the worker most complained. The early factories, situated as they were in the country districts, laid the workmen open to an appalling system of payment in kind called "truck," an evil only gradually remedied by a series of Acts of Parliament beginning in 1831.

But more important than his dependence on his treatment by the master was the dependence of the workman on the state of trade. The sufferings during the Industrial Revolution in England were especially violent owing to the Continental System of Napoleon which shut out English goods from Europe except by smuggling between 1806–1812, and which was followed by the rupture with the United States, which cut off another very important market. After the peace of 1815 the utter exhaustion of the continent made Europe a bad customer, and England, equipped as she now was for production in bulk, suffered accordingly. The coming of machinery would have been a difficult time for any country, but the troubles were enormously aggravated owing to the fluctuations of trade and the depression after the war. English exports decreased in value between 1815 and 1825, and only began to recover about 1835, and to make a rapid advance in 1840. Nevertheless the increase in trade when compared with that of 1750 was enormous.

The exports in 1750 were valued at £12,690,081, in 1800 they were £34,381,617, in 1840, £116,479,678. The imports in 1750 were £7,772,039, in 1800, £28,257,781, in 1840, £67,432,964.

The growth in the import of raw cotton is very striking. In 1751, 2,976,610 pounds were imported, in 1815, 99,306,343, in 1830, 259,856,000.

The import of wool could not expand till the Australian wool became available. In 1800 the number of pounds imported was 8,600,000, in 1840, 49,436,000, in 1857, 127,390,000.

Then the English fiscal system had to be overhauled to get in cheap raw material, and the agitation of the manufacturers was successful in bringing about the free trade era.

During the 19th century the English Parliament has been mainly occupied in readjusting the relations of employers and employed, in facilitating the growth of a manufacturing state, and in abandoning the system which was made for an agricultural state; while no attempt has been made to preserve any balance between agriculture and industry.

The result of the industrial revolution in England was, to use the words of an 18th century writer, "to remove multitudes of people from our natural and fixed basis, land, to the artificial and fluctuating basis, trade."

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25 (b). **Great Britain—The Industrial Organization.** *The Recent Character of Important Changes.*—The industrial organization of the United Kingdom as it is at the present time is of recent origin so far as some of its most characteristic and important features are concerned. The "industrial revolution," so-called, which took place at the end of the 18th century, important as it was, did not extend very far, but left other countries comparatively untouched. Many British industries continued to be carried on by the old methods. Railways and the means of transport generally were ill-developed, and the old balance between agriculture and manufactures remained on the whole undisturbed. These conditions have all been altered in more recent times, especially during the last 30 years. The machine industry has spread to other countries, and whenever a new manufacture is now founded it is carried on by methods of which Great Britain formerly had the monopoly. Moreover, the relation of manufactures to the rest of the national economy has undergone a great and fundamental change.

The Decline of Agriculture and its Effect. — In the period 1831-5, 96 per cent, or 23.6 millions, of the then population were fed from home-grown corn. In 1841-5, the period immediately preceding the repeal of the Corn Laws, while the percentage of the population fed from home-grown corn had declined to 90 per cent, the actual number had risen to 24 millions. In the period 1901-5, the percentage of the population so supported had fallen to 10.6 and the actual number to 4½ millions. The change so indicated is not confined to wheat, but extends in some degree to every form of agricultural produce, including meat, and these changes have become more marked during the last 30 years. Most of the old economic arguments, which were in fact based upon an assumed balance between agriculture and manufactures and the action and reaction of one upon the other, have ceased to be relevant to the United Kingdom. The export of manufactures is absolutely essential to the maintenance of the United Kingdom.

The Relations between the Home and the Export Trades.—The home market, in the sense in which this expression is used in America and on the Continent of Europe, cannot be said to exist. Calculations, or to speak more accurately, "guesses," are frequently made as to the relations between the home and the export trades. It was calculated for example, a few years ago, that 20 per cent of the total wages in England was earned in productions for the export trade and in much economic reasoning at the present time, there is an implied assumption that the home trade is so much more important than the export trade that a considerable change in the character of the latter would be of no great importance. This reasoning might perhaps apply to a large extent to the United States and to a smaller extent to modern Germany: it certainly would not apply to the United Kingdom. Whatever the exact proportions may be — and until there is an industrial census we have not an adequate basis for calculation — it is certain that the relation between the home and the export trade in the United Kingdom is very different from that which is found in foreign countries and must necessarily affect both the international organization of the trade and business policy adopted. In the actual investigation of trade conditions, it is extraordinarily difficult to obtain from firms engaged in industry materials for any clear-cut distinction between the two branches of national activity, because, even in the case of firms which themselves do directly no export trade, the reaction upon their trade of trades which manufacture for export is both immediate and rapid. We may take one or two examples to show how this works out.

The Cotton Trade in Relation to Other Industries.—The Cotton trade differs from all other British industries in the proportion which the export trade bears to the home trade. More than 80 per cent of the output of the cotton industry is exported. The industry employs more than half a million working people directly in the mills, and they and their families depend directly for their livelihood on their weekly earnings. To these we must add the millions of people dependent upon the railways, the canals, the shipping which bring the raw materials to the mills, and carry away the yarn and manufactured goods; on the engineering industry which provides the machinery required; on the building trades which erect the mills, and house the operatives: on the countless other trades and agencies, state, municipal, and private, which supply the needs of the great industrial population. The result is that the prosperity or the depression of the cotton industry quickly affects other trades throughout the country, whether they do or do not manufacture for export. In the recent cotton boom the improved conditions spread over the country like a great tidal wave. Here then whether the actual proportions between the total export trade and the home trade of the country are as 1 to 5, or 1 to 6, is of trivial importance. If any considerable diminution occurred in the exports of Lancashire, or even if the export trade remained for a long period of time stationary, many other industries would suffer from stagnation.

The Export Trade and Domestic Competition.— Evidence recently obtained brings out another very important condition which is found in British industries at present. Here again we may in the first instance take the cotton industry. While there is no particular reason why Germany and other competing countries should not with ease and success spin coarse and medium counts both for the home and the export trades, Lancashire at the present time has almost the monopoly of fine spinning, and this branch of the spinning industry has beyond all question considerably increased in recent times; but until the boom of the last two years the depression in certain branches of the cotton trade reached alarming proportions. There was a marked tendency under these influences for capital to go into fine spinning and competition has in fact become exceedingly severe in recent years. The McKinley and Dingley tariffs prejudicially affected many important branches of the woolen industry. The result of the loss of these and other markets has been to throw manufacturers back upon the home market to such an extent, that whereas in former times the woolen industry was carried on in localities, each of which was devoted to specialties, the lines of demarkation between one locality and another are gradually being broken down. The West Riding competes with the West of England, and the different parts of the West Riding compete with each other in a far more marked degree than was formerly the case.

Textile Substitutes.— This movement has been accentuated by the invention of substitutes for different textiles. Cotton competes with linen, and in many of the cheaper classes of goods has displaced the linen. Cotton substitutes for wool have played havoc with certain branches of the woolen industry. Mercerised cotton has displaced many goods formerly made of silk. During the high price of wool in recent years cotton benefited considerably by the extended use of cotton substitutes for woolen goods. Generally speaking, three conditions fundamentally affecting the industrial organization of the United Kingdom have become more marked in recent years: (1) the old balance between agriculture and industry has been completely destroyed, with the result that the export of manufactures is of vital importance to the existence of the country; (2) the export trade in manufactures bears a higher proportion to the home trade than that of other industrial countries — in one industry, cotton, that proportion reaching more than 80 per cent of the whole; (3) the loss or relative diminution of some branches of the export trade has greatly increased domestic competition — a competition which has further been rendered more acute by the more extended use of substitutes for the various classes of textile goods.

Size of Firms.— The theoretical lines upon which economic investigation has been carried on in England have popularized a purely academic view of the industrial organization of the United Kingdom, based to a large extent on the conditions which prevail only in certain industries organized on the factory system. The picture is presented of the great factory employing large numbers of pure wage earners, above them the class of the foreman, etc., then the great *entrepreneur* and the capital in the background, the *entrepreneur* sometimes being resolved into a board of directors with one as managing director. Moreover, this idealized factory is becoming larger and larger, swallowing up the smaller works in its progress and ultimately forming part of one great amalgamation controlling a large proportion of the industry in which it is established. This highly-organized business proceeds every year to a higher grade of manufacturing, employing a class of workpeople progressively improving in skill and intelligence, and in the wages they earn. There can be no doubt that illustrations may be found in the industrial system of Great Britain of this type of industrial organization, but it would be a great mistake to suppose that it is normal or usual. Taking the United Kingdom as a whole there are probably not more than 90,000 to 100,000 manufacturing firms, and of these the vast majority are small works. Even in iron and steel and engineering the great firm employing thousands of workpeople is by no means common. Over a great part of the Midlands countless small industries are carried on in which the prevalent type of manufacturer does not differ so widely from his predecessor of two or three generations ago as the economic textbooks would lead one to suppose. To what extent the process of concentration has gone, how far the smaller firms have been eliminated, whether that elimination is proceeding faster or slower than it did 30 years ago, whether the whole of the industrial system is growing by degrees to conform to standards very largely derived from certain industries in the United States, are questions it is impossible to answer. At present, so far from conforming to one particular type, the industries of England as they pass under review present a bewildering complexity of organization.

Tendencies with Regard to Raw and Half-Manufactured Materials.— Some important changes have taken place in regard to the conditions of supply of raw materials. It is of course impossible in this article to review these conditions as they affect all industries, but taking the case of raw cotton, the general opinion in the trade appears to be that conditions have deteriorated, both absolutely and relatively, partly because of the liability to shortage which was illustrated on a great scale in 1903 and 1904, partly because of the competition of foreign countries, and partly because English spinners cannot use all classes of cotton. The last mentioned difficulty is said to be due in a large measure to the objections of the operatives, but the change in the proportion taken by the Continent, the United States and Great Britain respectively has reacted upon general conditions. The following table shows the weekly consumption of cotton in the United Kingdom and on the Continent during this critical period.

	Great Britain. (bales of 500 lbs. each)	*Continent.*
1901–02	62,560	93,000
1902–03	61,250	99,000
1903–04	58,020	99,000

Thus, while Lancashire was working short time, owing to a diminished supply of 3,230 bales per week, the Continent continued with the same supply as in the previous season. The explanations given for this state of things fall into two groups, one attributing it to differences in the method of buying, the other referring it to the general policy of the countries concerned. In regard to wool, the conditions have also altered considerably within recent experience. There has been a steadily-diminishing production of British wool which is probably connected with the agricultural depression, and Continental ools have also declined in use, but there has been an enormously increased use of Australian and other Colonial wools; and in regard to the Australian wool trade in particular great changes have taken place in the organization of the trade. Not only has a direct trade of considerable proportions grown up between the Continent and Australia, displacing much of the indirect trade which formerly took place, but the Continental manufacturers are now strong competitors with the British manufacturers in raw wool at the London wool sales. In no industry is the diminution of England as the emporium for raw materials so marked as in the case of silk, the re-export trade in silk having declined from more than £3,000,000 sterling in the period 1857–64 to merely a nominal sum at the present time. Going carefully into the figures with regard to the supply of raw material for the various English trades at the present time it is not so clear that, on the whole, Great Britain under existing conditions enjoys those marked advantages which she formerly possessed, in the instances above mentioned, and in many others, experience having proved that foreign competing industries can do equally well, and in some instances, in the opinion of manufacturers, even better. Above the stage of raw material also there has been in recent years a decline in the self-sufficiency of British manufacturing industries. Steel blooms and billets formerly obtained exclusively in the United Kingdom are now often imported; in the engineering industry steel castings, forgings, and shaftings are frequently obtained from abroad instead of as in former times giving employment to workpeople in England. Industries like the tinplate trade have grown to depend, as some think, to a somewhat dangerous extent, on imported materials.

Finished Goods.— Competition has also developed in regard to finished goods with reactions of considerable importance on the organization of some British trades. In the woolen trade the home manufacture of foreign countries such as France, Russia, Germany, and the United States, which formerly imported largely from Great Britain, has enormously increased, and there has taken place a decline in those branches. There has thus been a tendency for yarns to displace manufactures, for tops to displace yarns, and for raw wool to be exported in a larger proportion than was formerly the case. This process, if it continues, must have a considerable effect in deteriorating the quality of labor employed in the woolen industry. The highest paid and most efficient labor is in the finishing branches, and if these branches are displaced and inferior grades substituted, there must inevitably take place a gradual degradation both of the quality and the wages of labor.

Tendency to Specialties.— On the whole, however, the effect of the increase of foreign competition on the industries of Great Britain has been to produce a growing tendency toward the manufacture of specialties. Large generalizations in regard to an industry are scarcely ever correct, but if we may make one for the purpose of bringing out this point, we might say that while in the United States and Germany the tendency has been to capture certain staple lines, to rely for the maintenance and growth of production of these lines chiefly upon the home market, and to support the system so established by an export organization for the disposal of surplus products, the tendency in some great English industries, especially the textile, has been more and more in the direction of specialties. This condition affects fundamentally the organization of the British industrial system, because it is less possible to make to stock or to diminish the burdens of fixed charges; greater attention must also be devoted to watching the ever-changing character of the demand; greater expense must be devoted to designing and processes, and it is less easy to scrap old machinery. Thus the industries of England are probably less homogeneous than those of the competing countries. The cotton trade, big as it is, is not one industry, but a vast aggregate of industries in which it is scarcely possible to find two mills which are strictly comparable. There is not merely the distinction between fine, medium, and coarse spinning, but the range of counts produced differs from one mill to another. When we come to the weaving and finishing branches, every mill appears to have its own specialty, the spinning, weaving and finishing are not normally found conducted under the same roof, and manufacturers who cover all the different branches are comparatively rare. This, however, is not true of the linen trade, where the largest firms conduct every operation from the stage of raw material to the finished product.

Variations of Costs.— The problem of comparative costs in the United Kingdom and foreign countries is one of extraordinary difficulty and complexity; even in such grades of manufacture as pig iron and steel billets and blooms the variation in the amount and proportions of the different elements of cost are very great. Taking, for example, the actual figures of an iron and steel firm and comparing their costs in the production of steel for two consecutive periods, the works running three quarter time in the one period while they were running full time in the second period, the saving in the second period as compared with the first worked out at almost 6s. a ton, or in the case of this particular firm about £45,000 a year. Moreover, the saving was effected both on wages, fuel, and general charges, and the proportions of each element varied. Other instances showing even greater variations could be given in the same industries. These figures vitiate comparisons of the productive power of one country with that of another based upon average costs which pay no regard to output, the period during which the works have been running, or the trade policy adopted by manufacturers. But when we come to the different stages of production in the engineering or the textile industries, the problem is infinitely more complicated than in iron and steel because we have to consider not only the element of continuous running — the main factor in the iron and steel variations given above — but the different part played by the cost of materials and the quantity and character of the labor employed. Actual accounts are given by Lancashire manufacturers of the variations in salaries and wages from 14 to 63½ per cent in cotton spinning. Taking two mills spinning the same fine counts of cotton in France and England respectively, we find wages working out at 64 per cent in France against 70 per cent in England; fixed charges at 7½ per cent in France as compared with 4 per cent in England; working expenses at 28½ per cent in France as compared with 26 per cent in England. But this does not altogether show the matter correctly because although in the case of these particular mills the individual wages are smaller in France than in England, yet more workpeople are required in France for the same amount of work, and the wage bill in France is as a total very similar to that in England though the percentages are so different. Taking another instance from worsted manufacture, the analyses of the actual accounts of a large mill come out as follows: In the wool merchanting, wages worked out at .6 per cent of the cost; in the top making 6.9 per cent; in the yarn spinning 13.8 per cent; in the cloth weaving 30 per cent. But the various items, taking the English industry as a whole, vary so considerably that it is quite impossible to reduce the comparison of costs in England and in foreign countries to useful statistical treatment.

Continuous Running.— But in every industry without exception we constantly find the same argument insisted upon as to the importance of continuous running in diminishing costs. Taking this condition of successful competition in conjunction with the tendencies which have been explained toward the loss of staple lines, and the dependence upon specialties, it is at any rate open to discussion how far the changing character of British industry is favorable to the permanent retention of the markets upon which they have hitherto depended, as other countries which have already securely established their staple lines become more and more skilled in the production of articles which compete, directly or indirectly, with the specialties of Great Britain.

The Efficiency of Labor.— Generally speaking, inquiry does not give much support to the belief, which is very widely held, that labor in England is less efficient than that of foreign countries. On the whole the evidence points to the opposite conclusion, but it does appear doubtful whether the progressive increase in wages and the diminution in the hours of labor are, as a matter of fact, followed by a proportionate increase in the productive power of the industries affected. In particular, the relative shortness of the hours in the United Kingdom does appear to handicap British industry by making it extremely difficult or impossible to get so much out of the machinery and plant, and to proportionately reduce the burden of fixed charges. It is not a question of the working capacity or the intelligence of the individual employee or of groups of employees in the same grade, but of the running of the works as an organic whole. Hence, there appears to be, under existing conditions, a growing divergence between the claims of legislation and the interests of the workers as citizens and the need of making full use of modern machinery and plant if costs are to be kept within the limits necessary for successful competition in neutral markets, or even for retaining control of the home market.

Transport and Export Organization in Relation to British Industries.— To this may be added the complications that arise in relation to the organization of British industries through the different relations between each trade and the transport system in England as compared with Germany, the United States, or other foreign countries. The United States is full of examples in which the industry at every stage, from the raw material to the finished product, works in the closest harmony with the transport and general export organization which that industry requires, and the development of the state railways in Germany and the inclusion of transport in the general scheme of national policy, produce similar results. In the United Kingdom on the other hand, railways, steamship companies, commercial organization, and all the other aids to productive enterprise have grown up historically on their own lines, and the whole national system in England is on an "individualist" basis. One of the most interesting problems which the future will perhaps solve is, how far an industry so organized can satisfy the claims of labor at home and at the same time meet on equal terms the disciplined industrial armies of competing countries.

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INDUSTRIAL REORGANIZATION.

26. **Great Britain — Trade Unionism.** English Trade Unionism is an indigenous product, which has remained singularly uninfluenced by any foreign movements or ideas. Disregarding the analogous combinations among journeymen during the Middle Ages, which in England seem to have been usually intermittent and temporary, and also the mediæval guilds of master-craftsmen and merchants — between which and modern Trade Unionism no actual affiliation or connection has yet been traced — we may say that Trade Unionism, in the sense of durable combinations of wage earners for the purpose of maintaining or improving the conditions of

their employment, have existed continuously from the end of the 17th century. The earliest actual records known to us of such a combination is that of the woolen workers of the south-west of England, which is mentioned as existing in 1700, and frequently referred to in Devonshire, Somerset, Wiltshire, and Gloucestershire throughout the 18th century. The London tailors, too, can be shown to have been in continuous combination from at least 1720, when an Act of Parliament was passed to restrain them. Other Trade Unions known to have existed in the first half of the 18th century were those of the woolcombers, woolstaplers and silkweavers. It was, however, apparently during the last quarter of the 18th century, when industrial conditions were being revolutionized in so many trades by the introduction of machinery, the factory system, production for export and the use of water or steam power, that Trade Unionism first became widely prevalent. Since that date, it is notable that the aggregate membership of Trade Unions in the United Kingdom has, with a number of temporary suspensions, persistently increased, until it now (1907) approaches 2,000,000; organized in 1,150 different societies, possessing funds exceeding £5,000,000. As an institution Trade Unionism has, during the whole two centuries, and especially since 1824, when the first legalising statute was passed, steadily increased in solidity, and continuously improved in its temper toward society and in the economic character of the methods employed to gain its end. In all these respects the improvement during the last 30 years has been most marked. Whatever may be the causal connection, if any, the historian cannot but record the fact that the character of English Trade Unionism has varied from decade to decade in close correspondence with the variations of the treatment which the community accorded to it. So rapidly and certainly has an improvement in English Trade Unionism followed upon measures of legalization and tolerance that were it not that it would seem to palliate inexcusable outrages of past times, we should be tempted to the epigram that each generation of citizens and the employers in each trade in each generation have the Trade Unionism that they deserve!

The form which Trade Unionism takes among the English wage earners (and we may ignore for present purposes the Trade Unionism of other classes, such as lawyers, doctors, teachers, etc.), is that of a voluntary association among the persons engaged in a particular trade, based upon the payment of weekly contributions — varying from two pence to eighteen pence — to a common fund which is administered by an elected executive, bound by an elaborate code of rules, and controlled by frequent referendum votes of the entire membership, in such ways as are believed to promote the objects of the members. These objects are, first and foremost, the maintenance and progressive improvement of the conditions of employment of the wage earners in the trade concerned, including not only the amount of wages, but also the method of remuneration, the form of the agreement, the hours of labor, the sanitation, safety and comfort of the operatives, and all the other conditions, explicit or implicit, of the wage-contract. Auxiliary to this fundamental object, and always subordinate to it, are the various "friendly benefits" afforded to members, which may include maintenance payments to members out of work, whether from strikes or lockouts, or merely from slackness of trade; sick pay; medical attendance; funeral benefit on death of member or member's wife; accident benefit; insurance of tools against loss by fire or otherwise; legal assistance to members in litigation, and so forth. It is especially in the durability and financial solidity of the association, the multiplicity and amount of their friendly benefits, and the magnitude of their accumulated funds, that the principal English Trade Unions surpass those of all other countries. There are great Trade Unions (such as the Amalgamated Society of Engineers) which habitually enjoy an annual income of £4 per member; there are others (such as the Amalgamated Cotton Spinners) which possess accumulated funds exceeding £21 per member; there are others, again (such as the Boilermakers), which disburse on sick pay and medical attendance alone, more than £60,000 a year, including no less than £8,000 as salaries to the doctors in their employment. Among them all, the Trade Unions expend more than £250,000 annually in pensions of 5 to 10 shillings a week to their aged members, and nearly £100,000 in payment of their funerals; while £750,000 is annually paid to members out of work, only from one-sixth to two-fifths of this, according to the state of the labor market, being for anything that can be called strikes or industrial disputes. But this strong financial position and these substantial friendly benefits are confined to the well-known leading Trade Unions. Out of the 1,150 separate Trade Unions, there are 20 owning more than £50,000, which together possess one-third of the aggregate total of members and three-fifths of the accumulated funds of the whole movement.

The fundamental principle of English Trade Unionism is the necessity, in modern industrial and social conditions, for the establishment and enforcement of a common rule, with regard to the conditions of employment. Without the enforcement of such a common rule, Trade Unionists assert that the operation of competition is inevitably to degrade the conditions of employment irrespective of the profitableness of the industry or the wealth of the country as a whole; eventually forcing down the remuneration of the lowest and weakest wage earner to the very minimum on which he can manage to exist from day to day (far below the level for healthy subsistence); requiring him to labor for excessive hours, and exposing him to unsanitary, dangerous and brutalizing conditions of employment. Toward such a morass of "sweating," demoralizing to the workers themselves, and economically as well as socially disastrous to the community as a whole, the unrestricted competition of the labor market is always forcing out only the weaker members, but also, through the competition of these, the entire wage earning class. In confirmation of this analysis, the English Trade Unionists point to the state of millions of workers in every industrial country, the United States and Australia affording quite as striking demonstrations as England and the continent of Europe. Its essential accuracy is, indeed, now asserted by the economists of to-day, and mathematically demonstrated (consult 'Industrial Democracy,' by S. and B. Webb, 1902).

Against this persistent tendency of industrial competition in the labor market, the modern economist or statesman establishes, in the interest of the community as a whole, the Common Rule of standard minimum conditions, designed to prevent the wage earner being subjected, even with his own consent, to conditions of employment likely to impair his health, undermine his strength, or demoralize himself or his family. This is the philosophy of Factory Legislation, as yet only imperfectly applied in any country, but advancing in all; as yet restricted in the main to women and children, and to their hours and sanitation, but now slowly extending to wages and other conditions, and to adult men. The maintaining, extending and enforcing of Factory Legislation is one of the principal expedients used by English Trade Unionists (especially the textile operatives, the coal miners, the railway workers and the shop assistants) for obtaining the protection of the Common Rule. Such legislation has been carried to its fullest extent at present in New Zealand and Australia. (Consult 'State Experiments in Australia and New Zealand' by W. P. Reeves).

The second expedient used by English Trade Unionists is that of Collective Bargaining. Instead of each wage earner making his own bargain with the individual employer, the Trade Union aims at making common terms for the operatives as a whole, with the whole of the employers. Examples of such Collective Bargains are the "Working Rules" which govern the building trades in nearly every English city; the elaborate hierarchy of agreements of the iron-shipbuilding trade; or the highly evolved lists of prices of the cotton industry. This does not mean (as often ignorantly asserted) that Trade Unionism implies, or that Trade Unionists desire, that all workers should be paid alike. The mere fact that a large majority of the English Trade Unionists (including the strongest and ablest of them all) absolutely insist on piecework as the very basis of their Collective Bargains, and would instantly strike against any attempt to introduce wages by the hour or by the day, proves that equality of earnings is not their object. What they do aim at is equality in the rate of pay for a given unit of work; though even here their aim is only to secure for every worker the standard rate for the work done as a minimum. No objection is made to more than the minimum rate being given, provided that this is not done in such a way as to bring other workers below the minimum. Collective Bargaining, more or less universal throughout the trade, is now the prevalent practice in all the principal manufacturing industries of Great Britain and it is, to the economist, a notable fact that it prevails most universally and is most strictly enforced, just in those industries, such as cotton spinning and shipbuilding, in which British industrial supremacy is most demonstrable.

The third expedient of English Trade Unionism is Mutual Insurance. By bringing to the support of the individual workman, in any time of economic weakness, the aid of accumulated funds, he is enabled to stand out against the terms offered by the employer, and wait until better terms are conceded. It is with this object, and not primarily from any compassionate or humanitarian feeling, that English Trade Unionists have so generally united the well known "friendly benefits" with their trade combination. The large accumulated funds of some of the English Trade Unions, amounting sometimes to £25 per head of membership, afford valuable assistance in their Collective Bargaining for better conditions, by making possible the final arbitrament of the strike. But they do more than that. In small and closely unit trades, where the operatives are sufficiently self-restrained and intelligent, what we have called the strike in detail may be an effective weapon. There is no overt Trade Unionism. The employer may refuse to recognize the Union, or the law may make corporate action dangerous. There may even be no attempt to prevent the employer filling his vacancies. But if the men in the trade are strongly combined, the employer may find that he cannot keep any man more than a week or two. Each man in succession leaves in silence before he has well settled down to his work, leaving the employer to find out for himself in what way the conditions which he is offering offend against the undivulged Common Rule. Such a strike in detail is out of the power of any but a small, skilled, strongly combined, highly intelligent, and rich Trade Union having an elaborate Mutual Insurance. But with such a Union experience shows it to have often been more efficacious in maintaining the Common Rule, than the most turbulent of strikes.

The English Trade Unions form, with the analogous associations into which the employers in the principal trades are now brigaded, elaborate organizations — based on mutual discussions in joint committees, investigation by neutral accountants and the joint application of principles by the salaried officers of the employers and of the workmen respectively — for Collective Bargaining, the settlement of standard piecework lists, scales of wages, and other general minima of the conditions of employment to be observed throughout the trade; for the application of these formal agreements to the varying circumstances of particular districts, particular establishments, particular branches of work, and even particular jobs; and also for the revision of these general agreements, and the settlement by arbitration of the disputes that from time to time inevitably arise. This elaborate machinery for determining, irrespective of the will or caprice of individual employers or individual operatives, the minimum conditions on which the whole trade shall work, is most highly organized in the cotton manufacturing, coal mining and shipbuilding industries, together with some smaller trades, such as the brassworkers, lacemakers, and compositors.

The Trade Unions have, however, further organizations of their own. The local branches in each town are united for mutual support in Trade Councils, of which there are now over 200. These organizations are of little financial strength, and chiefly of moral support. More substantial are the great federations, of which the principal one, the General Federation of Trade Unions, now includes over 90 large Trade Unions, with 400,000 members, and an accumulated fund of £100,000. This has for its object the mutual support of its constituent unions in industrial disputes. Another federal body, the Federation of Engineering and Shipbuilding Trades, with 350,000 members (including most of those in the General Federation), has for its principal object, the prevention and settlement of the disastrous disputes that occasionally break out between one set of workmen and another as to the "encroachments" by one trade on another, and the proper "demarcation" of their several pieces of work. A third body, the Miners' Federation, is composed of practically all the coal mining Trade Unions, and has, beyond mutual support, principally for its object the obtaining of additional Mines Regulation Acts, especially the enactment of an eight hour law.

The relative proportion which Trade Unionship members in the United Kingdom bears to the wage earners as a whole, is often much misunderstood. The two millions of Trade Unionists amount to only one in seven of the whole. What is, however, obscured by the statement is that the vast mass of the wage earners belong to occupations in which Trade Unionism does not exist, or exists only in rudimentary form — such, for instance, as the agricultural laborers, the unskilled laborers in urban districts and the domestic servants, or the large numbers who work in one or other form as independent producers, such as the jobbing craftsmen, the tin and copper mines, the homeworking seamstresses, etc. Women workers, generally, including all the factory population, count only 125,000 Trade Unionists out of some four millions of women industrially employed. A more correct way to estimate the strength of Trade Unionism is to take the proportion of Trade Union membership to the adult males employed at wages in particular industries. In many cases, such as the boilermakers, the cotton spinners, the lacemakers, and the coal miners, it would be found that over whole districts of England every operative actually employed was a Trade Unionist. In such industries, indeed, Trade Unionism is as universally compulsory as citizenship, and is enforced by as little conscious pressure. It is taken for granted by every workman, as it is by every employer. The whole industrial organization is adjusted to it, with the result that it becomes as imperceptible as the weight of the atmosphere. On the other hand, there are great industries, such as the building and engineering trades, in which, while strong Trade Unions exist, are whole districts in which a majority of the workmen remain outside the unions, not caring to pay the weekly dues; and usually in every town some establishments which employ indifferently both Unionists and non-Unionists. To the economist it is significant that it is precisely in those industries in which Trade Unionism is virtually universal and compulsory — among them being particularly cotton spinning and shipbuilding — that both technical processes and the use of machinery have been most advanced, and both industrial efficiency and financial success have been most conspicuous. In contrast stand the "sweated" industries, low grade in quality in their nature, and curiously unstable in their position in the world-market. In these industries neither Trade Unionism nor effective Factory Legislation exists.

Bibliography.—The principal authorities are the 'Annual Reports' of the Board of Trade (Labor Department) on Trade Union Statistics, and on Strikes and Lockouts. For the history, consult 'The History of Trade Unionism,' by S. and B. Webb (1902 edition), and (as to origins) also 'Industrial Organization in the 16th and 17th Centuries,' by George Unrvin (1904). For an elaborate economic analysis of every form of Trade Union activity, consult 'Industrial Democracy' by S. and B. Webb (edition of 1902); also 'Methods of Industrial Remuneration,' by D. L. Schloss; 'Industrial Peace,' by L. L. F. R. Price; 'The Case for the Factory Acts,' edited by Mrs. Sidney Webb, with preface by Mrs. Humphrey Ward. For the case against Trade Unionism, from the standpoint of the individualist employer, consult 'Trade Unions and Industry,' by E. A. Pratt.

Sidney and Beatrice Webb,
Joint authors of 'The History of Trade Unionism': 'Industrial Democracy'; 'Problems of Modern Industry.'

27. Great Britain — The Labor Movement in Politics. The greatest politician of the last century, W. E. Gladstone (q.v.), writing in 1892, expressed the opinion that "The labor question may be said to have come into public view simultaneously with the repeal of the Combination Laws," — that is about 1825.

Accepting this authority, we may divide the 80 years that have since elapsed into three periods, dominated not as might be expected by three but by two ideas. From 1825 to about 1850, labor, when it fought at all, fought under its own flag, and disdained alliance with any other party. From 1850 to 1900, partly owing to the dominating personality of Mr. Gladstone, political labor for the most part joined hands with Liberalism. In 1900 the banner of independence was raised once more, and has already attracted the greater part of the political forces of the proletariat.

The First Period of Revolt.—Up to 1832 the Government of England was an irregular oligarchy rather than a democracy. The House of Commons which then as now exercised supreme control, was elected in a haphazard fashion. A few members represented large democratic constituencies; many were elected by some scores or hundreds of voters; many others were practically nominees of individual landowners or of the Crown. Labor scarcely aspired to political rights; all it asked was relief from coercive legislation and excessive taxation. The populace, of course, supported the reformers of 1820-32, and it was fear of revolution which forced the House of Lords to consent to the passage of the Reform Bill.

Nearly the first work of the reformed Parliament of 1832 was the amendment of the old Poor Law, which had reduced the agricultural laborers of southern England almost to the condition of serfs, owned not by individuals, but by their parishes. The abolition in 1834 of the system of indiscriminate outrelief was intensely unpopular, and this, combined with the memories of the recent reform agitation, and with the teachings of Robert Owen (q.v.), who had promulgated many of the doctrines of modern Socialism, led to the Chartist movement, the first distinctively working class political agitation in modern England. (See CHARTISM.)

"The People's Charter," drafted by Francis Place, the radical tailor, was issued in 1838. Its six points were universal (*i. e.* manhood), suffrage, election by ballot, payment of members, annual parliaments, equal electoral districts, and the abolition of property qualification for members. This purely political programme gathered to itself the whole of the working class discontent which hitherto had taken other forms. In 1839 the north of England was saved from a revolutionary rising by the ability of Sir Charles Napier; and Chartism was crushed by the imprisonment of its leaders. It survived till 1848, when the continental revolutions fanned it again into flame, but it expired after the failure of a monster meeting at Kennington, London, which was to inaugurate the British revolution. Meanwhile the agitation for the abolition of the Corn Laws, which was successful in 1846, had attracted to the Liberal party a great measure of labor support, and with the disappearance of Chartism, the first period of revolt terminated.

Labor in Alliance with Liberalism.— The abolition of the Corn Laws was followed by a series of years of expanding trade and growing wealth; the narrow Whig oligarchy was gradually replaced by a broader Liberalism which conferred the suffrage on the workmen of the towns in 1867, and on those of the rule districts in 1884. John Bright (q.v.), the tribune of the people, and Joseph Chamberlain (q.v.), the idol of radical Birmingham, were the real leaders of the working classes up to 1886, and Gladstone generally held their allegiance from 1868 till his retirement in 1894. The trade unions had during this period established themselves as national institutions, and the standing Parliamentary committee of their annual conference was in constant friendly communication with Sir William Harcourt (q.v.), Sir Henry James (now Lord James) (q.v.), A. J. Mundella, and other leading Liberals. George Odger was one of the first working-class aspirants to Parliament, but he died before the day of victory. In 1874, Thomas Burt (q.v.), the Northumberland miner, was elected for Morpeth, a position he still retains, and his remarkable career has been honored in his old age by the high dignity of a seat in the Privy Council. In the same election another Labor candidate, Alexander Macdonald, was successful. At first the Liberals opposed these upstarts: but their claims were soon admitted, while their harmless respectability and valuable special knowledge were generally acknowledged. In 1880–83 trade unionists were elected; in 1885, 11; in 1886, 9; in 1892, 15; in 1895, 12; while 3 more were successful at bye-elections between this date and 1900. Meanwhile Henry Broadhurst, a stone-mason, was appointed Parliamentary Under-Secretary of State for Home Affairs in 1886, and Thomas Burt, a miner, was Parliamentary Secretary to the Board of Trade from 1892 to 1895.

It may be said that almost all these men were elected as Liberals. The distinction between them and the others of their party was that they had been manual workers, they had entered Parliament as nominees of their fellow workmen, and usually their election expenses were paid and their maintenance was provided by the funds of their trade unions. But in fact the classification, though definite, is not determined by any one factor. Working men were elected during this period in considerable numbers to town councils, school boards, county councils, and other local governing authorities, and many were appointed justices of the peace, that is members of the unpaid courts of first instance.

The New Revolt. — The origin of the revival of independence in politics dates from 1884, when the modern Socialist movement began in England. In this year the Social Democratic Federation, founded a short time before by H. M. Hyndman, became distinctively socialist, and the adhesion to its ranks of William Morris (q.v.), the poet and artist, brought it into immediate prominence. Several Socialist candidates were put in the field at the election of 1885, but they all failed to secure more than a few dozen votes, except John Burns (q.v.), now President of the Local Government Board, who polled 598 votes at Nottingham, but, of course, was defeated.

From this time onwards the Socialist party made slow but steady progress. The Fabian Society, founded also in 1884, devoted itself to adapting the principles of socialism to English political conditions, and in 1893 J. Keir Hardie (q.v.) (Ayrshire Miners), who had been elected to Parliament for West Ham, near London, the year before, founded the Independent Labor Party, a socialist body whose object was to promulgate a form of socialism more acceptable to British trade unionists than the doctrinaire and revolutionary gospel according to Marx, which was then expounded by the Social Democrats.

Here we must turn aside to make one point clear. The Independent Labor Party (commonly called the I. L. P.) is a small, though influential, socialistic body, which has never numbered more than some 15,000 members. It must be carefully distinguished from the Labor Party which is before all things independent, as well as from the Labor Party in its wider sense. This important distinction is constantly neglected even in the best-informed London press.

During the fifteen years prior to 1899 the Socialist societies kept up a constant agitation for the direct and independent representation of labor in Parliament, with a certain measure of success. John Burns was elected in 1892 for Battersea as an independent attached to no party. Keir Hardie, after his election, carried his independence even further, but lost his seat in 1895, and was not re-elected till 1900. Meanwhile the trade unions had been gradually permeated with the new spirit, and in the autumn of 1899 at their Plymouth conference, a resolution was carried instructing their executive to call a conference of trade unions and Socialist societies in order to form a new body for the promotion of labor representation. This conference met in London in February 1900, and the Labor Representation Committee was then founded with a membership (at the close of the first year) of 376,000, of whom less than 23,000 were Socialists and the rest trade unionists.

The new body (which in 1906 altered its name to the Labor Party) consisted of a federation of trade unions, trades councils (that is the local organization of trade unionists in each town), and the three Socialist societies, of which, as previously mentioned, the Independent Labor Party is one. The Social Democrats, however, withdrew a year or two later. At the general election of 1900, the Labor Representation Committee, as it was then called, put 15 candidates into the field, but it was only a few months old; the Conservative Party, asking a vote of confidence from the country while the South African war was in progress, won an overwhelming victory, and the Labor Party was not ill-pleased to score two wins, Keir Hardie at Merthyr and Richard Bell at Derby. During the next five years it won three sensational bye-elections, but Mr. Bell dropped out, and at the dissolution the new party numbered four. Mr. Bell's defection was due to a change in the policy of the body. It was first formed to create a «group»; it was determined that candidates supported by the Labor Representation Committee might ally themselves on other questions with the existing parties; that independence should be limited to labor questions alone. Against this policy a constant internal struggle went on till the Newcastle conference of February 1903, when the extremists won an overwhelming victory, and thenceforward the watchword was complete independence of all other political parties.

There are two chief reasons for this policy. One, of course, is distrust of the Liberal Party which is largely middle-class, controlled by wealth, and in league with a section of the aristocracy. It is not necessary to discuss how far this distrust is well founded, because it is undeniable that the Liberal Party, as at present constituted, must consider other interests as well as those of the workers. The other reason is more cogent. If labor makes any political alliance it must be with the Liberals. Once indeed the secretary of the cotton-operatives was a Tory candidate for Oldham, but he lost the seat for his party, and he is the only exception to the otherwise unbroken rule tnat labor alliance means alliance with Liberalism. But very many trade unionists, especially in Lancashire, are Conservative, or at any rate are strongly anti-Liberal, and they would not be content to see their contributions to their unions invariably used in the interests of their political opponents. In fact it was the accession of 103,000 textile operatives that at the Newcastle conference turned the scale decisively for independence. Five years were spent in active preparation, and the long-expected election of 1906 found the Labor Party ready for the fight. It put 50 candidates into the field, and elected 29 of them. After the election another joined their ranks, and for the first time in British history the workers of the country were represented by a compact independent party in the House of Commons. No aspect of the election attracted more attention at the time, and in the few months since the new party has fully justified itself, by the activity and political ability of its members, and their success in moulding the policy of the Liberal government.

Political Labor in 1906.— Having traced the history of the participation of Labor in politics, we shall conclude with a survey of its present position, which will reveal an extraordinary complexity of organization, and a considerable diversity of ideas.

The most dramatic result of the Liberal victory was the appointment of John Burns, engineer, socialist, and trade unionist, to a seat in the Cabinet as President of the Local Government Board, which carries with it membership of the Privy Council. The appointment was fully expected. John Burns was too powerful a force to be left outside, and he can rightly claim that he entered the Cabinet as a direct representative of labor. He is still a member of his trade union, and until his salary as a minister began to run, he was largely maintained by grants from his own and other unions. As member of Parliament for Battersea Mr. Burns was never distinctly a Liberal: he stood as John Burns. His appointment was the most popular act of the government which took office immediately before the election, and for a time John Burns himself was the most conspicuous man in England.

The representatives of labor in the present parliament belong to three distinct groups: (1) The Labor Party proper, the group of 30 men who sit in opposition to the Government, and act in complete isolation; (2) the Miners, of whom there are 13 (besides one or two in the Labor Party), some of whom were elected as Liberals, some as miners simply, who in a few cases fought and beat the official Liberal; (3) the Liberal-Labor men who numbered 11 at the election, but who have since been reduced to 10 by the retirement of Mr. Broadhurst. The Miners and the Liberal-Labor men form a group within the Liberal Party, and a number of advanced radicals usually co-operate with them.

Outside Parliament there are three great working class organizations: (1) The Parliamentary Committee of the Trade Union Congress, which is the largest and traditionally most important of the three, though its functions have now been largely usurped by the younger bodies; (2) the Federation of Trade Unions, formed to organize a common fund for strike purposes, which takes but little part in politics; and (3) the Labor Party, which exists for politics alone. Joint committees of these three bodies have frequently been formed for special purposes; a joint board now exists to promote co-operation, and the same set of men form the executives, sitting sometimes on one, sometimes on another, and sometimes even on two of the committees.

The Labor Party consists first of the 30 members of Parliament. These men are required by the rules of their party to stand as labor candidates only. In fact about 23 are members of socialist societies, chiefly the Independent Labor Party. The Labor Party organization which finances these candidates consists of 158 trade unions with 904,496 members, two socialist societies with 14,730 members, and 73 trade councils whose membership owing to overlapping cannot be counted. Except for the Miners, who are scarcely represented, the whole of the English trade unions may be said to belong to the party. Its funds are provided by a payment of 15/– per 1,000 members, for working expenses, and one penny a member (likely to be increased to 2d.) for the Parliamentary Fund, out of which the 29 members elected under its auspices are paid £200 a year, with a small contribution toward election expenses.

The body holds an annual conference which has exclusive power to alter rules and determine policy. This conference elects the executive committee of 13, of whom nine are chosen by the trade unions, one by the trade councils, and three by the Socialists. It will be noted that Socialists who only contribute one-sixtieth of the funds and only possess the same proportion of the voting power at the conference are accorded three-thirteenths of the executive committee, while the Secretary, J. Ramsay Macdonald, M.P., also belongs to their party. This arrangement, deliberately maintained at the conference of 1905, after keen debate, is a tribute by the trade unionists to the political importance of Socialism. Every organization affiliated to the Labor Party can put forward its own candidates if it undertakes to provide their election expenses, and, if successful, the member is paid by the party. The 50 candidates who stood in 1906 were put forward partly by the trade unions and partly by the Independent Labor Party; the Fabian Society does not collectively run candidates, though many of its members stood and seven were elected. Of the Social Democrats only one, who stood as a Labor candidate nominated by the dock laborers, was elected.

The Socialist wing of the labor movement is represented by three national societies, the oldest and most orthodox or doctrinaire of which is the Social Democratic Federation. It claims about 10,000 members, and has done much to influence public opinion. The Independent Labor Party claims about 14,000 members and has about 19 members in the House of Commons. It is very influential because it has always striven to work in harmony with the trade unions; its members not only fill trade union Parliamentary seats but all other offices as well, both in voluntary and local governmental organizations. The third socialist society is the Fabian Society, a body with under 1,000 members, mainly middle-class. It may roughly be called an association of leaders. It does not aim at a large membership and devotes itself to education, and the formulation of socialist policy. It has eight members of Parliament, some Liberal, some Liberal-Labor, some Labor, and some both Labor and Independent Labor Party.

The political aims of labor are very indefinite. All are united on demanding such reform of the law relating to trade unions as will undo the recent legal decisions ("Taff Vale" and others) which have destroyed the security of their funds. As their bill will probably soon become law, an exact exposition of their grievances is unnecessary. These hostile legal decisions contributed largely to the success of the movement for political independence amongst trade unionists. Otherwise, the members of the Liberal-Labor section, including the miners, vary in the complexion of their opinions as do the others of their party; a few are individualists, many are Socialists, in their leanings; some are extreme and others are moderate in their radicalism.

The Labor Party itself includes men of divergent opinions, though to a less extent than the others. About three-quarters of its members are Socialists. The remaining quarter declines so to label itself, but it has no definite creed, and constant association with men of strong opinions, who as a rule have studied political and social problems, makes it to say the least, extremely tolerant of socialism.

Because of this divergence the Labor Party has refused to formulate a programme. It has issued official leaflets in favor of Old Age Pensions, and of the nationalization of railways and of land. It has advocated state provision of work for the unemployed and of meals for underfed school children; and it strongly supports free trade, a policy on which all sections of labor are united. The attitude of the Labor Party to the Liberal Government again is conditioned by various factors. The party exists by independence, but none the less it was elected largely by Liberal votes. Only five of the 29 members were opposed by Liberals. In 16 cases the Liberals left them alone to fight the Tories. In eight other cases of two-membered constituencies, the Liberals only put up one candidate. Thus 24 out of the 29 Labor men polled the bulk of the Liberal vote in their constituencies.

The Socialist political policy includes the labor policy above indicated, and goes farther on the same lines. It advocates the municipalization of the liquor trade, and more drastic interference with the evil results of competition, such as long hours and overtime, child labor, and sweating of women's labor; it favors compulsory arbitration to replace strikes and lock-outs; and a more vigorous extension of the sphere of municipal and governmental industry. Some Labor men oppose some of these proposals. Very few would oppose them all.

At present the prospects of the Labor Party are bright. Its leaders are united and harmonious. The party is in a stronger financial position than any other section, since its members are paid a regular salary from a central fund. Moreover the party has made a name for itself; it is a force to be reckoned with; its action is watched, and its intentions discussed in advance. In every respect the Labor Party member has a marked advantage over his Liberal-Labor rival. There is every prospect that the Labor Party will grow stronger and no doubt before long the half million miners with their 11 members of Parliament will join its ranks.

Prophecy in politics is peculiarly risky but it is fairly safe to say that the share of labor in the control of the destinies of the Empire will be larger in the future than it has been in the past.

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Third Period.— Webb, 'Socialism in England' (Sonnenschein 1893); Noel, 'The Labor Party: What it is and What it Wants'; (Unwin 1906); Annual Reports of the Labor Party (London); Annual Reports of the Trade Union Congress (London); Annual Reports of the Independent Labor Party (London); Publications of the Social Democratic Federation (London); Annual Reports of the Fabian Society (London).

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28. Great Britain — The Co-operative Movement. The earliest examples of co-operative institutions are the corn mills and baking societies started in the closing years of the 18th century and the first decade of the 19th as a relief from the millers' monopoly and the exorbitant price of flour. At Hull, Whitby, Sheerness, Devonport, and sundry places in Scotland, mills and bakeries were worked successfully on a ready-money, cost-price basis, but they had little effect on the subsequent movement, though Sheerness and a few other societies still exist. The co-operative idea, as we know it, was evoked in the mind of Robert Owen by consideration of the antagonism of classes produced by the industrial revolution with its widespread misery among the factory operatives. Failing to persuade his fellow manufacturers to follow his example of humane treatment of his employees, and failing to obtain efficient factory legislation from the government, he devised the plan of organizing the workers into self-sufficient communities, owning and cultivating the land in common and producing commodities for their own use or for exchange with other communities. Two such colonies, at Orbiston in Lanarkshire (1826) and at Ralahine in Ireland (1830–4), nearly succeeded. His followers, who enthusiastically adopted his communist doctrines, started, from 1828 onwards, numerous associations for co-operative trading, which employed their profits in setting their members to work at manufacture on a small scale. To provide a market for the goods so made, Owen in 1832 opened his Equitable Labor Exchange at Gray's Inn in London, where persons leaving goods for sale received in exchange labor-notes based on the average time of production at sixpence per hour. In 1830 there were nearly 300 "Union Shops" with over 20,000 members, and between 1830 and 1835 seven Co-operative Congresses were held. But by 1835 the whole movement collapsed owing to want of legal status, the divergent interests of the members, and the failure of the labor-time principle. The enthusiasm of Owen's followers now overflowed into the Chartist movement.

The second stage in the history of co-operation began in 1844 with the founding of the Rochdale Society of Equitable Pioneers by a group of socialists, chartists, and trade unionists, who found the motive in the failure of a strike among the flannel weavers. Its objects were the sale of provisions, etc., the building and buying of houses for members, the employment of out-of-work members in manufacture, the purchase of an estate to be cultivated by members out of work or underpaid, "to establish a self-supporting home colony of united interests," and to start a temperance hotel. Cash payment and good quality were principles shared with the older movement, but the new departure on which the success of co-operation was to turn was the surrender of the attempt to sell at cost price. In lieu thereof Charles Howarth introduced the system of dividing profits upon purchases, and from that moment co-operation has never ceased to prosper. This system took the government of the society out of the hands of founders or shareholders and transferred it to the customers, that is to the general co-operative community. The rules for the organization of a Co-operative Society have remained substantially the same as those of the original Rochdale Society. To quote one example: "The object of this society is to carry on the trade of dealers in food, fuel, clothes, and other necessaries, and manufacturers of the same; the trade of general dealers (wholesale and retail); including dealings of any description with land, and the trade of builders." Membership is free to all, and each member must hold a fixed minimum of one-pound shares one to five, carrying interest at 4 or 5 per cent. The maximum investment is £200, and each member has one vote only, whatever his holding of shares. The quarterly general meeting of the society is the governing body, but the management is in the hands of the committee, generally elected for a year, half retiring each six months. The secretary is elected for a year by the general meeting, but is the servant of the committee, which appoints all the other officials and workpeople. The shares can be withdrawn but are not transferable and therefore have never more than their face value. The business of the store is transacted in the same way and at the same prices as ordinary shopkeepers, and after interest has been paid the profits are divided among the customer-members in proportion to their purchases. Metal tokens or paper checks registering the value of each purchase are given to the buyer, and are collected periodically and credited to him. Non-members are allowed half dividend. Out of the profits a bonus is sometimes paid to labor (£45,073 in 1905) and grants made for educational and charitable purposes (£120,831 in 1905).

The co-operative movement now grew with exceeding rapidity. In 1862 the total sales of all the societies of all kinds in the United Kingdom amounted to £2,333,523; in 1870 to £8,201,-685; in 1880 to £23,248,314; in 1890 to £43,731,-669; in 1900 to £81,020,428. In 1905 there were 1,457 retail societies with 2,153,185 members, a share capital of £26,077,174, total sales of £61,-086,991, and profits of £9,959,238. Nineteen stores have annual sales exceeding £400,000 each. The obvious advantages of buying in large quantities led to the formation of the North of England Co-operative Wholesale Society in 1864 which in 1874 amalgamated with a similar metropolitan body to form the Co-operative Wholesale Society of England, with headquarters at Manchester. Only societies can be members and each member society must take up one five-pound share for each 10 of its members, such shares being transferable at par. The general committee of 16 sitting at Manchester governs the society with the assistance of two branch committees of eight each at Newcastle and London. The final authority resides in the quarterly meeting, which, for sake of convenience, is held in three parts at Manchester, Newcastle and London, each member-society being entitled to one delegate for each 500 members. Questions are settled by the total votes at the three meetings. Goods are sold at slightly over cost price and the profit divided among the purchasing societies in proportion to their purchases. The Scottish Co-operative Wholesale Society, established in 1868, is similarly managed, but the member-societies have one vote in virtue of their membership, one vote for the first £1,000 of purchases, and one vote for each additional £2,000. A bonus is paid to employees at the rate of twice the purchasers' dividend. The two Wholesale Societies do not compete but act as each other's agents. There are sale depots at Leeds, Nottingham, Blackburn, Huddersfield, Birmingham, Leith, Kilmarnock, and Dundee, and buying agencies in Ireland, Denmark, Germany, Spain, United States, Canada, etc. In 1905, the two societies had 1,419 members with £1,660,072 capital, their sales amounted to £27,-725,207, and their profits to £635,873.

Besides buying and selling at wholesale, the Wholesale Societies carry on a large amount of manufacture — boots and shoes, candles, woollens, clothing, furniture, brushes, upholstery, bedding, butter, flour, lard, jam, tobacco and printing by the English society; flour, tweeds, blankets, tailoring, shirts, mantles, furniture, boots and shoes, hosiery, brushes, preserves, confectionery, tobacco, fish-curing and printing by the Scottish Society. The output of the English Society's productive works in 1905 was valued at £3,543,501, and of the Scottish Society at £1,942,321. The two societies own tea plantations in Ceylon, and the Scottish Society is now considering the purchase of a tract of land in Canada for wheat growing. The English Society conducts a banking department for the distributive stores and its turnover in 1905 was £98,999,831. The Co-operative Newspaper Society is another federal institution owned by co-operative societies. It publishes the *Co-operative News*, the weekly organ of the movement. The Co-operative Insurance Society is another "society of societies" doing mainly fire insurance of society buildings, £22,000,000 of property being so insured. The United Baking Society of Glasgow (capital £130,372, sales £482,544 in 1905) and eight corn mills (capital £347,071, sales £1,364,527 in 1905) are also productive societies, federations of ordinary stores. Production to the amount of several millions sterling is carried on by ordinary distributive societies, mainly in flour and baking, 19,456 persons being employed in production, and much activity is also shown by many societies in building houses to be sold or leased to members. The total investments of the stores in "house property" (including presumably their own buildings) is £6,576,217.

A large section of co-operators has always held that co-operation, which did not include a co-partnership with labor, was only a masquerade. To the Owenite communities succeeded the Redemptionist Societies "for carrying out the practice of associative labor," which had a brief life about 1850. The Christian Socialists—Kingsley, Maurice, Ludlow, Neale—in 1848–52 established some twelve "self-governing workshops" in which the employees were to supply capital, management, and labor. Next in the early sixties came the "Oldham Coops.," joint-stock cotton spinning companies in which the shares were mainly held by operatives, but they degenerated into ordinary companies. Efforts at founding manufacturing societies were persistent, and the wholesale and distributive societies and trade-unions lost large sums of money; 275 societies established before 1880 were extinct in 1882, leaving only eight corn-mills and 25 other societies. In 1884 the Labor Association was founded to promote productive societies on the basis of a co-partnership of labor and capital, the workers being entitled of right to a share of profit and being at liberty to invest their savings in shares. The mortality among societies continued high despite brisk propaganda—139 societies disappearing between 1880 and 1898. In 1905 there were 131 "productive societies" (excluding the federal corn-mills, the United Baking Society of Glasgow, and the Co-operative Newspaper Company) with 27,813 members, £409,054 share capital, £1,316,126 sales, and £68,051 profits. Losses were made by 23 societies, and of 91 making profits, 72 gave part to capital, 35 part to labor, and 37 part to purchasers. The Co-operative Production Federation was started to aid the societies with capital and prevent overlapping. Eighteen textile societies had sales of £456,100 and 22 boot and shoe societies had sales amounting to £272,935; 16 metal working societies had sales of £92,886 and 14 building societies sales of £92,825. A new branch of activity is the "Co-partnership Tenant's Movement" for building and owning houses which has established since 1888 many co-operative colonies; there are now eight societies, of which four are active with £82,600 capital. In agriculture there are now 125 societies with 10,000 members and £250,000 turnover; they consist of farmers and small holders, buy seed and manures and sell produce for their members. On the whole they belong to a different class from the ordinary working-class societies. Finally, there is to be mentioned the Co-operative Union, started in 1869, which carries on propaganda through its district committees and the United Board formed of representatives of the sectional boards. It is also the parliamentary organ of the movement and devotes much labor to organization and education. Under its auspices is held an annual congress of co-operative societies at which matters of interest to the movement are discussed, but the resolutions carried thereat have no mandatory force. The Woman's Co-operative Guild, started in 1883, had, in May 1906, 424 branches and 22,077 members; it has done much education work among woman members of stores and has been specially active in organizing special stores in very poor districts.

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29. **Great Britain — Factory Legislation.** In the year 1784, there raged at Radcliffe, near Manchester, an epidemic fever in the cotton spinning works, where long hours of labor and a total absence of sanitation had undermined the strength of the juvenile operatives. The conditions of work in the Radcliffe Mills were not worse than those prevailing throughout the neighboring industrial district, in which the new factories were multiplying fast. The epidemic of fever was but one among many similar epidemics. But when, at the request of the Lancashire Justices of the Peace, this particular outbreak was investigated by a committee of Manchester doctors, and when the leading physician among them, Dr. Thomas Percival, and the Chairman of the Quarter Sessions, Thomas Butterworth Bayley, persuaded their fellow magistrates that the gravity and rapid diffusion of the sickness really arose from the "putrid effluvia" of the "numbers crowded together" in the new mills, and the "injury done to young persons through confinement and too long continued labor," they were close to the discovery of the great device of factory legislation. At once the Manchester Justices, who were not at that date pecuniarily interested in cotton mills, decided henceforth to refuse to allow the "indentures of parish apprentices whereby they shall be bound to owners of cotton mills and other works in which children are obliged to work in the night, or more than 10 hours in the day." In 1796, Dr. Percival and his friends definitely formulated certain resolutions, in which they again drew attention to the physical and moral evils of excessive hours of labor, of the unsanitary conditions of the factories and of night work; and in which they proposed, "if other methods appear not likely to effect the purpose," that Parliament should enact "a general system of laws for the wise, humane and equal government of all such works." Here we have expressly suggested the expediency of factory legislation. Within half a dozen years the first tiny instalment of that legislation—the "Health and Morals of Apprentices Act, 1802"—had, at the instance of the greatest mill owner of the time (Sir Robert Peel), passed into law. This experimental legislation of 1802, expanded by Robert Owen in 1815 into a general principle of industrial government, and applied in tentative instalments by successive generations of unwilling statesmen, has spread to every industrial community in the Old World and the New. Of all the 19th century inventions in social organization, factory legislation is the most widely diffused. The opening of the 20th century finds it prevailing over a larger area than the public library or the savings bank; it is, perhaps, more far reaching if not more ubiquitous, than even the public elementary school or the policeman.

It is sometimes said that England has lost the lead in factory legislation; that New Zealand and several of the Australian states far outstrip her; and that in one respect or another France, Germany, Switzerland, and even Austria, surpass the United Kingdom in the protection of labor. This is not the place to examine into the accuracy of these assertions. It is by no means easy to ascertain, even from the laws of a country, exactly what national minimum it proposes to enforce, in all the varied circumstances of place and process, age and sex. Still less easy is it to discover to what extent the law is really obeyed and enforced. Though the policy of a national minimum is, in the United Kingdom, as yet most inadequately embodied in law, and most imperfectly enforced, yet it may well be that the scope of the factory legislation is, taken as a whole, and as applied in actual practice, more extensive than that of any other state.

What is often overlooked is that the law on the subject is, in the United Kingdom, not contained in any single code, or in any one act of Parliament, but has to be collected from among seven different branches of English law. There is first the law as to sanitation, which applies to factories as to other places, and is administered by the Town Council or other local governing body under the supervision and, more or less, the control of the local Government Board. With this we may name the law as to education, with its incidental restrictions on the employment of children under 14, enforced by the Town and County Council under the supervision of the Board of Education. It is partly in connection with education, too, though partly also in connection with the prevention of cruelty to children, that the Town and County Councils are empowered to make by-laws, subject to the approval of the Home Office, regulating or prohibiting the employment of children and young persons under 16 in certain occupations. The law regulating the conditions of employment as such is itself scattered over five distinct series of acts of Parliament, relating respectively to (a) factories and workshops generally, including all manufacturing industries, laundries, docks and works of engineering; administered partly by the Home Office itself and partly by the local governing bodies under the Local Government Board; (b) mines, administered wholly by the Home Office; (c) retail shops, administered wholly by the local government bodies, under the Local Government Board; (d) ships, and (e) railways, both administered wholly by the Board of Trade.

The principle underlying this mass of complicated and detailed legislation—a principle which was not consciously present to the mind of its early advocates, and one which is still only grudgingly admitted—is the establishment and enforcement of a "national minimum" in the circumstances of employment, below which it is judged to be inexpedient, in the permanent interests of the community as a whole, that any person should be employed. "The ultimate end of factory legislation," approvingly wrote the *Times* of 12 June 1874, "is to *prescribe* conditions of existence below which population shall not decline." This compulsory national minimum is naturally a rising one. "Every society is judged, and survives," aptly said Mr. Asquith in 1901, "according to the material and moral minimum which it *prescribes* to its members."

It would be an interesting and supremely useful subject for graduate study to discover what is the national minimum which the various civilized states of the world, now actually *prescribe*, by compulsory law, to the various grades and classes of citizens, in the different circumstances of their respective employments. To do this even for the United Kingdom would require much more than the space here available. The student would find that the system of regulation which began, in 1802, with the protection of the tiny class of pauper apprentices in textile mills now includes within its scope every manual worker in every manufacturing industry. From sanitation and the duration of labor, the law has extended to the age of commencing work, protection against accidents, the fixing of meal times and holidays, the methods of remuneration — not yet (though this, too, in New Zealand and Australia) the amount of the wages. The prescription of national minima is, however, still very far from being either uniform or systematic. The various requirements in the way of sanitation, duration of labor, hours of beginning and ending, age of commencement, meal times and holidays, methods of remuneration and protection against accidents, often apply, each of them, to particular industries, particular processes, particular ages, particular localities and particular sexes; partly, of course, because the various detailed prescriptions are, in their very nature, applicable only to this limited extent; but, more commonly merely on account of the empirical, and so to speak, accidental character of all our legislation. Speaking generally, we may say that the policy of the national minimum has been most completely and efficiently worked out in the industry to which it was first applied, mainly cotton spinning and cotton weaving; and in which—whether *post hoc* or *propter hoc*—England still leads the world; taking industries generally, it has been far more thoroughly applied to the employment of women and children than to that of men, in respect to whom it is only just beginning; with regard to subjects of prescription, it is most universal in respect of the cleanliness, ventilation, temperature and sanitary accommodations of the work place, and the means of escape from fire; next most in respect of the age of commencement, the maximum working day and protection against accidents; whilst with regard to the enforcement of a national minimum of subsistence, we are in the United Kingdom, still in the stage of wondering how the unlettered rulers of New Zealand and various Australian states can manage actually to accomplish that which the English statesman and captain of industry agree to be demonstrably impossible. The policy of a national minimum secures universal lip homage, so far as it applies to children. Yet our young children may lawfully be industrially employed, or even hired out for wages, in all Ireland outside the few large cities, if in any industry not coming under the Factory Acts, at any age, at all hours, without stint; in Great Britain and the Irish cities (unless new by-laws have recently been made) in any such industry at any age, for any number of hours; under such by-laws, generally only after 11 years of age, and for limited hours, differing from place to place; in factories or workshops, not under 13, and then only halftime unless a minimum educational standard, prescribed by the local education authority, has been attained; generally speaking, full time after 14; but in some specified industries or processes not until 16, or even 18. Still more wanting in universality and uniformity is the enforcement of such national minima as the law does prescribe. The distribution of the task of enforcing the law among over 2,000 independent local governing bodies, in England, Scotland and Ireland; the supervision and imperfect control exercised over these by four different government departments in England, besides several others for Scotland and Ireland; and the very different views which these government departments take of their duties—to say nothing of the very different degrees to which they have consciously adopted the root-idea of factory legislation as above set forth—necessarily makes the enforcement of the law extremely uneven. Only in one branch, indeed, that which deals with "factories" properly so called, in which women and children are employed in connection with mechanical power, can the law be said to be at all successfully and systematically enforced from one end of the Kingdom to the other. This happens to be the branch of the law which is enforced by an official staff, appointed by and solely responsible to, the Home Office in London.

For the enforcement of the policy of the national minimum, so far as this is committed to him, the Home Secretary has at his disposal, in the Factory Department of the Home

Office, a "Chief Inspector," a score of specialist and superintending inspectors, 42 district inspectors, nearly 50 extra inspectors who share the work of heavy districts, and nearly 40 assistant inspectors. This staff of about 150 men, who are paid from £150 to £1,000 a year, is supplemented by 15 lady inspectors, who receive from £200 to £300 a year. All the staff are appointed after examination, without regard to politics, and are permanently employed. These inspectors are perpetually traveling over the United Kingdom, covering among them, nearly a million miles annually, and keeping under inspection more than a quarter of a million distinct factories, workshops, warehouses, laundries, docks and wharves (excluding those employing adult men only, which are ignored in practice), in which nearly five millions of persons are employed. Their efforts are aided by about 2,000 "certifying surgeons," who are paid by fees only. These are doctors in local practice who give the certificates of health without which, in certain cases, children cannot be employed. A similar, but more limited, staff is employed in the inspection of the mines and quarries. The tradition of the Home Office in this department is that it is the business of the inspector, not merely to act on complaints, or to make so many visits, but to get the law enforced. Hence, the inspectors go hither and thither as they think fit, visiting one factory frequently, another not at all; acting on any hint or suggestion that they can get of any illegality being committed, and, not only not refusing to act on anonymous communications, but eagerly welcoming them when nothing better is to be had. Unfortunately, however, the paucity of the staff allowed to it by the treasury, and the curious reluctance of English government departments to see their functions expand, has led the Home Office to forego whole fields of industrial employment in which the enforcement of a national minimum is no less necessary than those which it inspects. It deliberately omits from its regular inspection, not only the workplaces where men only are employed (though these are also subject to the law in various particulars), but also the myriads of "domestic workshops," in which only members of the same family are employed, and in which the worst cases of "sweating" are found. The sanitation, too, of the workshops (not using mechanical power), even where women and children are employed, is, like the whole regulation of the homeworkers, abandoned to the more perfunctory hands of the local authorities. On the other hand, it must be said that the Home Office far surpasses the Board of Trade in the execution of its duty of enforcing the policy of the national minimum. The scanty inspectorial staff of the Board of Trade, on whom we have to rely for the enforcement of the law relating to the conditions of employment in connection with railways and ships, confines itself, practically, to the investigation of cases actually brought to its notice by responsible specific complaints, or by accidents; and takes up the attitude that it is not the business of the office, or of its parliamentary chief, to initiate anything. To the student of the factory system of the 19th century, the reflection will inevitably occur that, if the Home Office had acted on this principle, we should still have with us the "white slavery" of the Lancashire Cotton Mills, denounced by Oastler and Lord Ashley. But there is even a lower depth than the Board of Trade. The Local Government Board, the department to which Parliament has entrusted the enforcement of the national minimum of sanitation takes no action whatever to see that the local governing bodies put into operation the sanitary provisions of the Factory Acts with regard to workshops and the residences of home-workers; and fails even to compel negligent or recalcitrant local government bodies to put in force the Public Health Acts. It does not even make itself aware of the extent to which the national minimum of sanitation is being secured in the different localities.

Thus it is that, after a whole century of experiment in factory legislation—of experiment so demonstrably successful that it has converted the statesmen and the economists of the entire civilized world—the United Kingdom still contains districts, classes, and industries in which there prevail the precise evils from which the cotton operatives of Lancashire and the coal miners of Northumberland suffered a century ago. The so-called "sweated" trades, to which factory legislation has not yet been effectively applied, remain as they were described by the select committee of the House of Lords in 1890, regions of "earnings barely sufficient to sustain existence; hours of labor such as to make the lives of the workers periods of almost ceaseless toil; sanitary conditions injurious to the health of the persons employed and dangerous to the public." What those who believe in factory legislation demand, and what the second century of such legislation may bring to us, is the conscious application of the policy of the national minimum to every branch of industrial employment; the explicit formulation of this policy in a systematic code, applicable, with only the necessary technical variations, to every trade in every part of the Kingdom, and to every worker in such trade, of whatever age or sex; the deliberate prescription, in the interest of the whole community, of the conditions of employment, whether sanitation or hours, education or subsistence, below which no individual can be permitted to be employed; and the vigilant enforcement of this minute universal code by the joint activities of the central departments and local governing authorities, each acting, through its highly organized inspectorate, as a check, not only upon all who break the law, but also upon any who should neglect their own part of its enforcement.

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THE IDEAL LIFE OF THE NATION.

30 (a). Great Britain — The Church of England. It is difficult to define the characteristics of the Church of England so as to enable an outsider to understand it. In much that concerns its external form and traditions it is probably the most mediæval institution in Europe. In much that concerns its religious teaching and life it is more abreast of modern thought than any other religious body. The former characteristic may be illustrated by the fact that its property is held in some cases by direct gift of Anglo-Saxon kings, and that many of its institutions are feudal in their origin. Again it differs from any of the Protestant Churches of the Continent by the fact that it does not express as they do the teaching or influence of one individual reformer. In a very true sense its history has been continuous. It is an institution which has grown and developed with the history of the English people. It has been modified and changed to meet the needs of each age. It is an institution which has created a theology, not one which is the outcome of its theology. It is therefore clear that the Church of England can only be described by its history.

History. — The history of the Church of England dates from the mission of Augustine in 597 A.D. This mission was the direct action of the Church of Rome, but almost from the beginning there were other elements. A large part of England was as a matter of fact converted by missionaries from Scotland and Ireland, representatives of the old Celtic Church. Although the organization introduced by Augustine and Theodore ultimately prevailed through the whole island, yet the Church contained elements and traditions derived from Celtic sources. Gregory the Great had used language in his letters to Augustine which implied that a considerable degree of independent development was to be left to the newly founded Church, and from the first its rites and ceremonies differed from the Roman. During the Anglo-Saxon period there were two elements in its history. The kings and the people of England were full of admiration for the Church of Rome to which they owed Christianity, but, on the other hand, the Church developed more and more as a national institution and its ecclesiastical laws were the work very largely of secular councils, on which the bishops sat. The Norman Conquest brought the British Isles very much into the swim of European life, and gradually two opposing currents of policy asserted themselves strongly. On the one side a series of able ecclesiastics aimed at securing the independence and privileges of the Church and at bringing it into close obedience to the central organization at Rome. On the other side the national development tended to assert the insularity and independence of the English state and sovereigns. There was a strong opposition to foreign ecclesiastics, to payments to foreign courts and to the influence of foreign monastic orders. Legislation such as the Act of Praemunire was introduced, limiting ecclesiastical authority and in the reign of Henry V. the property of alien priories was confiscated. Throughout the Middle Ages there is literary evidence of criticism on much connected with the Church, which reached its head in the work of Wycliffe who combined opposition to the monastic body and the Church of Rome with a good deal which would be called in the present day Radicalism.

Like the Church of England the history of the Reformation (q.v.) is a complicated story. The final result was produced by various influences. There was the old national feeling as opposed to the claims of the papal curia expressed in the Reformation Acts by the statement that the realm of England was and always had been an Empire; there was the influence of the Humanism of Colet, More and Erasmus, which demanded a Conservative Reformation; there was the popular objection to the rights and privileges of the clergy; there was the strong conservative element which has always been characteristic of the English people and which checked any great tendency to change; and especially during the reign of Elizabeth there was the influence of the foreign reformers. The result was a Conservative Reformation. No attempt was made to sweep away the Old Church and reconstruct it, either doctrinally or as regards the constitution *de novo.* Such changes were made as were found necessary to express the different influences which prevailed. This might be shown in various ways and will appear as we proceed with our account. For example by a statute law which has never been repealed, the whole of the canon law which had been accepted in England before the Reformation is still the law of the Church, except in so far as it is contrary to Act of Parliament. By the time of Queen Elizabeth's reign the various parties had become clear. It was clearly the aim of the rulers of the time to unite as many elements as possible in one national Church and the ultimate reform settlement was based therefore on a policy of modelling a national Church which should include very varied elements. The result of the

Reformation was to modify and reform the existing institutions, not to create a new Church in accordance with any system of doctrine. (See GREAT BRITAIN — THE REFORMATION.)

Since that time the Church of England has suffered hardly any change in its formularies or in its constitution; but it has been profoundly changed by the influence of various schools of thought, each of which has interpreted its formularies in accordance with their convictions. The close of the reign of Queen Elizabeth, the writings of Hooker, mark the beginning of a typical theology, and Anglicanism in the modern sense of the term was developed and worked out by the great divines of the 17th century. The result of the Commonwealth and of the Puritan domination was to strengthen the hold of the English Church on the nation, and at the time of the Restoration a vast majority of the people were attached to it. A very little more statesmanship on the part of the restored Cavaliers might have almost wiped out Puritan traditions. At the time of the Restoration the High Church party were the dominant factors in the Church, but the Roman tendencies of Charles II., the Roman Catholic position of James II., the fear of papal influence, and the Non-Jurors schism on the accession of William weakened its influence. Some of the ablest members of the High Church party left the Church at the time of the Non-Jurors' secession. High Churchmen were under suspicion as being opposed to the reigning dynasty, and in the first half of the 18th century the prevailing influence was the latitudinarian movement associated largely with the name of Tillotson. The Whig ascendency, the suppression of convocations and the influence of the deistic literature reduced the spiritual life of the country to the lowest ebb. The movement for religious awakening grew up in the Church of England, but a secularized Church was unable to contain the vigorous spiritual life of Wesleyanism. But though the Wesleyan Society passed outside the Church, its influence lived within it, and at the close of the 18th and the beginning of the 19th century, the evangelical movement was strong. All through this period the High Church party had lived on. The failure of the Stuart succession destroyed all suspicion of disloyalty, and eventually latitudinarianism and evangelicalism lost their hold on the country. High Church influences began to assert themselves again. The religious movement was assisted by a romantic reaction against the commonplace 18th century traditions and by the revival of an idealistic philosophy, and it came to a head in the well-known Oxford Movement, which is usually supposed to date from the year 1833. The Oxford Movement in its double aspect of High Church principles and of ritualism has profoundly changed the religious life of the whole Anglo-Saxon world. It was followed rapidly by a Broad Church reaction, and there has been a tendency of recent years for a new party to arise, combining many of the elements of both the schools. At the present time the theology of the Church of England is influenced by all the different movements we have described. The Church of England is not "Anglicanism," but it has created Anglicanism within the fold of an Establishment. Various different types of thought prevail and the position can only be understood by looking at the Church as the result of the history we have described.

General Principles. — The Church claims to be that portion of the Universal Church of Christ located in England, a "true and apostolical Church teaching the doctrine of the Apostles." It acknowledges that to the Crown "the chief government of all estates of this realm, whether they be ecclesiastical or civil in all cases doth appertain." It is established, *i. e.* it is part of the constitution of the country. It is National; Protestant in so far as denying that the Bishop of Rome has jurisdiction in England and condemning the errors of the Roman Church; Catholic as claiming to be a portion of the Universal Church of Christ. It grounds itself on Scripture and the three creeds. Its ministers are bishops, priests, and deacons. It claims to be continuous with the primitive church.

Constitution and Law. — The constitution of the Church was influenced by two main characteristics. One was a desire to do away with what we believe to be mediæval corruptions; the other to preserve the primitive organization of the Church. Naturally also there was a tendency to preserve all the distinctly national institutions which were inherited from the past. The orders of the Church of England are: bishops, priests, and deacons, and it is definitely laid down that the possession of episcopal ordination is necessary for holding office in the Church. The clergy of the Church meet in their own assemblies in Convocation which were originally the meetings of the clergy for taxing themselves at the time when they were immune from general taxation. At the present day, Convocations have no legislative power except such as is intrusted to them on any special occasion by Parliament, and no change can be made in any law or custom of the Church without the consent of Parliament. But it was the theory, not perhaps always acted upon, of the Reformation and it has been the custom since, that Parliament should not legislate for the Church except with the advice of the clergy. Practically the result of this has been that external changes in either form or constitution of the Church have hardly been made since the Act of Uniformity of the year 1662. By the common law of the country the parson or parish priest has a freehold in his cure, and he can only be removed by very complicated legal processes. The result of this has been to make the English clergy very independent of any authority. The influence of the bishops as men may be very powerful and effective but if they wish to support their opinions or the administration of the law by any appeal to authority they are hampered at every turn by a complicated legal system which makes it exceedingly difficult for them, even in spite of recent changes, to interfere with acrimonious or refractory clerks. The difficulties have been increased by the unsatisfactory character of the Church Courts. It is a fundamental principle of the English law that the Sovereign is in all causes, as well ecclesiastical as civil, supreme. The Church has its own courts and those courts are very largely secular in character and do not command the adherence of the clergy, while the Judicial Committee of Privy Council which is the final court of appeal in matters ecclesiastical, has not confined itself to reviewing judgments of courts on the point of view of justice to the individual, but has attempted to legislate by its judgments, and has not met with anything like universal acceptance. The position then is that the constitution of the Church and the Church Courts has grown up not in obedience to any particular theory, but by modifications from time to time of the traditional system and that it does not at present satisfy the convictions of a large section of the Church.

Establishment.— The position of the Church of England is that it is established by law and it is part of the constitution of the country. What exactly this implies has never been clearly defined and there are different sections of opinion on the subject in the country. The High Church party claim that the position of the Church is continuous with that before the Reformation and that the Church is by constitutional right free to determine its own teaching. A party which would be called by their opponents Erastian would claim that the Church was entirely subject to the Sovereign and to the Houses of Parliament. The former would point out that the Sovereign is rightly supreme in all actions relating to liberty of person and property, that (as shown by many Acts of Parliament, notably the Scottish Church Act of 1905), when questions of property are involved the Civil Courts or Parliament have to deal with the internal matters of the different religious bodies whether they call themselves "Free" or not, and that what the state has done is to accept to a large extent the Church Courts as part of its constitution.

The situation can really be determined only by historical principles. The position of the Church is that it is not in obedience to any theory but in obedience to a number of historical facts. During the Middle Ages the Church had great independence. The clergy had the right of taxing themselves and met for that purpose in their convocations. The bishops and mitred abbots were members of the House of Peers, but there was continued friction between the crown lawyers and ecclesiastical lawyers as to their respective jurisdiction and the secular authorities always resented the right of appeal in ecclesiastical matters to Rome. The present position of the Church and State is determined by the following points: (1) The position of the Sovereign is in a certain sense that of the head of the Church. It is to be noted that the title "Supreme Head" was definitely given up by Queen Elizabeth and the actual position is rather that the Sovereign is head over "all causes, as well ecclesiastical as civil, supreme." (2) The patronage of the Crown. The Crown appoints to all bishoprics and deaneries and to many canonries of the inferior clergy. In most cases the Crown right of patronage is directly inherited from the Middle Ages or taken over from the rights of the Popes. (3) The Church is subject, like every other body in the kingdom, to the laws laid down by Parliament. The Book of Common Prayer has been adopted by Parliament, and by the Act of Uniformity the authority of the State is added to the authority of the Church.

The Property of the Church.— The property of the Church consists of the following: (1) Tithes, which are charges upon the land paid originally to the parochial clergy. The origin of the institution of the tithes is much debated. It appears to have begun as a voluntary custom from charges made upon the land by the owners, and these customs and charges have gradually been recognized by law and become universal. Up to the time of the Tithe Commutation Act in 1836 all these payments were made in kind: by that Act they were commuted into money payments. (2) Landed Property. The Church has inherited a portion of the large estates which were in the possession of the bishops and other ecclesiastical bodies during the Middle Ages. These were ultimately derived in many cases from a grant by the sovereign or of individual land-owners. They include in addition to landed property, manorial rights and in the County Palatine of Durham royalty rights. In many cases they date from a period before the Conquest; for instance, Farnham Castle has been the property of the Bishops of Winchester from the time of a grant made in Anglo-Saxon times. In the great majority of cases now the landed property apart from the Glebe lands of the parochial clergy is managed by the Ecclesiastical Commissioners and the bishops receive fixed stipends. (3) Modern Endowments. These largely consist of money, and are for the most part administered by the Ecclesiastical Commissioners.

Prayer Book.— The character of the Church of England is shown very clearly in the Book of Common Prayer. The Prefaces lay down that the object throughout was to preserve the old form of services but to fit them to the altered needs of the time, and in many cases to return to what were looked upon as more primitive customs. The first edition of the Prayer Book was issued in 1549, the second in 1552, the third in 1559, the fourth in 1604, and the fifth edition in 1662. The services throughout preserve the structure of the pre-Reformation books, but they are shortened and simplified. What was believed to be superstitious was cut out, and, of course, the whole translated into the English language. The Prayer Book was influenced to a certain extent by some of the earlier Lutheran formularies and some of the finest of the collects were the work of Archbishop Cranmer himself.

Doctrinal Formula.— The doctrinal formula of the Church of England is the Thirty-nine Articles and the belief of the Church is also to be gathered in the Homilies and Prayer Book. The production of religious formulæ was the leading feature of all sections of the Christian Church during the Reformation period and amongst all the varied formulæ the Articles of the Church of England are conspicuous for their shortness. During the reign of Henry VIII, various doctrinal documents were issued. The first document we have to consider is the Forty-two Articles issued in 1553. They were not systematic in character, they were mainly directed against the different evils of the time and in their broad outline were concerned with the errors of the Anabaptists on the one side and the Mediæval Schoolmen on the other. These Articles were revised in the reign of Elizabeth and published as in Thirty-eight Articles in 1563. These were made more systematic in character and the relation of the Church of England both to certain Protestant movements on the Continent and to the Church of Rome was more accurately defined. By this time the results of the Reformation had begun to shape themselves more clearly. But throughout they bore the impress of the statesman. They were clearly drawn up with the object of including as large a number as possible of the different sections of opinion which existed at the time within the limits of the national Church. These were further revised and finally issued as the Thirty-nine Articles in 1571. At one time the subscription to these Articles was imposed by the State not only on all the clergy but all sections of the laity as the means of qualifying for office, but the tests for the laity have now been entirely done away with and that of the clergy is limited to a general assent to the teaching of the Articles. The courts have always been very broad in their interpretation of the doctrine of the Church of England. The clergy undertake to use the Prayer Book and no other document in public worship except in so far as allowed by lawful authority and give a general assent to the teaching of the Thirty-nine Articles. Within these limits the fullest freedom of opinion and expression of opinion is allowed.

Anglican Theology.— The theology of the Church of England has had certain special characteristics. (1) Owing to its connection with the universities there has always been a markedly learned character about a section of its clergy. *Clerus Anglicanus stupor mundi* was the verdict of the 17th century, and during that period a number of very learned works were produced by the Church. It suffered like all departments of the country by the intellectual lethargy of the universities in the 18th century. In the 19th century its character to a large extent revived. (2) But though a learned Church there have always been certain characteristics to distinguish it from other religious bodies. Its interest has been very largely in historical and exegetical studies. It has sedulously eschewed systematic theology. There is not at the present day an authoritative work stating the beliefs of the Church of England. It has been largely concerned with questions of ecclesiastical organization and the special features which have distinguished it from the Roman Catholic and Protestant churches. (3) The most prominent product of its activity has been the creation of that school of theology which might be defined as Anglican. Whereas Luther and Calvin created Lutheranism and Calvinism the traditions of Anglicanism, on the contrary, are the product of the position of the Church of England rather than the creator of it. Although certain broad principles underlie the Reformation it would be impossible to say that any one prominent principle prevailed, but the result of a Conservative Reformation, with some reference to primitive truth, was to create a body which preserved historical tradition in the threefold order of bishops, priests, and deacons, and the customs and rites of the primitive Church and at the same time had largely abolished mediæval corruption. The defence of this position created Anglicanism. A knowledge of the Eastern Church provided the exponents of that system with a very strong weapon and the Oxford Movement (q.v.) finally made this the dominant note in Anglican theology. But it must not be thought that it is necessary to hold "Anglican" views to be a member of the Church of England. Within the limits of the Church are many who would strongly object to those views. (4) The opportunities for a liberal position created on the one side by the relations of the Church with the universities and on the other side by the freedom of opinion secured by secular courts created a strong Broad Church movement. As the modern exposition of Anglicanism dates from the 'Tracts of the Times' so the modern exposition of the Broad Church theology dates from 'Essays and Reviews.' The aim of the Broad churchman has always been to keep himself in touch with modern science and modern criticism. But of recent years there has been a considerable rapprochement between these two schools and the appearance of 'Lux Mundi' marked a new departure by which the Anglican school accepted many of the results of modern criticism and thought which their predecessors had condemned. (5) Ever since the Wesleyan movement, and the Evangelical movement which was its accompaniment in the Church of England, there has been a strong Evangelical party within the Church. Its tenets were represented by Simeon and the Cambridge school of the early 19th century and it took for many years a lead in philanthropic work and is especially connected with the abolition of the slave trade. But it has always failed as compared with the other two schools in an intellectual exposition of its system and has never in any great degree influenced the theology of the Church. Outside all these definite schools it is probable that there is a considerable element in the Church consisting of those who are by tradition loyal members of the Church of England, who accept its formularies without attempting to interpret them very definitely, whose interest in religion is practical rather than theoretical, and who are prepared to accept and work from the point of view of common sense rather than of elaborate theological accuracy the system in which they find themselves.

Doctrinal Teaching.— As will appear from what has been said above it is not particularly easy to fix the standard of belief in the Church of England. On the one hand it did not arise from a definite body of teaching, like that of the Lutheran and Calvinistic churches, on the other side its Articles were drawn up with the idea of inclusion rather than exclusion. Moreover its historical position has led to its holding a mediating belief in many respects. A resolution, however, of the Lambeth Conference has laid down the following principles. (1) The acceptance of the Old and New Testaments. The English Church, however, has never accepted the position that the Bible and the Bible only is the authority for its belief. Its definite statement is that whatever is not contained therein or may be proved thereby is not necessary to salvation. But it has always recognized that in interpreting the Bible the traditions of the Church may be used. As regards the canon of Scripture it occupies a middle position between the Protestant and Roman Catholic churches. It accepts the Apocrypha, though not as a standard of belief, or as authority for faith. (2) The acceptance of the two Creeds: The Nicene and the Apostles. This definitely means that its standard of belief is the traditional, orthodox teaching of the Church. It is, however, slow to express a decision, or impose its belief. (3) The acceptance of the two sacraments, of Baptism and the Lord's Supper, as generally necessary to salvation. As regards sacramental teaching it has always been very wide in its limits. It makes its standard the acceptance of the authorized service and it has frankly admitted that while Zwinglianism and the doctrine of transubstantiation are incompatible with its formularies, within these limits any form of eucharistic doctrine is allowed. As regards other rites and ceremonies it has always made a very definite distinction between the two sacraments and others, although its formulas have occasionally used the term sacrament in a wider signification. But it lays great stress on confirmation, orders, and matrimony and allows private absolution and confession, although it does not make them compulsory. (4) The acceptance of the threefold ministry of bishops, priests and deacons. Here again its demands point to a system rather than to a doctrine. All its clergy must be episcopally ordained, but it does not demand any definite theory of ordination apart from what is implied in acceptance of the ordinal. A section of the Church would make the acceptance of the doctrine of apostolic succession necessary, but it has never been the teaching of the Church officially and as a whole.

Negatively the Church condemns emphatically the system and authority of the Roman Catholic Church and the infallibility and supremacy of the Pope. It definitely condemns also certain doctrines of purgatory, the invocation of saints, the sacrifice of the mass, relics, the merits of the saints, and works of supererogation. In relation to the Eastern Church, while differing fundamentally in tone and temper it is very nearly in doctrinal harmony, the chief points of distinction being of course the invocation of saints, the doctrine of t double procession, the use of the term transubstantiation, while there is some general hesitation about the acceptance of all the seven councils or the necessary acceptance of the seven sacraments. As against the Protestant churches as a whole, it would always avoid accepting the extreme forms of predestination or justification by faith; it would lay stress on the need of interpreting the Scriptures in accordance with the traditions of the Church; it would almost universally lay greater stress on the reality of the sacramental system, and it would maintain episcopacy as an institution against every other form of Church government whilst condemning the tendency to disunion which characterizes so many of the Protestant bodies. To some its mediating attitude appears to be a mere political compromise between two incompatible ideals, to its own members it would seem to be the one Church which most clearly holds the balance between the various conflicting aspects of Christianity.

The Church and the Nation.— The relation of the Church of England to the English nation has been modified very considerably in the early part of the last century by a series of enactments. Almost all its exclusive privileges have been gradually taken away. It has no longer a paramount position in the universities, and membership of the Church of England is no longer necessary for any civil position in the state. Side by side with this there has been an enormous increase in the population, which has made the existing ecclesiastical arrangements quite unfit to cope with the immense mass of new work. Many of the dioceses are excessively large and the process of sub-division has not been rapid enough to keep up with the demands. In many districts the clergy and the Church have been quite inadequate to meet the spiritual demands of the people. This fact, combined with the increase in just those sections of the populace which were least touched by the influence of the Church of England, has led to a very great increase in Nonconformity. But this loss of privilege and greater need of work have not been detrimental on the whole to the Church. The various spiritual movements that we have narrated and the demands of the day have stirred up an immense amount of voluntary work on the part of the Church. The old rigid high and dry schools have had to make way for younger men with very varied forms of activity. Methods of religious propaganda have been borrowed, alike from Nonconformist and Roman Catholic sources. The Church has taken a vigorous interest in educational and social topics. Missionary enterprises, always strongly supported by the Low Church party, have been exceedingly vigorous. The exigencies of a Colonial Empire, the spread of commercial activity, have created new demands, and the last hundred years have marked an immense increase in the religious activity and the enterprise of the Church. Including the Anglican Church in America the number of bishops now connected with the Church exceeds 300, and every 10 years the Conference at Lambeth marks the extent and growth of the Anglican Church.

As regards its hold upon the people there are no trustworthy statistics, but on the upper and upper-middle classes its hold is very strong. Amongst the working classes the greater majority are nominally adherents of the Church of England, but a great deal of the religious life is Nonconformist. As against Nonconformity the Church of England is little organized for political activity, and its hold upon the people and its influence are very intangible and indeterminable quantities. Probably, except perhaps in some of the great centres of the populace, its influence is very much greater than is often imagined.

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30 (b). **Great Britain — English Nonconformity.** *Early History — Death of Queen Elizabeth.*—Nonconformity as a definite ecclesiastical movement in English history may be said to have had its origin in Elizabeth's reign. But regarded as a spiritual force appearing now and again and here and there in the nation, it may be traced back to a much earlier time. All who protested against the prevailing ecclesiastical assumptions of the clergy, and who dared to think and act for themselves in matters spiritual, may be regarded as Nonconformists, and were called to suffer for their faith. From 1401, when the statute for burning heretics came into force, to 1534, the date of the renunciation of Papal supremacy, no fewer than 111 persons were burnt at the stake; and from 1534 to 1558, the year Queen Mary died, 337 more were added to the roll of the protestant martyrs. On the accession of Queen Elizabeth it was hoped that a better day had dawned for those men of Puritan sort who desired to see the Reformation carried still further. But, while breaking with the Papacy as completely as did her father before her, the queen was not prepared to yield to what she regarded as their extreme views in the matter of religious ceremonial. She cared for order, pomp, and appearance in the worship of the Church as in other things, and her princely power combined with her indomitable will made her supreme in ecclesiastical affairs. Several of the bishops and divines in the early years of her reign had been in close friendship with the continental Reformers and were prepared to go far in the Puritan direction. But the queen would not hear of it. Bishop Jewell writing to his friend Bullinger at Zurich in 1566 said: "I wish that all, even the slightest vestiges of Popery might be removed from our Church, and above all from our minds. But the queen at this time is unable to endure the least alteration in matters of religion." Thus began that conflict between the individual conscience and the power of the state church which has continued down to our own time.

The rupture between Elizabeth and the Puritan party first took open shape on the promulgation of the orders known as "Advertisements," which, in 1566, specified the minimum of ceremonial the State was prepared to tolerate in the services of the Church. Uniformity was to begin to be enforced at a given date, and deprivation of benefice was to follow in the case of the clergy after three months' refusal of compliance.

The two sides thus having joined issue the Puritan party became divided, taking different directions. Many of the ministers conformed, using only such ceremonial as they were compelled, submitting to many things they did not approve in the hope of a better time when a simpler and, as they believed, a more scriptural system, might come to prevail. Others, again, while remaining in the Church, sought to bring about a radical change in the direction of Presbyterianism, the discipline of which was elaborately organized both in London and the Midlands, and a literature created which assailed with more and more of vehemence the existing establishment. In 1571 Thomas Cartwright, Lady Margaret Professor of Divinity at Cambridge, issued two addresses to Parliament under the title of "A First" and "A Second Admonition," which were elaborate attacks upon the Episcopal system, and vigorous assertions of the divine right of the Genevan discipline. Having exercised this discipline privately for a time they proceeded to bolder measures, setting up their system openly in the parish churches of Northamptonshire and Warwickshire. Eventually, however, this movement was stamped out by the greater power of the State, and Nonconformity was henceforth to be sought for in other directions. Some of the Puritans became actual Separatists from the episcopal system. Their starting-point in church polity was the existence of spiritual life, the personal relation of the individual soul to God; and a church in their view was a community of spiritual men: "The kingdom of God," said they, "is not to be begun by whole parishes, but rather of the worthiest, were they never so fewe." Taking as their fundamental position that the Church visible consists of a company and fellowship of faithful and holy people gathered in the name of Christ, they went on to maintain that a Church so composed is competent for self-government. This self-governing power they further regarded not so much as a privilege to be enjoyed as a sacred trust to be discharged. The period when these men, who came to be known as Congregationalists or Independents, actively promulgated their views may be roughly stated as between 1570 and 1593. Their leaders during the first half of this period were Richard Fitz, the pastor of a London church, and Robert Browne and Robert Harrison who formed a Congregational church in Norwich in 1580; and the most active promoters of their principles in the second half of this period were Henry Barrowe and John Greenwood, who, together with John Penry, the Welsh martyr, suffered death for their opinions in 1593.

The penal laws against Nonconformity, severe before, were made still more severe by the Conventicle Act of 1593, which provided that all persons above 16 years of age being present at unlawful conventicles, should, on conviction, be committed to prison, there to remain without bail or mainprise until they made open submission and declaration of conformity at some church or chapel, or usual place of common prayer. The offender who refused to make such public submission within three months of conviction should be compelled "to abjure this realm of England, and all other the Queen's Majesty's dominions forever." This sternly repressive Act explains why during the

10 years previous to the accession of James I. so many Nonconformists languished in prison, while many were banished, and many more went into voluntary exile.

From the Accession of James I. to the Revolution of 1688.— With the death of Elizabeth and the accession of James I. the hopes of the Puritan party once more revived. For the King had been brought up among Presbyterians, had been the pupil of George Buchanan, and a frequent hearer of the disciples of John Knox; and had even invited Thomas Cartwright, the leader of the English Presbyterians to a professorship in Scotland. Regarding him, therefore, as at least not unfavorable to Puritan ideas, they met him on his way to London in 1603 and presented the Millenary Petition, so called, as representing the views of a thousand of the clergy. But again their hopes were destined to disappointment. At the Hampton Court Conference, held the following January, the King spoke contemptuously of Presbyterianism and declared he would either make these church reformers conform themselves or he would harry them out of the land. The Conference was followed by the Canons of Convocation which were so constructed as to make it impossible for any man who disagreed with the constitution and articles of the Church, as set forth in them, to remain honestly among its clergy. The immediate result was that some 300 ministers were ejected from their livings. The Nonconformists who had fled to Holland in search of liberty of worship after the Conventicle Act of 1593 were reinforced from time to time by the arrival of others of like mind. Especially memorable among these were the members of the little church at Scrooby in Nottinghamshire, who, under the leadership of William Brewster and John Robinson, fled to Amsterdam in 1608, and subsequently settled in Leyden. This was the church from which, in 1620, the Pilgrim Fathers of New England crossed the Atlantic as the founders of Plymouth Colony, the starting-point of the United States.

The Separatists who remained in England were subjected to perpetual hardships and persecution on account of their faith. James I. was succeeded by Charles I., the new king coming completely under the influence of Archbishop Laud, who proceeded to great lengths in enforcing conformity to Prayer Book, articles and canons. While the two opposing forces of Catholic tradition and Puritan earnestness were thus contending within the arena of church life, the two opposing forces of absolutism and the desire for popular government were at the same time at war within the political sphere. The men who contended for the divine right of bishops maintained also the theory of absolute monarchy and the divine right of kings. The leaders of the Church made the serious mistake of allying its interests with the side hostile to the constitutional liberties of the nation. With a high-spirited people such a course could only have one issue — that of disaster and overthrow. The attempt to base the Church on the subversion of freedom ended in civil war and the temporary overthrow of the very institutions the advocates of absolute government sought to maintain.

After Charles and Laud came the Long Parliament and Cromwell. Two main ideas seem to have guided Cromwell's ecclesiastical policy — first, that there should be an established non-episcopal Church, on a broad basis of evangelical comprehension, to be endowed and controlled by the State; and next, that outside that Church there should be an ample toleration of Dissent, which therefore provided for the existence of separate congregations. The Church, as established, recognized no one form of ecclesiastical organization; it had no church courts, no church laws or ordinances. Nothing was said about rites and ceremonies, nothing even about sacraments. These were left as open questions to be determined by each congregation for itself. All that the commissioners for each county dealt with was the personal piety and intellectual fitness of the minister presented by the patron to the living; and the church buildings were regarded as the property of the several parishes.

This loosely organized system came to an end with the ending of Cromwell's life. When the strong hand which alone was able to control the conflicting forces let loose in a time of civil war, fell powerless, the nation, weary of strife, restored the monarchy, and with the restoration of the monarchy there came back also the episcopal system of government in the Church. In 1662 the Act of Uniformity cast out 2,000 of the ministers as being unable to give unfeigned assent and consent to all and everything contained and prescribed in the Book of Common Prayer. From that hour Nonconformity took definite and permanent shape in English national life. It defied all attempts to crush it out of existence. The Conventicle Acts of 1664 and 1670 sent thousands of godly people to prison where many of them died in the pestilential jails of the time. Others were ruined by heavy fines and the spoiling of their goods, but the more Nonconformity was oppressed the more it grew, and at length by the Declaration of Indulgence of 1672 the government was compelled to admit that no fruit had been gained by these forceful courses. Still after brief respite these forceful courses were resorted to again. Conventicles were again frequented; spies and informers renewed their dishonored calling and persecution went on its cruel and iniquitous way so long as the Stuart kings remained on the English throne. Happily sooner or later tyranny digs its own grave, and when William of Orange landed at Torbay, 5 Nov. 1688, the hour of deliverance had struck. The persecuted Nonconformists felt that the tidings were almost too good to be true. Year by year for a long period they observed the anniversary of their emancipation, exclaiming ever and again: "When the Lord turned again the captivity of Zion we were like them that dream. The Lord hath done great things for us whereof we are glad!"

From 1688 to the Present Time.— The Revolution of 1688 was followed by the Toleration Act of 1689 which repealed the Penal Acts and permitted Nonconformists to erect their own places of worship which were registered, and so placed under the protection of the State. To the providing of local habitation for their communities and their principles they addressed themselves with considerable energy, In the quarter of a century which elapsed between the accession of William III. and the death of Queen Anne, besides many temporary structures, some 1,500 permanent places of worship were opened and maintained. The political history of Nonconformity in the 18th century is largely concerned with the endeavor to set aside certain disabilities to which its adherents were still subjected, the Toleration Act notwithstanding. The Corporation Act of 1661 provided that no person could be elected as mayor, alderman, recorder, bailiff, town clerk, or common-councilman who had not previously taken the sacrament according to the rites of the Church of England. The Test Act of 1673, though aimed mainly at the Roman Catholics, by widening the scope of the Corporation Act told heavily also against Protestant Nonconformists. It forbade any person holding office under the Crown, of any nature whatsoever, who could not produce a certificate to show that he had taken the sacrament at the parish church. Whoever offended against this law was thenceforth disabled from suing in a court of law, acting as guardian or executor, taking any legacy or deed of gift, or bearing any public office, and was further liable to a penalty of £500.

These acts were unaffected by the Act of Toleration and were naturally felt by the Nonconformists to be a serious grievance. The Occasional Conformity Act of 1711 intensified this grievance. It provided that any person holding any civil or military office who should be found in a conventicle, or in any religious meeting of more than 10 persons, other than one conducted according to the rites of the Established Church, should forfeit the sum of £40, and be disabled for the future from holding any public office.

In 1717 an agitation was commenced for the repeal of these three tyrannical and disabling acts. A bill for the purpose was introduced into the House of Lords by Earl Stanhope, and on a second reading was carried by a division of 86 votes against 68; but on going into committee the clauses relating to the Test and Corporation Acts were withdrawn from the bill and it passed without them. Thus it came about that while the Occasional Conformity Act was repealed at that time it was not till 1828 that a bill for the Repeal of the Test and Corporation Acts received the royal assent.

Still in the interval between 1717 and 1828 several distinct steps were taken in the direction of liberty. In 1742 a dissenter was elected to the office of sheriff of the city of London, and on his refusal to qualify by taking the sacrament he was cited to the Court of King's Bench which decided against his claim to exemption. The Corporation then passed a by-law imposing a fine of £400 upon every person who declined to stand for the office after being nominated, and a fine of £600 upon every person who, being elected, refused to serve. Again and again dissenters were nominated, and as they all refused to serve, fines were levied amounting in six years to more than £15,000, which went toward the erection of the new Mansion House. In 1754 it was resolved to make a stand against this oppressive procedure. After a lawsuit which was traversed from court to court, and which lasted for 13 years, Lord Mansfield, by his memorable and scathing judgment of 1767, put an end to the iniquity forever.

This gain in the direction of freedom was followed by another in 1779 when Protestant Dissenting ministers and schoolmasters were no longer required to sign the Thirty-nine Articles. In 1812 the Quakers' Oaths, the Conventicle and Five-Mile Acts, which till then had remained on the statute book, were repealed, and the Free Churches were placed, in respect to legal protection from disturbance during times of public worship, on an equality with the Established Church.

The repeal of the Test and Corporation Acts in 1828 was followed by the great Reform Bill of 1832 which did much to introduce the rule of the middle class in English society. The result was a large accession to the strength of Nonconformity, both political and social. Their influence entered more fully into the stream of the national life. They were found taking active part in Parliament and in municipal councils, the national universities were thrown open to them in 1871, and as the result of a recent religious census it was found that quite half of the worshipping population of the country were in attendance on the Nonconformist churches of various denominations. It may be well to add to this historical sketch of the older Nonconformity a brief reference to the laterborn but powerful religious society known as Wesleyan Methodism, which taking its rise in the 18th century, has gone on developing and consolidating ever since. Its internal history is largely that of a struggle for greater freedom and an increased representation of the laity in the government of the Church. Neither Wesley himself nor the other early leaders in Methodism believed in democratic government in ecclesiastical affairs, and continued resistance on their part to the extension of the lay element in the Conference led to one secession after another, these separating bodies forming sister communities. Still while working with more breadth and democratic freedom they remained loyal to the doctrines held by the great founder of Methodism and to the ecclesiastical system he had elaborated. These various off-shoots are known as the Methodist New Connexion, the Primitive Methodists, the Bible Christians, the Wesleyan Reform Union, the United Methodist Free Church, and the Independent Methodist Church. Notwithstanding these successive secessions and some occasional disasters the original Wesleyan Society has shown marvellous vitality, elasticity and resource. While in 1816 in Great Britain and Ireland there was a membership of 241,319, according to the latest minutes of Conference that membership has risen to 565,088. If we add to this the number of members belonging to the various branches of Methodist outside the main body, to the Foreign Missions, to the French Conference and to the South African Conference we reach a total of 1,217,081. If again to this the membership in Australia, in the United States and in Canada, according to the latest information, we arrive at a grand total of 7,870,730. For the due care of this large body they have an ordained ministry of 49,113, and a band of lay preachers numbering 102,608.

Passing from Wesleyan Methodism to the Free Churches generally it may be mentioned that these various bodies of Christians outside the Established Church have in recent years entered into a sort of federation without sacrificing their separate self-government. This federation is known as the National Council of the Evangelical Free Churches and consists of representatives of the local Councils of the Congregational and Baptist churches, the Methodist Churches, the Presbyterian Church of England, the Free Episcopal churches (including the Moravians), the Society of Friends, and such other evangelical churches as the National Council may at any time admit.

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From the Accession of James I. to the Revolution of 1688.— 'State Papers, Domestic'; Gardiner, 'History of England'; Barclay, 'Inner Life of the Religious Societies of the Commonwealth'; Waddington's 'Congregational History 1567–1700'; Stoughton's 'Church of the Commonwealth' (2 vols.), and 'Church of the Restoration' (2 vols.); Masson's 'Life of Milton' (6 vols.); Firth's 'Life of Cromwell'; Calamy's 'Nonconformists' Memorial,' (Palmer's edition, 3 vols. 1802).

From 1688 up to the Present Time.— Stanhope's 'Reign of Queen Anne'; Burnet's 'History of his Own Time'; Calamy's 'Own Life'; 'History of the Dissenting Deputies' (1813–14); Halley's 'Puritanism in Lancashire'; Wilson's 'History of the Dissenting Churches'; Bogue and Bennett's 'History of the Dissenters'; Crosby's 'History of the Baptists'; J. J. Taylor, 'A Retrospect of the Religious Life in England'; Skeats's 'History of the Free Churches' (2d ed.); Stevens's 'History of Methodism'; F. Storr Turner, 'The Quakers'; Post's 'History of the Bohemian and Moravian Brethren'; University Tests Abolition Act, 34 and 35 Vict. c. 26:16, June 1871.

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20 (c). **Great Britain — English Roman Catholics.** *History.*— The Roman Catholic Church in England is descended from those who in the reign of Elizabeth refused to accept the Reformation (q.v.) and remained in communion with the see of Rome. Nearly all the English bishops were included in this number, and were deprived of their sees, and stringent laws were made with a view to enforcing conformity with the established religion. Notwithstanding these, however, and the fact that they were frequently put into execution, the number of those who adhered to the Roman Catholic faith was, for a time, very considerable. No form of ecclesiastical government was instituted at first, as hopes were entertained of a national reunion with Rome; but in the meantime, in order to perpetuate a succession of clergy, several colleges were established on the Continent, in which also the laity obtained their education. Chief among these was the college at Douay, in Flanders, founded by Cardinal Allen in 1568. Others were in Rome, Paris, Saint Omer, Seville, Valladolid, Lisbon, etc., several owing their origin to the well known Jesuit, Father Parsons. Most of these still exist, some on their original sites, while others, having come to an end during the French Revolution were re-founded in England, for the laws against Catholic schools had then been relaxed. It was undoubtedly due to the English colleges abroad that the Roman Catholics in England were saved from extinction.

Early in the 17th century, when the hopes of reunion had become remote, an attempt was made to form a proper ecclesiastical government for the Roman Catholics; but it was not until the reign of James II. that affairs were put on a permanent footing. England was then divided into four "districts"— the Northern, Western, Midland and London — each under the government of a bishop called a "Vicar Apostolic." This means that he was, by a kind of legal fiction, bishop of an Asiatic see "*in partibus Infidelium*," and he ruled his actual "district" with authority delegated directly by the Pope. Thus the first "Vicar Apostolic" was nominally Bishop of Chalcedon. A similar arrangement was made a little later in Scotland. And all the colonies having no ecclesiastical government of their own, were considered as belonging to the "London District," so that in early days, the Roman Catholics of North America were under the London "Vicar Apostolic." The beginnings of the present American Roman Catholic hierarchy date from the time of the War of Independence. In England the government by "Vicars Apostolic" continued until the establishment of the hierarchy in 1850; in Scotland it lasted until 1878.

After the brief reign of James II., new penal laws were enacted against Catholics, and the time which followed may be considered the low water mark of Roman Catholicism in England. The hopes they had placed in the Stuarts had failed, and the outlook seemed dark and dreary. There were numerous defections about that time, and hardly any converts were made to replace them. The only centres where the Catholic religion could be regularly practiced were the country seats of the old Catholic families, and in London the chapels of the various Roman Catholic ambassadors.

Towards the end of the 18th century, however, there were signs of better times for them. The penal laws were mitigated by Parliament in 1778, and practically abolished by a second Act in 1791, after which Catholic chapels began to spring up in many of the larger towns, and a certain number of conversions were made. Roman Catholics were still, however, disqualified from sitting in either house of Parliament, and were under many other civil disabilities. These were not formally removed until the Act of "Catholic Emancipation," obtained by the agitation of O'Connell and the Irish in 1829.

Three events of later time must be briefly alluded to, as having had a permanent effect on the state of English Catholics. One was the French Revolution, which had a double effect. In the first place, it drove back to England the numerous communities of English monks and nuns, who had settled abroad during penal times, and by accustoming the people in England to their presence amongst them, prepared the way for the rapid multiplication of such institutions in later times. In the second place, it caused some thousands of French priests to take refuge in England, where they were received with marked hospitality, and considerable sums both of private and public money were apportioned to their relief. Most of them indeed returned to France on the signature of the concordat between Napoleon and the Pope in 1801; but a certain number remained in England, and founded missions or other Catholic works, some of which still continue. The second event to be alluded to was the great immigration of the Irish after the potato famine in 1845–9, which was the chief cause of the rapid increase of the Catholic congregations at that time and later. The third was the Oxford Movement (q.v.), which though it did not have such a great effect numerically speaking, nevertheless brought over men of standing and influence who have left a lasting mark on the Church. The names of Newman, Manning, Faber, Ward, Oakeley are only some of many that might be mentioned in this connection.

Present Ecclesiastical Organization.—At the present day the Roman Catholic Church in England is ruled by an archbishop of Westminster, and 15 suffragan bishops; and Scotland by two archbishops and four suffragans. The titles of the English sees were expressly chosen to be different from those of the Established Church, though the latter have since adopted three of the Roman Catholic titles — Liverpool, Birmingham and Southwark. Each diocese has a chapter, though there are no resident canons: they are chosen from among the senior clergy of the diocese, and meet at stated intervals. There have been four archbishops of Westminster — Cardinal Wiseman (1850–1865); Cardinal Manning (1865–1892); Cardinal Vaughan (1892–1903); and Archbishop Bourne since 1903. The new cathedral at Westminster was begun under the direction of Cardinal Vaughan in 1895. It is in the Byzantine style, the architect being the late Mr. J. F. Bentley, who died during its construction in 1902. Although yet far from finished, it has already cost over £200,000.

Since the abrogation of the penal laws more than a century ago, mission churches have rapidly multiplied throughout the country, and few towns of any importance are now without one. Some have been built by individual rich Catholics, and are good specimens of architecture: for example, the church at Arundel, built by the Duke of Norfolk in 1873, or that at Cambridge, built by Mrs. Lyne Stephens in 1890; and a certain number of handsome churches have been built by subscription, a prominent instance being the Oratory at Brompton, opened in 1884. Moreover, the influence of the elder Pugin, who was a Roman Catholic, is largely visible in the churches set up during the early days of the Gothic revival. Nevertheless, the large majority of Catholic churches bear evidence of the poverty of that community as a whole, and have been built with the sole view of securing a maximum amount of accommodation at a minimum of cost.

In their practical working the missions do not differ much from parishes, though they are not canonically constituted as such. The clergy, being unmarried, live together in a house or "Presbytery." They are supported entirely by voluntary contributions. For the most part they lead laborious lives, ministering to the wants of their people, most of whom belong to the poorest classes. There is also a large section of the clergy known as "Regulars," including Jesuits, Benedictines, Dominicans, Franciscans, as well as the modern Redemptorists, Passionists, and other similar congregations. They commonly live in monasteries or large houses; but in the present state of England they often find themselves obliged to undertake the care of missionary churches, like the secular clergy. The total number of priests in England is about 3,400, serving 1,600 churches, chapels or stations.

The Laity.— From what has been said, it will be seen that the Roman Catholic laity belong to three very heterogeneous groups: (1) The hereditary English Catholics, consisting of a number of county families, and in some few districts, such as Lancashire and parts of Yorkshire, and elsewhere, some of the working classes; (2) Converts, or children of converts, of whom there are usually a certain number in most town missions; and (3) those who are Irish, or partly Irish, by descent, who form the majority of the congregations, many of them belonging to the poorer classes of the population. At the present time there are 41 Roman Catholic peers, and 49 baronets, many of them of course being Irish. The total number of Catholics in England and Scotland is said to be about two millions. The prejudices of former times are steadily dying away, and Roman Catholics in general live on good terms with their neighbors. They intermarry to a certain extent, but such "mixed marriages," as they are called, are discouraged by the ecclesiastical authorities and a special permission is requisite for each. Many Roman Catholics may now be found occupying prominent positions on county councils, boards of guardians, or other public bodies. In politics, owing to the composite nature of the body, they are divided, almost every shade of political opinion being represented amongst them; but in general it may be said that while the majority, including almost all the Irish, sympathize with the Liberal party, many of the upper class hereditary Catholics have in recent years become strong Conservatives. When Catholic interests are at stake, however, those of all political views unite on a common platform.

Education.—Very remarkable energy and perseverance has been shown in providing elementary schools for Catholic children, and there is one attached to almost every mission. In spite of past difficulty and poverty, they have usually been carried on very efficiently. Training colleges for the supply of Catholic teachers, both male and female, exist in various parts of the country. There are numerous poor law, reformatory and industrial schools. In the provision of secondary day schools Catholics are less well off, though there are a certain number of efficient ones in some of the chief towns; but the boarding schools for the upper classes are on a very large scale in proportion to their numbers. The chief ones — Stonyhurst, Ushaw, Beaumont, Downside, Ampleforth, Old Hall, and others, are all equipped fully up to the standard of modern requirements. Some of them are descended from the English colleges on the Continent which were broken up during the French Revolution; others, as for example Cardinal Newman's school at the Birmingham Oratory, have been founded in more recent times.

Until a few years ago, Roman Catholics were forbidden to attend the National universities; but in 1895, in response to a petition from the laity, the law of the Church was relaxed, and there are now over a hundred Catholic undergraduates at Oxford and Cambridge. They are scattered in the various colleges, and mix freely in the general life of the university; but there is in each case a centre, where lectures on Catholic subjects are given periodically, and there is a Catholic Debating Society both at Oxford and at Cambridge.

Convents, Charities, etc.— One of the features of Roman Catholic life in England during the last 50 years has been the rapid multiplication of convents, which now number over 700. In a large number of cases the nuns devote themselves to the work of education, either in the parish (primary) schools, or by conducting a secondary school of their own, either for boarders, or day scholars, or both. Others work among the poor, or undertake the care of the sick or the aged, or the unfortunate, while a certain number belong to "enclosed" orders, and give themselves to a life of prayer. Many other homes, orphanages and "rescue" societies deserve to be enumerated; nor ought we to omit at least a mention of the Catholic Truth Society, for printing and distributing cheap Catholic literature among the poor, in these days an essential provision for Catholic life.

Bibliography.— For details of the present state of Roman Catholics, see 'Catholic Directory,' published annually under authority.

The following books may be consulted on the history of the Roman Catholics in England, from their point of view: Dodd's 'Church History of England' (Dodd's real name was Rev. Hugh Tootell. His history was published 1737–42); Tierney's 'Dodd' (The notes of Canon Tierney form a very valuable addition, and make this practically a new book; but it breaks off at about 1640, and was never finished. It was published in 1839–43. Both editions of Dodd are often met with in second-hand catalogues); Lingard's 'History of England'; Sander's 'Rise and Growth of the Anglican Schism' (Lewis's translation [1877], the Latin original [1585] having run to over 30 editions); Challoner's 'Memoirs of Missionary Priests, 1577 to 1664' (1st ed. 1741–2; many times republished); Berington's 'State and Behaviour of the English Catholics from the Reformation to the year 1780' (London 1781); Butler's 'Historical Memoirs of English and Scottish Catholics'; Milner's 'Supplementary Memoirs.' (These two books formed part of a long and acrimonious controversy on Catholic affairs between Bishop Milner, Vicar Apostolic of the Midland District, and Charles Butler, the distinguished lawyer, who on the passing of the Emancipation Act in 1829 became the first Roman Catholic K. C. Butler's Memoirs appeared in 1819, and Bishop Milner wrote to correct what he considered misrepresentations of Butler. Both books are still fairly commonly to be found); Husenbeth's 'Life of Milner' (1862); Flanagan's 'History of the Church in England' (1857); Olliver's 'Collectanea' (1857); Ullathorne's 'History of the Restoration of the Catholic Hierarchy' (1871); Mazière Brady's 'Annals of the Catholic Hierarchy' (1877); Foley's 'Records of the English Province S. J.' (8 vols. 1877); 'Records of English Catholics' (edited by Knox); vol. I., 'Douay Diaries'; II., 'Letters and Memorials of Cardinal Allen' (1878–82); Amherst's 'History of Catholic Emancipation' (1886); Morris' 'Catholic England in Modern Times' (1892); 'The Catholic Church During the Last Two Centuries' (Lord Braye's Prize Essay 1892); Bernard Ward's 'Catholic London a Century Ago' (1905); Gillow's 'Biographical Dictionary of English Catholics'; Wilfrid Ward's 'Life and Times of Cardinal Wiseman' (1897); Purcell's 'Life of Cardinal Manning' (1896; a book full of inaccuracies, but containing much valuable documentary matter).

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30 (d). Great Britain — Judaism. *Historical Summary.*—Though the statements as to the presence of Jews in Roman and Saxon England are more or less legendary, it is tolerably certain that William I. brought a number of Jews with him from Rouen to England. Under the Normans, the Jews enjoyed some privileges; they developed a communal life of culture and distinction; but they were practically restricted to financial pursuits as a means of livelihood. Henry I. granted them a charter, but at the coronation of Richard I. serious massacres occurred in London and elsewhere, especially at York, where the ordeal of martyrdom was heroically endured. The "Exchequer of the Jews" was then founded to preserve the Jews from some of the effects of such riots and to enable the Crown, as chief partner in the Jewish money-lending business, to secure its share of the gains. By the middle of the 13th century the Jews were chattels of the king, and their unpopularity on religious grounds was increased by the power they gave the king to obtain a revenue independently of barons and people. In 1275 the *Statutum de Judaismo* forbade the Jews to lend money, and as there was no other function for them in feudal England, their expulsion followed as a matter of course in 1290.

For the next three and one-half centuries a few Jews visited England from time to time; Queen Elizabeth had a Jewish physician. Toward the middle of the 17th century a number of Marano merchants came to the front in English colonies and in England itself. These men, who had escaped the Spanish Inquisition by assuming an outward garb of Roman Catholicism, now boldly asserted themselves as Jews, and in 1655 Cromwell, as a result of the Whitehall Conference of that year, connived at the open resettlement of a Jewish community in England. But two centuries more were to pass before the English Jews obtained full civil and political emancipation. In 1753, Pelham prematurely passed a naturalization bill, which he was forced to repeal next year. The struggle recommenced in 1830. In the years 1828–9 Protestant Dissenters and Roman Catholics were relieved of most of their disabilities. But the Jews were still excluded from Parliament, from membership of the University of Oxford, and from degrees and posts of emolument in the University of Cambridge. Nor could they occupy high posts in the army or navy. Political emancipation was won in 1858. In 1870, following on the senior wranglership of a Jew, the University Tests Act conferred full scholastic rights on the English Jews. In 1858 Baron Lionel de Rothschild took his seat as a Member of the House of Commons, and in 1885, his son, Sir Nathaniel de Rothschild was raised to the peerage — the first Jew so distinguished. Since 1858, many English Jews have sat in Parliament; there has been a Jewish Master of the Rolls; and in the Civil, Military and Diplomatic services a goodly array of Jews has become prominent.

Statistics.— In 1290 the number of Jews who left England amounted to 16,000. At the Restoration of Charles II. there were about 40 Jewish families in London. The increase was slow in the 17th century, but toward the end of the 18th century there was a larger immigration. Colquhoun estimated the Jewish population of London as 20,000 at the beginning of the 19th century, which would bring the total for the British Isles to about 25,000. This estimate is probably too high, for it is doubtful whether there were more than 60,000 Jews in the country before the Russian immigration of 1881. Mr. Jacobs calculated that in 1901 there were nearly a quarter of a million Jews in the British Empire, of which number 160,000 were in the British Isles. Mr. Isidore Harris conjectured ('Jewish Year Book,' X, 229) that in 1905 the total Jewish population of the United Kingdom amounted to 227,000 (of whom 140,000 were resident in London); and for the whole of the British Empire he assigned a total of 350,000. For the United Kingdom, this estimate makes the Jewish population 5 per cent. of the total population. All these estimates are conjectural.

Organization.— Since the dispersal of the Jews from Palestine in the first centuries of the Christian era, the organization of Jewish communities has been almost invariably on an independent congregational basis. Each congregation in the mediæval period constituted an independent unit. Sometimes there would be a combination of these units for certain purposes, as in the famous Council of Four Lands in Poland (c. 1550–1750). In the pre-expulsion period in England, there were officials who bore the title "Presbyter Judæorum" and who were the acknowledged leaders of the whole Anglo-Jewish community. Such officials were closely connected with the royal finances in so far as they affected the Jews, and were more or less responsible for assessments of talliages. When the Jewish community was re-established in the 17th century, the old congregational system was restored. There was first the Sephardim or "Spanish and Portuguese" Congregation which for long took the first place in the guidance of the whole Jewish life of London. Founded by a body of men distinguished alike fo culture and commercial capacity, this congregation gave to English public life many a noble son. They bore a considerable part in developing Colonial trade. This congregation, whose present Bevis Marks Synagogue was consecrated in 1701, was governed by a Mahamad or Council of Elders with an ecclesiastical head or Haham. The Mahamad claimed and exercised considerable power over all the individual members. Gradually, however, the leadership passed into the hands of the Ashkenazim or "German" Jews. At first each German congregation was completely independent, and this condition continued with more or less completeness till 1870 when the United Synagogue was founded. A large number of Metropolitan Jewish congregations are constituents of this united body, but the Sephardim have maintained their complete independence, and besides a few German congregations of old foundation which have remained outside the Union, there was established in 1841 a West London Synagogue of British Jews which introduced some ritual reforms and placed itself (as it still remains) in an independent position. The increase of foreign Jews had, however, led to the formation, especially since 1880, of a considerable number of smaller East End congregations outside the Metropolitan Union. These were "federated" in 1887. It is difficult to define the exact condition of the Jewish communal organization at the present time. The Chief Rabbi is the official head of the great bulk of the congregations of the British Empire, but except for statutory powers conferred over the constituent Synagogues of the United Synagogue by the Act of 1870, the influence of the Chief Rabbi depends on the voluntary acceptance of his jurisdiction by the various congregations. As to the rest of the communal organization, it does not differ from that found in other Jewish centres all the world over. The distinctive mark of Anglo-Jewish arrangements is perhaps the tendency to centralization. In Germany and in America there are Rabbis for every separate congregation; in England there are "Ministers" who preach and teach rather than Rabbis who exercise judicial functions. But there are many indications that the centralization is in process of breaking down. Certainly the organization of the English Jews on its religious side is now in a transitional phase. On the other hand, charitable and philanthropic organization is in a condition of first-rate efficiency, and men of such ability, public spirit, and philanthropic nature as Lord Rothschild are readily acknowledged as lay heads of the community.

The Communal Life.— Cromwell re-admitted the Jews unconditionally, and though the acquisition of political rights was a slow process, the English Jews were never subjected to restrictions of the Ghetto type. On the other hand, the fact that emancipation in England was gradual and not sudden gave the English Jews a training in civic adaptability which had rather exceptional consequences. The Jew easily assimilates, but in England assimilation was not accompanied with any wide-felt desire to forsake Judaism. The English Jews who have taken the lead in serving the state have on the whole been identical with the English Jews who have served the synagogue. The Disraeli family was an exception that proves the rule. But while English Judaism thus gained in coherence and stability by the fact that the leadership of the community was in the hands of its chief men of affairs, the communal life suffered some loss of idealism. English Jews have, indeed, consistently taken the lead in dealing with crises in the fate of the Jews of the world, but on the whole, communal life was respectable rather than brilliant. The institutions which resulted were, however, striking examples of practical philanthropy. The Board of Guardians for the relief of the Jewish poor (founded in 1859) occupies a high place among institutions of its class. It not only prevents the Jewish poor from falling on the rates, but it takes an enlightened view of the aims of poor-relief, fostering self-help by a carefully organized system of loans and emigration. Another characteristic institution is the Jews' Free School (founded 1817). This is probably the largest school in England, and it has served the cause of education while at the same time providing a friendly atmosphere for the children of alien parents. Considerable changes have followed on the increase of foreign Jews. The whole communal life has been vivified. In the first place, the presence of these Jews for the first time made evident a passing wave of anti-Semitism which culminated in the futile Alien Bill. Anti-Semitism has no deep roots in England, but the anti-Alien agitation did undoubtedly rouse the Jews of England to a sense of their responsibilities. Again, the Zionist and Territorial schemes introduced some of the previously lacking idealism. The absence of Jewish Mission deprives the Jews of a powerful driving force. But there is one important Jewish missionary society — a society of Jews with a mission to Jews. The Anglo-Jewish Association (founded 1871) has, under the enlightened presidency of Mr. C. G. Montefiore, had its horizon widened partly by the Hirsch Colonization Scheme which is directed in part by the Anglo-Jewish Association, and partly by the revived interest felt in the Jews of the world in consequence of the propaganda of Dr. Herzl and Mr. Zangwill. The Russian persecutions had considerable influence in the same direction. The general result has been that the leadership of the community is passing from the men of affairs to the idealists, and though there would be serious danger were this process carried too far, there can be little doubt that the change is on the whole fraught with advantage. As another token of present-day idealism may be instanced the initiation of a literary revival. English Jews have not played a foremost role in the promotion of Jewish learning. While the 'Dictionary of National Biography' was edited for the larger part by a Jew (Sidney Lee), and the British Academy was founded by another Jew (Israel Gollancz), though Jews have filled professorial chairs at the Universities and though there have been two Jewish R. A.'s, the literary performances of Jews in the field of specifically Jewish learning have been insignificant. But a new spirit is now discernible, or rather the old Jewish spirit has invaded the English Jewry. Thus, without enumerating the many institutions which are the just pride of the community, without detailing the eminent service to the State rendered by English Jews, it may be said generally that the practical spirit which has so long directed the current of Jewish life is now receiving a long-needed infiltration of idealism. In no part of the world is there greater hope for Judaism. Fullest toleration is enjoyed and more than toleration, sympathy. Fullest civic and political rights are the possession of English Jews. And above all there is undoubtedly a genuine affection for Judaism. Official Judaism is not in a thoroughly healthy condition, but there is in the general mass of Jews a sturdy confidence in the religion and an immovable hope in its power to civilize and save. Sobriety, good citizenship, devotion to the state, and a practical appreciation of all humane virtues are being once more touched by the fire of enthusiasm. Judaism is not only a creed and a code, it is a life. In England this principle seems likely to reassert itself. The English Jew is pre-eminently an Englishman, and he may become at one and the same time pre-eminently a Jew.

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31. **Great Britain — Education.** *Introductory.*— For a history of the early days of British Education the hour has not yet come. Much of the spadework of research has yet to be undertaken. Even the origin of the two ancient universities remains obscure. The records of secondary schools, with very few exceptions, do not begin before the Reformation, though the claim of King Edward VI. to be a patron of education has been shown to rest rather on having attached his name to a portion of the older foundations, of which a considerable number were destroyed under the Chantry Act of 1547. Elementary education was a matter too humble to receive much definite permanent

record, and probably, as in Scotland till recent years, it was frequently given in the same schools in which the elder children were being prepared for the universities. Neither taxes nor rates were levied for education before the 19th century (to speak in general terms), and the only method of maintaining any permanent educational institution was by means of endowment. Considerable sums were devoted to this end in the reign of Elizabeth, and, after the troubles of the Civil Wars were over, there was an outburst of endowment in the end of the 17th and beginning of the 18th centuries.

ENGLAND.

Elementary Education.— Two important factors in spreading elementary education were the Society for Promoting Christian Knowledge, founded in 1698, and the Sunday School movement, crystalized in the foundation of the Sunday School Society in 1785, and representing largely the Evangelical Revival of the 18th century.

The educational work of the Society for Promoting Christian Knowledge was in 1811 transferred to the "National" Society (The Society for Promoting the Education of the Poor in the Principles of the Established Church), which for the time being was devoted to carrying on Schools on the "Madras" monitorial system, as organized by Dr. Andrew Bell. In 1808 a Society, known subsequently as the British and Foreign School Society, was founded, chiefly by Nonconformists, to establish schools on an almost identical system which had been developed by Joseph Lancaster. The provision of Elementary Schools in England and Wales was thus in the beginning almost entirely the work of those connected with religious bodies, of which the Church of England was numerically and financially by far the most important. These Voluntary Schools, aided since 1833 by gradually increasing grants from government, continued to hold the field alone until 1870. Since the introduction of Board Schools, supported by rates, at that date, and even since 1902, the Voluntary Managers have gone on raising considerable sums of money, which, however, of late years, have been devoted chiefly to building and maintaining the fabric of their schools.

The religious difficulty in English elementary schools has thus been involved in their very origin.

It was not till 1833 in the first Reform Parliament that the State came to their aid. In that year the House of Commons made a money grant of $100.000, which was apportioned between the two Societies, and it was not till 1839 that the Government Education Department for directing the administration of the grant was established. The grant was gradually increased, and between 1850 and 1860 rose from $725.000 to $4.000.000 for Great Britain. In 188?, it was $12.500,000 for England and Wales only, and now is over $55.000.000 for elementary education. The years between 1840 and 1860 were years of great expansion. The population, which in 1801 had been under nine millions in England and Wales, by 1861 numbered twenty millions. The Government Education Grants greatly encouraged the clergy of all denominations, and schools sprang up in all directions. In 1861 the economists took fright, and severe mechanical tests were applied to the system of grants by the "Revised Code." Payment was to be made only on the results of individual examination of every pupil, in reading, writing, and arithmetic. Undoubtedly some check was needed on a system advancing so rapidly and with teachers so ill prepared as many were for their profession. But the method adopted was disastrous, and its cramping influence is felt in the traditions which exist to-day, years after the last relics of this method of payment by results have been abolished.

By 1870 it was quite plain that, magnificent as the efforts of the Churches had been, nothing short of a national local system could provide the necessary schools, especially in the large towns. The Elementary Education Act of that year enabled boroughs and parishes to form School Boards, with powers (if necessary) to levy a rate for building and maintaining Schools in addition to the building grants and other grants from the State. The Central Education Department had after due investigation to declare what school accommodation was needed in each district. If in any case it were not duly supplied, they might order the formation of a School Board; and in case of further default appoint such a School Board themselves. Existing Voluntary Schools were to receive the Government Grant, but no aid from rates. They might still give such religious instruction as they thought fit. In the Board Schools no religious catechism or religious formulary distinctive of any particular denomination was to be taught. This regulation is known as the Cowper-Temple Clause, from the name of the member who introduced it as an amendment. Subject to this a School Board might give in its schools such religious instruction as it thought fit, or might abstain from giving any. As a matter of fact, except in some places in Wales, where the religious instruction is given in Sunday Schools, plain Bible lessons are given by the ordinary teachers in all these schools with very few exceptions. Any School Board might make by-laws enforcing the compulsory attendance of children between five and thirteen, subject to a conscience clause, and a number of School Boards were established for this purpose only. In 1876 attendance was made compulsory in *all* districts by the establishment of School Attendance Committees where no School Boards existed. The provisions for compulsory attendance have been strengthened and diversified by four subsequent Acts, and are further complicated by conflicting Factory and Workshop Acts, so that the whole now urgently need consolidation. In 1891 fees were abolished in most schools, a process nearly completed since 1902.

The Act of 1870 aroused the most intense opposition at once from the Church party and the extreme Nonconformists. The latter were disappointed of their hopes of a uniform national system, the former found themselves in competition with a rival subsidized by the State. The greatest activity prevailed on both sides in providing additional schools. Between 1860 and 1876 provision was made in elementary schools for 1,600,000 additional children, and of these two-thirds were in voluntary schools, toward the cost of which only one-fifteenth was paid in Government building grants. Educational enthusiasm was not, however, the sole factor; in many cases the chief ratepayers realized that they could build and maintain the schools far more cheaply by voluntary subscriptions than under the administration of a School Board, and large corporations such as railway companies, were willing to contribute to voluntary schools for similar reasons. And in point of fact, the annual cost of education per child in Voluntary Schools in 1902 amounted to $11.50, and in Council Schools to $15. By 1902 the number of Board Schools was 5,878, as against 14,275 Voluntary, but they were educating 2,344,000 children, as against 2,546,217 in Voluntary Schools. These figures sufficiently indicate that the voluntary system had proved wholly inadequate in the large centres of population, but still prevailed in the majority of country villages.

By the end of the century the time was ripe for further legislation. Secondary education was in chaos, and it was imperative that it should be coördinated with the elementary system. The development of the latter moreover was in many places completely at a standstill and unlikely to be further improved under existing conditions. The tendency to local self government had rapidly increased during the past few years. In 1888 the Local Government Act established County Councils, and in 1894, by another Act, District and Parish Councils were constituted. In 1889 the Technical Instruction Acts had authorized the County and Borough Councils to supply technical instruction, and the vast majority of them were spending for this purpose the large sums of money handed over to them in 1890 by the Local Taxation (Customs and Excise) Act. They had thus already some experience as education authorities. On the other hand, the requirements of the Education Department (which in 1899 had been reorganized as the Board of Education) had been steadily growing, in accordance with modern ideas of education, so that the Voluntary Schools began to find it impossible in most cases to obtain the money requisite to keep them efficient.

Accordingly in 1902 a fresh Education Act was passed. By this every County, every County Borough (*i. e.* to speak roughly, city of more than 50,000 inhabitants), and (for elementary education) every urban district of over 20,000 inhabitants and every non-county borough of over 10,000 became local Education Authorities, and all School Boards were abolished. Each new authority must appoint, according to a scheme approved by the Board of Education, an Education Committee, which they are bound to consult, and to which they may delegate all powers for education except that of raising money. The Voluntary Schools must give their religious teaching in accordance with the terms of their trust deed (if any), and it is under the control of their managers. They appoint and dismiss their own teachers, subject to the consent of the local authority which pays them. The voluntary managers are responsible for the upkeep of their buildings, subject to an allowance from the authority for internal fair wear and tear, but the local authority is bound to maintain and keep the schools efficient otherwise, at its own expense. Each Voluntary School is managed by a body of managers, usually six, of whom two-thirds are appointed under the trust deed, amended by Order if necessary, and one-third by the local authorities. Board Schools are now known as Council Schools. The managers are appointed by the local authorities. In counties two-thirds are appointed by the County Council, and one-third by the local District or Parish Council. To the managers such powers are at present delegated as the central local authority thinks fit. London was excepted from this measure but received an analogous Act in the following year.

Unsatisfactory as many of the provisions of this Act are to the politician and to the religious controversialist, there can be no doubt that from the point of educational administration over the country as a whole, it has brought about great progress, an advance proportionately almost as great as the Act of 1870. Even in those cities where there was already a strong progressive School Board, it has concentrated the powers for higher as well as for elementary education in the hands of one authority, has materially increased the grant, and has given considerable powers over the standard of accommodation and of staffing in the elementary schools. In the Counties moreover it has abolished the small rural School Boards, whose sole object was to reduce expenditure, and has placed in charge an authority which can apply a reasonably high and uniform standard of efficiency in staffing, in school accommodation, in hygiene, in school material, in school attendance, and even in the small, but important matters of school cleaning and offices.

It is not yet possible to obtain statistics for the whole country which are up to date, but, to take a typical large county, the following figures relating to Staffordshire speak for themselves:

STAFFORDSHIRE EDUCATION COMMITTEE.

Number of Elementary Teachers:	1902	1906
Certificated	789	954
Uncertified	581	722
Average Attendance	85.5	90.9
Number of Departments in which was taught:		
Cookery	28	62
Manual Instruction or Handicraft	14	33
School Gardens	4	89

In 1902 in 79 departments in Staffordshire the principal grant was paid on the lower scale on account of some lack of efficiency; by the end of 1906 it is reduced in only one case.

Notice has been given of the intention to provide 6,575 additional places in elementary schools in this county, and steps are being taken to carry out the whole of this work as quickly as possible. In most cases the new accommodation is to replace schools which are wholly unsuitable.

Of these items, the increase in School Gardens is the only abnormal figure; the remainder are fairly typical of what has been done in ordinary progressive counties. They are far from reaching the ideal, but they mark a very real progress. They represent moreover the first fruits of a new movement whose efforts have not yet had time to reach their full effect. Of the three years during which this advance has been made, at least a year and a half had to be devoted to preliminary organization.

On the other hand the Act of 1902 has met with the most violent antagonism from the enemies of the Voluntary School system. It is urged with good reason that complete maintenance from the public funds should be accompanied by full public control, that no denomination should be allowed to have instruction in its tenets given at the public cost, and that in any parish where there is only one school, the children of the minority, who have no alternative but to attend it, are liable to suffer from a stigma attached to the exercise of the conscience clause. Nonconformist teachers moreover find it difficult to obtain engagements in Church Schools or places in training colleges of which very few are undenominational. The Church party on the other hand are not unreasonably unwilling to allow only undenominational religious instruction to be given in schools which they have built, largely at their own expense, for denominational instruction, and claim a right to have such instruction for their children.

At the moment this is written the news comes that the negotiations for a compromise over the Bill of 1906 have broken down. That measure aimed at complete popular control of the school, and the abolition of tests for teachers. The provisions to secure freedom for religious instruction were extremely complicated and teachers were forbidden to give denominational instruction, even if they desired to do so. A long controversy is evidently before us, in which very little will be heard of true education. The more simple the ultimate measure is, the more permanent is the settlement likely to be. But the general feeling of the country is against a secular solution.

Probably the large bulk of the people, apart from the Roman Catholics, would be quite ready to accept religious instruction under the Cowper-Temple clause. Meanwhile there is among politicians a growing weariness of the whole squabble, and among enthusiasts for education an entire distrust for politicians as educational reformers.

Training of Elementary Teachers.— In England and Wales the reform probably most needed is to improve the general education and the professional training of teachers in elementary schools. Out of 165,000 teachers employed in 1904–5, only 78,000 were fully certificated, and of these less than 43,000 had been to a training college. Of the residential training colleges in 1905, four-fifths were denominational, but this does not apply to the day training colleges. The total number of teachers in training was only 7,522. Pressure is being brought to bear on local authorities to improve their staffing, and to provide more training accommodation. Perhaps, however, the best work done as yet has been in laying the foundation of this reform by re-organizing the education of pupil teachers. Formerly a child in an elementary school was allowed to act as probationer, then became a pupil teacher in the same school, receiving instruction before and after ordinary school hours from the head teacher only. The pupil teacher then passed or failed to pass, examinations for which it was difficult to obtain any special preparation. The teacher so trained might then well spend the rest of his or her life in the same school. The board now refuses to recognize pupil teachers under 16 (in rural districts 15, with a three years' apprenticeship), requires at least half time attendance (where it is possible) during the apprenticeship of two years at a centre, which in most cases forms part of a secondary school. Previous attendance at a secondary school is encouraged as far as possible, and all the larger authorities are giving special scholarships for this purpose. The barrier between elementary and secondary schools is thus being broken down to an unhoped for extent, and pupil teachers so educated will be better able and far more likely to go on to the training colleges. Of 140,216 adult teachers in public elementary schools in 1905, 33,855 or 24 per cent were men.

English Secondary Education.— The best defence of English secondary schools at any rate during the past century, is that they have successfully educated a large number of men of high character and ability who have served the nation well in political and administrative life, not only in England, but all over the world. There was, however, till quite recently, nothing that could be called a system. Each school utilized or abused its endowments and its opportunities, and the abuses were very slowly revealed by the inquiry of royal commissions, and still more slowly corrected. Although inquiries began in 1818 under Brougham, it was only in the "sixties" that the reports of the commissions on the great "Public Schools" (nine in number) and on the endowed schools led to two acts of reform, the Public Schools and the Endowed Schools Acts, and under these most of the abuses of endowments have been brought to an end.

But in the leading English "Public Schools" (*i. e.* the leading secondary schools for boys, and principally for boarders), a considerable measure of reform had come in early days from within. The twin names of Arnold and Rugby are best known, but the Rugby reform was in part inspired by Winchester, and great names are not wanting to Eton and Harrow which with the many glaring defects they possessed at that period were relatively efficient. From Arnold and his successors, Temple and Percival, influence radiated and few schools failed to become different, whether by attraction or repulsion. Thring at Uppingham, Vaughan at Harrow, Cotton and Bradley at Marlborough, Bradby at Haileybury, were mighty instruments in "changing the face of education all through the public schools of England."

Not only have science and modern languages been introduced, as well as opportunities for the arts and manual instruction, but the teaching of Greek and Latin has to a great extent been remodelled. Physical development, which was always encouraged in those schools by games, has been pushed to a degree which now makes against intellectual interests. Nearly all the so-called first grade schools are boarding schools, and consequently the corporate life gives far greater scope to the influence of masters and of boys, and thus to education in the widest sense, than is possible in day schools. For good or evil, the effects are more marked, and on the credit side must be set that independence and self reliance which the best schools produce. On the other hand over-organization and "spoon-feeding" seem at the present time to be a real danger.

The first chief influence of modern science on the schools' curricula came from a separate government department founded in 1836 as a school of design. In 1853 this was reconstituted as the Department of Science and Art, largely by the influence of Prince Albert, and partly as a consequence of the first international exhibition held in London in 1851. This department began to hold examinations and make grants for teaching of science and art, and ultimately extended its subsidies to schools recognized by it as "Organized Science Schools," in which regular courses of instruction in science were given. In 1900 the new Board of Education absorbed the Department of Science and Art, and also the Education Department dealing with elementary schools. It thus became the sole central authority, and in 1901 began to give grants to approved secondary day schools with regular courses. It has also in connection with these grants developed a very full and valuable system of inspection conducted by its own staff. In 1902, as already mentioned, the county and country boroughs became education authorities, the minor localities possessing only concurrent jurisdiction with the counties in higher education. Since 1902 these authorities almost without exception have made considerable annual grants to the secondary schools in their areas, and a marked improvement is already visible in the efficiency of the schools, and the length of attendance of the pupils. These grants of course are given almost entirely to the smaller schools. The endowments and fees of the first grade "Public Schools" render them independent of such assistance and consequently of the Board of Education.

But if there has been great development in boys' schools, what is to be said of the education of girls? With the awakening of the middle of the century to the defects of the teaching of girls, came the establishment of numerous high schools, and were it not from the lack of endowments, and the relics of a tradition against spending much on girls' education, their secondary schools in receipt of State and local grants would soon be as numerous and fully as efficient as those for boys.

Mixed Schools.— There has been a certain amount of experiment in this direction, and prejudice has to a large extent been dispelled, but on the whole the best English opinion seems inclined to the view that, other things being equal, it is preferable to educate girls and boys in separate schools. There are, however, many places unable to support two separate schools, and in these co-education is being tried with some success. But there is no likelihood of its ever being tried in the older public schools, where the school age does not end before 18 or 19, and this precedent will probably always militate against it in smaller schools.

Curriculum of Secondary Schools.— So far as boys' schools are concerned, not very much liberty is really left to initiate startling reforms. Pupils are prepared for the universities, for civil service, or for army and professional examinations, and it is these which really prescribe the subjects. In addition to the actual university courses most of the universities have followed the example of Oxford and Cambridge in establishing "Local Examinations" and the "Examinations of the Joint Board" for the benefit of pupils still at school. These tests, especially when joined with inspection, have done most valuable service. The chief difficulty, however, is that there is no correlation of these examining bodies, and there are no definite principles upon which they are agreed, more especially with regard to the examinations to qualify for admission to professions.

Other Secondary and Technical Education.— The Science and Art Department, already mentioned, held various examinations and gave grants to classes and prizes to pupils. But it was the Technical Instruction Act of 1889, and still more the Local Taxation (Customs and Excise) Act of 1890 which encouraged local authorities to spend money on so-called "technical" subjects. The list of these subjects finally included, I believe, everything secondary except the classics. Even Shakespeare is said to have been taught under the head of "Commercial English." These powers brought the councils of counties and boroughs and urban districts into the field as education authorities, and in addition to their grants to secondary schools and their scholarship schemes, they did much to prepare for their future work in secondary education proper. The chief effect of the limitation to "technical" instruction was to encourage the teaching of science subjects, which had never before received proper recognition. This limitation to "technical" instruction was entirely swept away in 1902, when the local authorities received power to administer all higher education as well as elementary. In the last 15 years a large number of "Institutes," "Schools of Art," and "Technical Schools" have been built or enlarged. Marked progress has been made in the education of those persons who during the day are engaged in trades and professions. The quality and scope of the teaching have been considerably improved, and the chief need at present is to secure the attendance of lads and girls who are leaving the elementary schools and to induce them to complete well-arranged courses of not less than three or four years' duration.

Board of Education.— Much of this progress both in elementary and secondary education is undoubtedly due to the increased enlightenment and energy of the Board since its re-organization and above all to the present permanent secretary, Mr. R. L. Morant, who was specially promoted to this post in 1903, and has shown himself to be in the first rank of educational administrators. Not only have the different departments been re-arranged on wise and appropriate lines, but the whole of the codes and regulations have been entirely rewritten from an educational standpoint. A Board of Education Library was started in 1895 under the charge of a director of special inquiries. The series of invaluable special reports issued by Dr. M. E. Sadler, and his successor Dr. Heath, have been of first rate importance, not only to British education, but to students all over the world.

English Universities may perhaps most conveniently be divided into two classes, the old and the new. In no branch of education has there been a more rapid or startling development than here. In 1826 there were only Oxford and Cambridge, the traces of whose origin are lost in the early Middle Ages. In 1906 no less than six new universities enjoy a prosperous existence, while there are other university colleges which may hereafter develop into universities themselves.

The New.— Manchester, Liverpool and Leeds, federated in 1880 as Victoria University, have recently acquired separate charters. Birmingham, established in 1880 as Mason College, became a university in 1900. Durham, founded in 1832, has been constituted more on the lines of Oxford and Cambridge, except for its association with the college at Newcastle. London, which received its first charter in 1836, was afterward for many years merely an examining body, but at last in 1898 received a new constitution enabling it to embrace all the chief institutions for higher teaching situated in and near the capital, and to distinguish between its internal (or taught) and external (or merely examined) students. It is difficult to do justice to the splendid energy and the magnificent generosity which has founded and worked most of these institutions — qualities which can be more easily paralleled among the universities of America. These institutions are new, they are efficient, they do well a work which needed doing. But as the object of educational study, they are less interesting than the universities of Oxford and Cambridge.

The Old.— It would be hard to explain to a stranger the way in which Oxford and Cambridge have in the past entered into the life of the whole country, attracting to themselves not only the sons of men of rank, position and leisure, but also poor and able lads likely hereafter to make their way both at home and in the world at large. It is probable that no Cabinet will ever again be composed almost exclusively of men drawn from these two universities, but it is equally improbable that any Cabinet will ever lack them altogether. Oxford and Cambridge supply a very large part of that executive civil service to which England owes so much, and of which so little is heard. In nearly every country parish the squire and the parson can still exchange reminiscences of a university common to them both, for in the past the size of the country and of the population rendered it possible for two universities to gather together, widely speaking, the representatives of the governing and teaching classes. If these young men did not always get much learning, at least they grew from boyhood to manhood in an atmosphere of discipline and among their equals. The influence moreover of the beautiful buildings set in an environment of groves and lawns and quiet streams, and the association of national history and literature, were a factor in their education which nothing else could supply. Oxford "as she lies in the moonlight, spreading from her towers the enchantments of the Middle Ages," and Cambridge, her equal and rival, have an influence still reaching deep and wide into the character of the nation.

It must not, however, be supposed that cautious reforms have not adapted these universities to the changing needs of the time. By the beginning of the 19th century examinations were instituted, the best of which have probably done the work possible to examinations as well as it has ever been done. Royal commissions in the middle of the century, and again in 1877 led to the revision of the mediæval statutes and to the abolition of many obsolete restrictions and privileges. All religious tests were finally abolished in 1873. The time has perhaps come round for a new inquiry, but the particular methods of teaching by lectures and by tutorial work are carried out with a thoroughness and care which it would be difficult to surpass. In the past 50 years nine distinct new courses have been added to the curricula both for Oxford and Cambridge graduation, besides new subjects for which diplomas are granted. Museums and libraries, laboratories, institutes and workshops have been freely erected, and only a lack of money prevents further developments. For it is a curious feature of their constitution that in both places eight-ninths of the property belongs to the individual colleges in which the men reside and one-ninth only to the universities themselves.

The Rhodes Bequest.— The most striking departure of recent years has, however, been due to a son of Oriel College, Cecil Rhodes, who bequeathed an income of some $170,000 a year to be given in 60 scholarships to the Colonies, 102 to the United States, and 15 to Germany, all tenable only at Oxford. The result of this policy it is premature to forecast, but the experiment so far has met with success. Oxford has welcomed the scholars, and they have at once found their feet and seem cordially to recognize the distinctive character of the benefits which the university has to offer without being blind to its limitations.

University Extension.— Besides the direct work of the universities, old and new, notice should be taken of their pioneer efforts in developing education by means of lectures. This has proved specially valuable in the development of some half dozen university colleges, of which Reading is the most conspicuous example.

Higher Education of Women.— The education of women has met with many difficulties in England, but except for the refusal of degrees at Oxford and Cambridge, practically all desired privileges are now everywhere open to them. In the newer colleges and universities they are received on the same terms as men, except in certain medical courses. In Cambridge they have two colleges, in Oxford four and they are admitted to all such teaching as they require and to all examinations. Degrees alone are withheld and actual membership of the universities which would involve a share in their government.

WALES.

Introductory.— Of the four quarters of the United Kingdom, Wales has made the most rapid progress. In the middle of the 19th century her elementary education had probably the worst equipment; her secondary schools were inadequate and inefficient; while in higher education she possessed only the recent foundation of Lampeter, which was then little more than a theological college.

Elementary.— The Welsh elementary schools have always been under the administration of the English Board, and, considering the inaccessibility of the wilder parts of the country, have made at least a proportionate progress. Nowhere has more difficulty arisen in the administration of the Education Act of 1902, and a section in the Bill of 1906 provided for the establishment of a separate Education Department for Wales. Teachers and schools probably suffered to some extent, but the future progress of Welsh education is in any case assured. Wales has the educational advantage of being a bilingual country to a greater extent even than Ireland, and this has long been fully recognized in her schools.

Secondary.— Wales, while sharing in the educational inquiries and reforms of England, made in 1889 an enormous step in advance. In that year she obtained the Welsh Intermediate Education Act, under which small joint education committees were established in all the counties and county boroughs, and by this means an admirable system of county secondary schools for boys and girls was established. In 1897 a Central Welsh board was created to provide for examination and inspection of the different schools which had been created and organized out of the rates and grants placed at the disposal of the joint education committees. Of these county schools, 93 obtained a grant in 1905.

Universities.— In university teaching Wales in a single generation has rivalled the provision of Scotland. A training college was founded in 1862, and the first university college at Aberystwyth in 1872. In 1883-4 university colleges were established at Cardiff and Bangor, and the annual grant they received from Government was before long extended to Aberystwyth. In 1893 they were incorporated in the University of Wales, which has since been extended so as to include Lampeter, which, however, has the power of giving separate degrees. Women have been admitted from the beginning to the Welsh university colleges and the university.

SCOTLAND.

Preliminary.— A love of education is in the blood of the Scot. He will get his education and profit by it, and he will utilize any existing means to this end. This is the history of education in Scotland, and accounts for the virtues and most of the defects in the Scottish system. In the old days the elementary school led direct to the universities, and the universities were hampered by doing the work of secondary schools. On the other hand there were few boys of ability and character who could not get the best education in the country, and the sacrifices they made had a large share in the success so many of them ultimately achieved. To-day the path is easier, the opportunities greater, and the instruction has progressed with the times.

Elementary.—John Knox laid down a scheme for the establishment of a grammar school in every town, but most of the funds intended for the endowment passed into other hands. In 1696, however, a system of schools was established by statute, the landowners being bound to provide a school-house, and a salary for the teacher, in every parish. The salary was small, and the exceptions numerous, but a rate-aided system was actually organized, and owing to the cheapness of the university system, and the frugality of the country, much excellent work was done. The conditions of the teacher and the method of his appointment were gradually improved by statute, though no State aid was forthcoming till 1833. The first Parliamentary Grants for elementary education applied equally to Scotland, which was under the English Board of Education until 1872. In that year the first education act for Scotland was passed. In spite of the multiplicity of her religious denominations, Scotland was ready to accept a universal system of school boards, who were left entirely free to teach what religious formulæ they pleased in their schools. Compulsory attendance between five and thirteen was enforced throughout the country under a maximum penalty amounting to as much as five dollars, a sum not reached in England until 1900. A special committee for education for Scotland was now created, which in 1885 was given a separate secretary.

In a general sketch it is impossible to point out the numerous small differences between the Scottish and English systems. Scotland was earliest to escape from the revised code and payments by results, uniform curricula and mechanical inspection; first to provide special treatment for blind and deaf children; first to secure free education, and to improve her physical training. A Scot may be pardoned if he sums up the main results by saying that the outlook is generally more from the education standpoint, the teacher more fervid and better educated, and the children more eager for knowledge. The religious difficulty has been entirely avoided, and that in the chief home of religious controversy. A mention should be made of the celebrated Dick bequest which in the northern counties has done much to improve the quality of the teaching by subsidies to better qualified teachers. This also has materially assisted children from elementary schools ultimately to fit themselves for a university education. A bill to introduce certain reforms into the organization of the system and increase the powers of the school boards, has twice been introduced into Parliament, but has not yet been passed, though Scotch members now appear fairly agreed on its merits.

Secondary and Higher Education.— In spite of Knox's comparative failure there were burgh schools and academies established in nearly all the burghs by 1866, and the existing endowments, though capable of better use, had never been greatly abused or misappropriated. A leaving certificate has been organized with much success by the Education Department, which holds the necessary examinations, as well as inspecting higher class schools.

The science and art teaching formerly conducted under the auspices of South Kensington was in 1897 transferred to the charge of the Scotch Education Department. Technical Instruction in the United Kingdom may be said to have had its rise at Glasgow in Anderson's Institute, but the cheapness of the universities and greater facilities for general education has always prevented much specialization on purely technical subjects.

Universities.—In no respect has Scotland fared better than in the number and accessibility of her universities. Saint Andrews (1411) with three colleges, Glasgow (1450), Aberdeen (1494) with two colleges, and Edinburgh (1582) afforded every opportunity that the poorest student could wish. It was necessary to attend lectures, but there was no residence in college, and the long summer vacations were used by poor students to earn their fees for the winter. The chief reforms which have been carried have been to raise the minimum requirements for graduation, to make fees uniform, to admit women, to provide adequate buildings, and to endow new subjects of instruction. The greatest liberality has been shown in providing funds for the last two of these purposes, and the universities are now well housed and well staffed. Mr. Andrew Carnegie has given $10,000,000, the income of which is to be spent equally between the endowment of certain branches of study and research, and paying the fees of poor students. The latter half of the bequest seems unlikely to benefit the character of a class which would formerly have found such assistance unnecessary, but the value of the portion applied to the endowment it would be difficult to exaggerate.

IRELAND.

Introductory.—In Ireland the state of education has been most deplorable, and is still far behind the rest of the kingdom. This is due to poverty, to politics, and to religious bigotry. The difficulties caused by bigotry and politics when a Protestant minority was in power in the earlier half of the 19th century caused those who were responsible for elementary education to steer a cautious and ineffectual course; a different set of difficulties due to the same causes, working through the priesthood and the politicians, prevent any thorough reform to-day. And always the grinding poverty of the nation as a whole has hindered the schools and the teachers from being brought up at any given time to the standard which prevailed in English or in Scottish education.

Elementary Education.— Till the end of the 18th century Catholic schools were illegal, and existed chiefly as "Hedge Schools." Considerable funds were spent, chiefly in encouraging proselytising institutions. In 1831, however, the present system administered by the Board of Commissioners of National Education in Ireland was introduced, and has continued without any sweeping changes to this day. These schools are supported almost entirely by Government Grants, and are placed each under a patron, who appoints a local manager. There is no rate raised for elementary education, the whole grant coming from Imperial funds. All schools are open nominally to all denominations, and religious instruction must be given separately, but practically all but a very small proportion of the schools are attended solely by Catholics or by Protestants respectively. Compulsory attendance is still extremely limited in its scope, and the percentage of average attendance in 1904 was only 65.7 throughout the country, as against 85.98 for Scotland and 85.70 in England and Wales. The standard of school accommodation is very low, and an amount of discomfort and squalor exists in the elementary schools which it would have been impossible to find anywhere in England for many years past. Thus in 1904, one thousand schools stood in need of having out-offices provided. The number of teachers who had been trained was 7,210, as against 5,071 untrained, or 58.7 per cent. The quality of the less capable teachers, however, compares very unfavorably with the standard in England.

The most hopeful feature in Irish education in recent years has been the establishment of the Department of Agriculture and Technical Instruction, created in 1899, which, beside administering technical instruction, has acted as the adviser of the National Commissioners with regard to teaching agriculture and elementary science in the elementary schools, and in enabling the teachers to obtain instruction in these and kindred subjects. The report of the Belmore Commission, in 1898, showed the most deplorable backwardness in all modern developments of primary instruction. Progress *is* being made, though it will naturally take years to overcome the neglect and ignorance of ages, and it is to be hoped that the managers of the schools will co-operate with the teachers and the central board, and that a healthy feeling as to school attendance will gradually spread throughout the country.

Secondary Education.— The chief agent in secondary education in Ireland, apart from the board which administers the endowments, and before the establishment of the Technical Instruction Board, has been the Commissioners of Intermediate Education. In 1878 this board was founded and endowed with five million dollars from the funds of the disestablished Church of Ireland. In 1890, $250,000 a year were added to this income. The money, however, has been awarded on the results of examinations, and before the system was reorganized in 1902 the whole scheme was one of payment-by-results run mad. The reform is still far from satisfactory, but a change at any rate has been made in the right direction. The Technical Instruction Board is, however, doing most admirable work and is being well seconded by the county councils.

University Education.— The Elizabethan foundation of the University of Dublin and Trinity College, which practically form one body, has throughout its career had a marked success as a Protestant university on the lines of Oxford and Cambridge. Tests were abolished to a great extent in 1793, and finally in 1873, but the Catholics have never as a body accepted Trinity as a national institution. The three Queen's colleges, founded in 1845, have had even less success in this respect, and the Queen's University, in which they were amalgamated, was replaced in 1879 by the Royal University of Ireland, which is in itself merely an examining body. At the same time it is true that the fellowships of the Royal University are used practically as a means of endowing the Catholic University College in Dublin, as well as the Queen's colleges. The question of establishing and endowing a Catholic university or of creating a National university, of which Trinity College should or should not form an integral part, has been debated again and again. Catholics refuse to be content with less than a Catholic university; English Liberals and Nonconformists cannot see their way to spend public money on endowing a denominational institution. It is difficult to see how this deadlock can be overcome under existing conditions, but in the meantime the country is suffering severely.

Higher Education of Women.—Women have been admitted to the examinations and degrees of the Royal University from its foundation, and have since been allowed to attend the lectures of the Queen's colleges. For a long time Trinity College and the University of Dublin would not admit them either to lectures, examinations, or degrees. The examinations were conceded first, the lectures followed; and now women who have been at Oxford and Cambridge, and require a degree for teaching or other purposes, obtain it freely at Dublin, which thus drives a flourishing business at the expense of its less progressive rivals.

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31 (b). Great Britain — Medicine. *Registration.*— With few exceptions medical practitioners in Great Britain are registered by law. This legal recognition, and this alone, allows them to recover their charges in a court of law; to practise medicine, surgery, and midwifery under recognized titles in the United Kingdom, and (subject to local law) throughout the Empire; to hold medical appointments in the government services, in emigrant and other vessels, in asylums, hospitals, and other institutions and capacities under local authorities, and in benevolent and similar societies. This registration alone qualifies them to sign certificates of birth and death. Here is the dividing line. Unregistered medical men may practise, and they may hold appointments in hospitals entirely supported by voluntary contributions. But they cannot recover charges in courts of law; they are debarred from public appointments; they may not wilfully and falsely use the title of physician, surgeon, apothecary, doctor of medicine, or any description implying legal registration; above all, they may not sign death certificates.

Anyone may *claim to be registered* after a minimum course of five years' study on payment of $25 (£5) after passing a written and oral examination of high standard qualifying for one of the recognized diplomas, and taking out one such either in medicine, surgery, or midwifery. The qualifying examinations must be in all three subjects. There is no state examination. The lowest actual standard in England is probably that of the Society of Apothecaries, which is about equal to certain Irish and Scotch diplomas; and even this minimum is a high all-round practical test, rarely, if ever, maintained in other countries. American and other foreign and colonial graduates in medicine are usually admitted to the final examination for the diplomas of the Royal Colleges and Society of Apothecaries, on showing that they have obtained degrees from universities recognized by these boards and have passed a preliminary examination in general education equal to that required in England. Particulars may be obtained of the Secretary to the Examining Board, Examination Hall, Victoria Embankment, London, W. C.

Value of English Diplomas.—The commonest is the combined license and membership, respectively, of the Royal Colleges of Physicians and Surgeons, given after a series of examinations by a conjoint board of the two colleges. With or without this diploma or that of the Apothecaries' Society, distinction in England is obtained by taking out a degree at one of the universities, Oxford or Cambridge, London or Durham, Manchester (The Victoria), Sheffield, Liverpool, Birmingham, Leeds. The highest distinctions are the Doctorate in Medicine and Mastership in Surgery of Oxford, Cambridge, and London universities, the Membership of the Royal College of Physicians of London, and the Fellowship of the Royal College of Surgeons of England. For each of these a further examination, considerable fees and certain other evidence of professional position and training are required, beyond the original qualifying test; and the Fellowship of the Physicians' College is elective and in a high degree exclusive, with a view of maintaining the highest ideal standard, both professional and general, amongst the body of consulting physicians. *In Scotland.*—By one series of examinations held both in Glasgow and Edinburgh, a student obtains the licenses of the Royal Colleges of Physicians and Surgeons of Edinburgh and of the Faculty of Physicians and Surgeons of Glasgow. With or without this qualification, distinction is obtained by taking out a degree at one of the universities,— Saint Andrew's, Glasgow, Aberdeen, Edinburgh, — or the Fellowship of the Edinburgh Royal Colleges or Glasgow Faculty. *In Ireland.*— The Royal Colleges of Physicians and Surgeons of Dublin hold conjoint examinations for their licenses, the Apothecaries' Hall of Ireland holds a separate series of examinations, and distinction is obtained by taking out a degree at the older university of Dublin (Trinity College), or at the Royal University of Ireland, or the Fellowship of the Dublin Royal Colleges.

Professional Titles.—The relative attainments of any practitioner at the outset of his professional career may therefore be to some extent gauged by the letters after his name. University qualifications, M.B., M.D., B.Ch., (or B.C., or B.S.), M.Ch., (or M.C., or M.S.), besides the social and general education they have involved, count as a rule for more than the conjoint qualifications, M.R.C.S., L.R.C.P. in England, L.R.C.S., L.R.C.P. (Edin.), L.F.P.S. (Glasg.) in Scotland, L.R.C.P.I., L.R.C.S.I. in Ireland; and these again for more than the English and Irish apothecaries' licenses, L.S.A., L.A.H. English qualifications are commonly reckoned of a higher standard than Scotch or Irish. Besides the initials already given are those for midwifery, viz., at the Irish universities, B.A.Oh., M.A.Oh., and Irish Royal Colleges, L.M., and those for public health (Hygiene or State Medicine), and tropical medicine, viz., D.P.H. (Diplomate), D.S.Sc. (Sanitary Science), D.Hy., and B.Hy. (Hygiene), M.D. Stat. Med. (State Medicine), and D.T.M. (Diplomate). Dental degrees are independent of the medical profession. There are no degrees in other special subjects, although special subjects are allowed to be taken in the thesis or examination for certain M.D. degrees.

Councils.—The General Medical Council (address 299 Oxford St., London, W.) is constituted under Act of Parliament. It consists of 34 medical men of eminence, holding office each for five years, five nominated by the Crown with the advice of the Privy Council, 12 by the Universities, Royal Colleges and Apothecaries' Hall in England, 7 by those of Scotland, 5 by those of Ireland, and 5 by direct vote of all registered medical practitioners in the United Kingdom. There are Branch Councils for England, Scotland, and Ireland. The duties of the council are to establish and preserve the roll of registered practitioners. They have to regulate by deputed inspectors the standard of examination and other tests required for the qualifying diplomas; but direct pressure can only be exerted on examining bodies through the Privy Council. It is theirs to publish the register every year; and to hear penal cases, with a view to removing from the register the name of any man judged "guilty of infamous conduct in any professional respect." Such cases are first investigated by the Branch and then by the General Council, which is for this purpose practically a court of law, its decisions not being open, however, to revision in any other court. Infamous conduct includes "covering" or the employment of unqualified assistants; it does not include the adoption of any theory of medicine or surgery.

Professional Training.—Education for admission to the register is largely in the hands of the Universities and other examining bodies already mentioned. But in London medical education is carried out entirely in connection with the large general hospitals supported by endowment or voluntary subscriptions, included only recently and as yet only formally as constituent colleges in the remodelled London University, which, until 1900, was but an examining body. The colleges of medicine in London, 12 in number, are the schools of the following hospitals: Guy's, Saint Bartholomew's, London, Saint Thomas's, Saint Mary's, Saint George's, Middlesex, Charing Cross, Westminster — with University College and King's College, both having hospitals attached, and the London School of Medicine for Women, attached in 1877 to the Royal Free Hospital in Gray's Inn Road. These hospitals contain from 165 beds (Royal Free), to 927 beds (the London), with large out-patient departments. Most of the medical, surgical, and pathological work is carried out by students under the supervision of a visiting staff; the resident appointments are held for short periods only, by recently qualified students, who are the best men of their year and are given much responsibility and actual major surgical practice. It is this practical experience under supervision, this training by responsibility, that gives a special value to the English training, as compared for instance with that in Scotland or on the Continent. Each medical school is a separate organization, to which students look as their professional home usually from the beginning to end of their professional lives, the organization in many instances being completed by a residential college, clubs' union, athletic ground, and periodical gazette or journal. This system involves a subdivision of the otherwise unique clinical material of London; but it leads to a healthy rivalry, closer contact of students with their responsible work, and greater individual attention to their needs by the lecturers and visiting staff. An attempt is at present being made to concentrate the teaching of elementary medical studies in London *in that part of the Imperial Institute now given over to the London University;* but University College, King's College, and the larger London Schools are unlikely in the near future to curtail their own spheres of educational activity, even for the sake of an Imperial ideal in medical education. In the provinces education is conducted by university schools of medicine in connection with some large local general hospital, that of Durham University, for instance, being at Newcastle. But Oxford and Cambridge Universities, being situated in small towns, encourage their students to do their clinical work at the London hospitals. They are content with having given them as thorough and liberal an education as possible in all the medical sciences, including laboratory pathology, and they trust, by a final examination in which they can impose their own tests of efficiency, after two or three years in a London hospital, to ensure the proper development of sound professional ability from the groundwork of principles which they have laid. This mixed university and London training, a system of only 20 years' growth, is being gradually developed by Prof. Clifford Allbutt at Cambridge and Prof. Osler in succession to Sir John Burdon-Sanderson at Oxford, and is already recognized as providing an exceptionally sound education. All the other schools give an almost complete course of medical education. This, however, may be supplemented by private schools and special hospitals; and a course of instruction in infectious diseases at the large fever hospitals of the Metropolitan Asylums' Board or elsewhere is obligatory for all diplomas. It is a subject of regret to many in the present day that the old system of training by apprenticeship is dead, the law allowing no qualified practitioner to employ unqualified assistants, and the General Medical Council not reckoning any period into the requisite time of study unless spent at a medical school. After passing the examination in general knowledge, the minimum length of the course of training is five years; the average is over seven. The fees for the course of teaching, examinations and final diploma vary in general from $1,000 to $1,500 (£200 to £300).

Medical education in Scotland and Ireland is on similar lines, the extra-mural school of the Royal Colleges at Edinburgh and the Rotunda Hospital for Midwifery at Dublin having exceptional influence.

Post-graduate study is arranged for separately in each hospital; but in London a combined hospital ticket is now obtainable, from the London Post-graduate Association, Examination Hall, Victoria Embankment, London, W. C. ($42½ for 3 months, $75 for 6), giving admission to the clinical practice of the chief hospitals. Comprehensive courses of post-graduate study are well organized in London at the West London Hospital, and at the Polyclinic; special courses are arranged for at the London and Liverpool Schools of Tropical Medicine and at most of the special hospitals. Research work, and bacteriological and chemical analysis are carried out at all the above institutions, and virtually at all fever hospitals. Research and supply of vaccines and antitoxins are the sole aim of the Lister Institute of Preventive Medicine in Chelsea, with its fine farm at Elstree, Herts. Bacteriological and chemical analysis are efficiently organized as a commercial concern by the Clinical Research Association, and in certain private laboratories.

Voluntary Organization in Practice.—A considerable fraction of the best students in every year secure junior positions in their hospitals or in the medical schools attached to them, and work their way up by degrees to consulting practice, mainly with the help of their student-friends and pupils in general practice. The majority of those qualified find their way into the provinces, often after spending a few years in junior positions at London or provincial hospitals, in trips abroad as ship's surgeon or otherwise, in assistantships to practitioners; and they in most cases buy the good-will of an established practice or partnership at one to two years' purchase. In such positions they are isolated, attached by little more than sentiment and a dining club to their old hospital, officially organized only in their occasional vote for a direct representative on the General Medical Council. Voluntarily, however, they organize themselves to a considerable extent for relief and for protection, as in the British Medical Benevolent and Lancet Relief Funds, The Society for the Relief of their Widows and Orphans, the benevolent and educational work of Epsom College, and various associations for medical defence. Still more, a thorough scheme of organization has been established by the British Medical Association, with its 20,000 members, grouped systematically into geographic divisions throughout the Empire, each with its divisional council and its delegates to the Annual Representative Meeting, which recommends the policy to be carried out by the partly co-opted, partly nominated Central Council, during the ensuing year. This council works largely through committees, of which the chief are the medico-political, the ethical, and that which conducts the well-known weekly journal. Apart from the protection of professional interests, the association exercises considerable influence by memorials and deputations to government, which otherwise relies for medical advice on the Royal Society, the Royal Colleges of Physicians and Surgeons, and the few medical advisers to government departments.

Women mostly take the license of the Apothecaries' Society in England, the Scotch or Irish conjoint qualification or the degrees of the London and the other newer universities. They are debarred from the English conjoint qualification, and from the degrees of the universities of Oxford and Cambridge. They take little part in the professional organizations, and as yet they practice but little in the United Kingdom, many being trained for the mission field.

Homœopathy.—In England Homœopathy is a specialty practiced without exception by men who possess a legal qualification to practice. They receive their special training, if at all, by post-graduate lectures and resident appointments at the homœopathic hospitals. Of these there are a fine example of 100 beds in London, and 9 in the provinces. Most homœopaths belong to the British Homœopathic Society, founded in 1844, which publishes a quarterly journal. There are also two monthly journals of the cult and a new "British Homœopathic Association" of practitioners and laymen.

Medical Societies, Libraries, Journals, and the Annual Congress form a considerable bond of union. Apart from branches of the British Medical Association, there are 100 such societies in London alone and corresponding numbers in the other chief towns, many being associated with a central body in London, some for general, many for special professional objects. Societies in London mostly meet at 8 p. m. The best medical libraries in London are those of the Royal Colleges, of the Medico-Chirurgical Society, and of the British Medical Association. The chief periodicals are the 'Lancet' and 'British Medical Journal' (weekly); the 'Annals of Surgery,' 'Practitioner,' 'Journal of the Royal Army Medical Corps,' and 'Public Health' (monthly); 'Brain' and 'The Journal of Hygiene' (quarterly); annual report-volumes of the various chief London hospitals; and the annual 'Medical Register' and 'Medical Directory.' The 'Pharmacopœia' is revised from time to time and published by the General Medical Council. An opportunity for the interchange of ideas on all subjects is afforded every year by the Congress of the British Medical Association, held usually in the United Kingdom, but in 1906 in Toronto, Canada.

The Government Medical Services are each separately organized under the corresponding Government Office. The Naval Medical Service includes 520 active and 240 retired medical officers, with its chief hospital and college at Haslar, near Portsmouth; the Royal Army Medical Corps, 1,031 active and 533 retired medical officers, with the new Army Medical College opened in 1907 at Millbank, Westminster; the Indian Medical Service, 747 active and 546 retired medical officers, sharing in the Army Medical College; the Colonial Office employs in Crown colonies several hundred medical officers, who do not hold commissions, but undergo extra training at the School of Tropical Medicine; and the Foreign Office has also a staff of medical men in its service abroad.

Under the Local Government Board, for purposes of *the poor law*, district and workhouse medical officers and public vaccinators are appointed in every parish and union for the most part in conjunction with their general practice, usually in return for very small salaries, to attend to paupers in need of medical attention. The workhouse infirmaries in the large cities are of great size and importance. Under the Local Government Board, too, is organized *the sanitary medical service*. The head of this service is the political President, advised by his medical officer, and by his legal adviser, with the assistance of a staff of legal secretaries and engineering and medical inspectors of the highest experience and ability. Local Government throughout the country is in the hands of borough and district councils, each of whom has a sanitary inspector and a medical officer of health, and many of whom maintain isolation hospitals for cases of infectious disease. Powers of supervision are given to County Councils, who, with the advice of County Medical Officers of Health, may report default of District Councils to the Local Government Board. The chain of authority is therefore through the lay authorities, each advised by its medical officer. Some of these sanitary appointments are of little pecuniary value; others of considerable value, demanding the whole attention of the holders; and they are increasing markedly in number, value, and importance. In practice the sanitary service largely depends on the unofficial Royal Sanitary Institute with its annual congress and monthly journal, its courses of instruction, its examinations and its diplomas for school teachers and sanitary inspectors, a body of non-medical men who are the foundation of British sanitary administration. Among other government appointments are those of police surgeon, prison surgeon, factories' surgeon, and inspector of factories and workshops under the Home Office, those of Medical Officer to Schools under County Councils and the Education Office; those to lunatic asylums and fever hospitals under the Metropolitan Asylums' Board and other local authorities.

With these offices and work for insurance and friendly societies, sick-clubs and private nursing homes, the practitioner ekes out his slender earnings.

The numbers on the British Medical Register in 1906 were roughly as follows: London, 6,400; Provincial England, 17,000; Wales, 1,200; Scotland, 3,800; Ireland, 2,700; Foreign and Colonial, 4,700; Naval, Military, and Indian Services, 3,200. Total, 39,000.

Francis Fremantle,
Herts County Medical Officer of Health.

31 (c). Great Britain—Engineering. Engineering as a profession is only partially organized in Great Britain. To understand the present state of development a brief historical statement is necessary.

Historical.— On the military side engineering is and has been thoroughly organized. Fortification and the art of constructing defences are probably as old as society. The Babylonians, Greeks, and Romans showed skill and originality in design and construction which has nowhere been surpassed. From the introduction of the catapult, ballista, and other engines of war amongst the Greeks and Romans mechanical skill likewise received wide and steady development.

Into Great Britain engineering was probably first introduced by the Roman invasion and then languished until William the Conqueror brought with him a large body of engineers.

As gunpowder, cannon, and later muskets replaced catapult, arquebus and crossbow, mechanical skill and ingenuity made steady advance until at the present day the manufacture of war implements and their invention and design have passed to a considerable extent into the hands of civilians. Military engineers are organized as the Corps of Royal Engineers with their headquarters at Chatham, although it has recently been proposed to remove them elsewhere.

The Artillery is organized in several corps, according as service in the fortress, field, mounted, or on foot, is required. Knowledge and training in a specialized branch of engineering is needed for these services.

Guns and military equipment are manufactured at the Royal Arsenal at Woolwich and at the Royal Small Arms Factories at Enfield and Birmingham, under Army control, and in various factories belonging to civilian firms.

In the Navy engineers have steadily increased in importance as the construction of ships and their working depended more and more upon machinery until under the recently modified regulations it has been arranged that all naval officers whether navigating, gunnery, torpedo, or engineering shall for the first years of their training be educated together, specialization being left to the later years of their course. Engineer officers will therefore rank with other officers of equal standing and be capable of executive command.

On the Civil Side.— The foundation of English Civil Engineering may be said to have been laid by Smeaton (1724–1792). He was the son of an attorney, became a philosophical instrument maker, and subsequently devoted his attention to a study of windmills, canals (for which he made a tour of the low countries in 1754), and lighthouses. He reconstructed the Eddystone Lighthouse in 1756. He was therefore "much consulted in regard to engineering projects, including river navigation, the drainage of the Fens, design of harbors, and the repair and construction of bridges."

Smeaton founded in 1771 the "Society of Civil Engineers," the members of which dined together once a month during the parliamentary session and discussed subjects of professional interest. It still exists under the name of "The Smeatonian Society of Civil Engineers." No records of its discussions have been kept nor published but its foundation shows the earliest step in the direction of organizing the non-military engineers into a profession in Great Britain.

Partly contemporary with Smeaton was James Watt (1735 to 1829). He was trained as a mathematical instrument maker, but was prevented from practicing by the trade as not being fully qualified, and therefore he was granted three rooms in the University of Glasgow where he carried on experiments resulting in the creation of the modern steam engine out of the crude pumps of the Marquis of Worcester, Newcomen, Cawley, and Savory. His improvements demanded for their perfect fulfillment mechanical skill and workmanship far in advance of the work of the millwrights of his earlier youth. Out of the millwright he therefore created the manufacturing engineer, and did for the *mechanical* side of the profession what Smeaton had done for the *constructive* side, and like Smeaton on the constructive side Watt on the mechanical side was consulted as an authority of the first rank on all important matters.

Watt moreover had, about 1767–1770, a large practice as a constructive engineer and surveyor, and prepared plans for a number of canals and harbors, chiefly in Scotland.

As manufactures increased, partly owing to the impetus given to them by Watt's inventions, partly as a result of the industrial development at the termination of the Napoleonic wars, the improvement of means of communication and greater rapidity of transit became of first class importance, and as the roads throughout Great Britain were at the end of the 18th century in an execrable condition we find attention more and more concentrated upon the construction of inland canals and new and improved roads.

The man who more than any other aided in this improvement was Thomas Telford (1757–1834), the son of a Dumfriesshire shepherd and in early life trained as a stone mason. After the construction of a house for the Commissioner of Portsmouth Dockyard he became Surveyor of Public Works for Shropshire and constructed a bridge over the Severn at Montford in 1792. The construction of the Elsemere canal in 1793 lead to his being employed in the construction of most of the chief canals in Great Britain, from the Caledonian in 1804 to the Birmingham and Liverpool junction in 1825 as well as the Gotha canal in Sweden in 1810. He constructed and perfected most of the main roads in Scotland, the North of England, and Wales, involving the erection of the Menai and Conway bridges, besides numerous others of less magnitude. He also made many continental roads in Austria, and was also employed in harbor construction.

He lived a bachelor in London at the Salopian Coffee House, afterward the Ship Restaurant, and two years after the establishment of the Institution of Civil Engineers in 1818 he was elected president for life. The meetings were thereafter held in the Ship Restaurant, whither the institution removed from the Kendal Coffee House in Fleet street, its earliest home.

Meanwhile, mechanical road traction, steam barge, and ship propulsion had advanced with the advance of the steam engine and with George Stephenson's triumph at Rainhill in 1829, railway construction had commenced and was fast monopolizing attention as the most efficient and rapid means of communication. The names of Brunel, Clarke Russell, Whitworth and a host of others claim recognition in the rapid advance of engineering both at sea and on land which now followed, but enough has been said to enable a grasp of the rise of the profession and the lines of its gradual development to be realized.

The progress in organization of the profession which has since taken place has been due firstly to the commanding position in the profession attained by the Institution of Civil Engineers and secondly to the development and organization of engineering scientific education which has taken place in the Technical and University Colleges and Universities throughout the kingdom.

Institution of Civil Engineers.— This institution founded, as already said, in 1818, obtained a Royal Charter of Incorporation in 1828, its objects being — as described by Tredgold in a statement prepared for the Council in applying for a Charter — "For the general advancement of mechanical science, and more particularly for promoting the acquisition of that species of knowledge which constitutes the profession of a civil engineer, being the art of directing the great sources of power in Nature for the use and convenience of man as the means of production and of traffic in states both for internal and external trade as applied in the construction of roads, bridges, aqueducts, canals, river navigation, and docks for internal intercourse and exchange, and in the construction of ports, harbors, moles, breakwaters and lighthouses, and in the art of navigation by artificial power for the purposes of commerce, and in the construction and adaptation of machinery and in the drainage of cities and towns."

This is the earliest definition of civil engineering and the profession of the civil engineer therefore embraces all non-military engineers who are laboring to "direct the great sources of power in Nature to the use and convenience of man" whatever be the special corner of this wide field of operations to which any individual member may be devoting himself.

During the earlier years of the institution's corporate existence the enormous development in the construction of railways, roads, harbors, docks, drainage, and waterworks lead to the not unnatural predominance of discussion on questions of special moment to these branches of the profession in the institution proceedings. The Council was consequently largely recruited from the men of eminence on the predominating side and the civil engineer became in public estimation more and more exclusively identified with the designer and constructor of such works.

With the rapid improvements which have since taken place in machinery and machine processes and with the revolution which has been effected in commerce and in the requirements and mode of life of the people, by the less prominent but equally remarkable achievements of such men as Stephenson, Armstrong, Whitworth, Bessemer, and Siemens, the demands for a greater outlet for the discussion of the mechanical problems of interest on this side of the profession of the civil engineer became more and more insistent and the opportunities available in the existing institution being by many felt to be inadequate, the Institution of Mechanical Engineers was founded in 1847 and was constituted in 1878 as a registered association under the Companies Acts.

With the discovery of the means of practically utilizing electricity for producing light and transmitting power and the consequent extension of its use in all departments of mechanical work a third development took place in 1889, when the Society of Telegraph-Engineers and Electricians which had been incorporated under the Companies Acts in 1883 and from its establishment in 1871 had until 1881 been called the Society of Telegraph Engineers again changed its name to the Institution of Electrical Engineers. Various other societies and institutions have been formed at various dates amongst which may be mentioned the Civil and Mechanical Engineers' Society, the name of which the membership is confined to junior founded on a misconception, the Society of Engineers, and the Institution of Junior Engineers, a very active and progressive institution of which the membership is confined to Junior members of the profession.

The Institution of Civil Engineers is thus the parent institution, embracing by its constitution and membership all branches of the profession demanding for entry to its roll (a) practical professional training in works or as an assistant to an engineer; (b) theoretical training as evidenced by the passing of its own examinations held twice a year or by the holding of the degree or diploma of a recognized university or technical college; (c) suitable and strictly defined qualifications for each of its classes of membership or studentship.

It is recognized as the leading professional body and membership of its Council and occupation of its presidential chair to which there is annual election are the most valued of professional distinctions. It can to a certain extent guide and control professional conduct within its own membership but does so with an all-too-sparing hand. To many it appears that the time is ripe for further extension of professional organization and for the application of stricter discipline in regard to what may be called, generally, professional etiquette, and it is the Institution of Civil Engineers which alone has the constitution and prestige which would enable it to successfully deal with such a development.

Beside this great leading institution are the Institution of Mechanical Engineers and the Institution of Electrical Engineers, each representing one branch of the profession only, and demanding professional but not examination qualifications for membership. Most of the members of each of these belong also to the premier institution.

To complete the organization of the profession much remains to be done. There is as yet no state registration enabling the assumption of the name civil engineer (embracing, as has been shown above, engineers of all branches) by unqualified and untrained persons, to be checked and fees and professional conduct to be regulated by a governing body, such as the Institution of Civil Engineers, with the help of the other professional institutions, might organize if they had the necessary statutory powers. The public thus lack the protection to which they are entitled against the employment of unqualified advisers whom they have no sure means of distinguishing from competent engineers. One difficulty in the way of this necessary step being taken would probably be removed if the popular misconception of the functions of a civil engineer were eradicated.

This perhaps is more strongly the case in the United Kingdom than elsewhere, for there it has been the custom, where work involving machinery or engineering construction of any magnitude was required by those who were not themselves engineers, to obtain advice as to the best way to obtain the ends in view, and the best engineering designs to employ, from leading members of the appropriate branch of the profession practicing as consultants. There has thus grown up a body of engineers whose function is to give this advice and draw up the instructions upon which tenders can be obtained from engineers who undertake the construction of the works or machinery involved. Much misconception has arisen in America and elsewhere as to the foundation and value of this method. The consultant is in a position of trust between his non-engineering client and the manufacturer. By clearly defining the requirements of his client, after investigating all the conditions of the problem, he enables competing contractors to estimate their prices upon a fair and uniform basis. On the one hand his duty is to see that his client obtains the best installation and that which most satisfactorily fulfills the conditions of the problem on reasonable terms; on the other he sees that no competing manufacturing or contracting firm is unfairly handicapped by a misunderstanding of the problem and by the unfair competition of a rival. Further, his duty is to see that the chosen contractor is not unfairly dealt with owing to the ignorance of engineering possibilities or limitations on the part of his client.

In this capacity, as arbitrator and adviser, the highest qualifications of judgment, independence, integrity, and justice are required of the engineer, and it is of the highest importance that the ranks should be kept purged of any who may usurp these functions without the necessary qualifications and bring discredit upon the profession as a whole. Here statutory powers of control and regulation by a professional body are pre-eminently needed.

Educational Organization.— On this question a brief word must suffice. Engineering schools were first established in London at King's College and University College in the first half of the 19th century. These have been followed by the establishment of other schools in the provinces and in London until a large number now exist in which the scientific bases of engineering are taught in an organized course lasting in general for three years. During that course Engineering Laboratory training at most schools occupies a large portion of the time. Experimental determinations of the efficiencies of various machines and prime movers working under varying conditions, the strength and properties of materials, flow of liquids, etc., are undertaken by the students, and the underlying scientific laws deduced and exemplified.

In some schools engineering manufacturing processes are also taught and workshop training undertaken, but in the United Kingdom it has generally been held that this branch of training is best obtained in the factories of manufacturing firms, and this is the method advocated by the Institution of Civil Engineers.

The University of London has an Engineering Faculty and grants degrees in Science (Engineering), and the University of Cambridge has a Mechanical Science tripos as an avenue to its degrees in arts.

The provincial universities all grant degrees in science on the engineering side. Dublin and Liverpool alone grant a degree in engineering.

The principle upon which such "engineering" as distinct from "science" degrees are generally held to be unsound in Great Britain is that the practical, which is an essential portion of an engineer's training, can not be rightly regulated or judged by an academic body. A professional body such as the Institution of Civil Engineers is alone competent to co-ordinate the two portions of the professional education.

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32. Great Britain — English Society. This paper does not purpose to deal with the history of society in England, or to compare the customs, clothes, and conventions of different centuries;— still less to compile personal anecdotes and present sketches of various social celebrities. To do any of these things adequately would fill a volume. The article therefore merely attempts to give an impression of English society as it exists in the year 1906, and some account of its chief characteristics, influences, and pursuits.

Society in England is very difficult of definition. There are no rules of admission, no graded qualifications, no inevitable exclusions. It is not essential to be well born, or rich — it is not necessary to be refined or clever. The enclosure is a very large one and there are many entrances and many tickets of admission. Certainly the fame of its easy hospitality attracts undesirables from all over the world, and people, who in spite of their vast wealth, have proved too stupid or too vulgar for Paris and Rome, often find a happy home in London; but it is to the credit of society in England that it tries to be appreciative and will always welcome anyone who can amuse or interest or stir it — brains, talent, fame, are keys which unlock every gate, and this hospitality, combined with certain national characteristics, helps to make social life in England, notwithstanding its obvious faults, on the whole vital and interesting.

A clever German woman said once that in her own country she would rather belong to the middle-class, for it contained almost all the people with brains and talent, but that in England there was only one thing to do if you wished to pass your life among interesting people — and that was to get into society. She should have added, from her point of view, that unless she had been gifted with certain qualities, she might have been born a member of one of the greatest families, without attaining this result. Mere rank or birth is not enough — both undoubtedly help, but it is no use being born within the enclosure unless you are able to walk about in it.

Unlike the custom of many foreign capitals it is not really necessary to be received at Court before admittance, nor on the other hand is the presentation to the King and Queen a sufficient introduction. The presentation is an honor but not a necessity, and except in rare cases, where the reception at court practically intimates to society that some scandal is to be ignored or condoned, carries with it, so far as England is concerned, no social privileges. The influence of the Court is, however, very considerable and confers a certain social position even though it cannot always secure admittance into some coveted circles. For in a sense it may be said that the Royal family is apart, having a circle round it drawn from society, but not itself forming a part of the general throng.

Roughly speaking, English society has always concerned itself with Government and with politics, from the days when the great nobles of the State took sides and fought for rival Kings, to the present time, when the sons of great houses join one or other political party, and when to be a prominent politician is to be a prominent social figure.

In the nearer past, society was divided into hostile camps, following the cleavage of party. Whigs met, talked, played, and danced with other Whigs; Tories with Tories, and the orbits of the two planetary systems rarely crossed. In the year 1906, these divisions hardly exist, and it may often happen that a Minister will find himself at the same table with a Member of Parliament who an hour before was denouncing him as a dangerous enemy to the best interests of his country.

There is a rule that no Member of Parliament when speaking in the House, shall step beyond a certain line drawn parallel to the benches; a necessary precaution once, when passions ran high, and swords might be whipped out at any moment. But now that there is more control, and men do not wear swords, the rule is only a survival whose origin is forgotten. The line beyond which no man may step has been transferred from the floor to the tongue. Even in the days of swords duelists before beginning to fight used to greet each other with elaborate bows and courtesies and, in the same spirit, two men engaged in a bitter struggle can now exchange smiles and laughter at dinner.

These conventions are reflected in the society of to-day, where no difference of opinion, no rivalry, hardly any dislike, is allowed to hamper social intercourse — the bitterest public opponents in politics and letters, the criticized, and the critics meet amiably round tables, and all goes well.

Two characteristics which during the last few years have affected the pace and the color of social life, are restlessness, and love of riches.

The first is fostered by the greater facilities of transit and of communication, which urge even the most quiet people into movement. Routine is almost unknown. The busier a man or woman, the more imperative becomes the weekly change of air, the journey to waters, the visits in Scotland — while life in London itself is forced to an ever-increasing pace by the telegram and telephone.

The second characteristic, the worship of riches, is the effect of a growing taste for expensive pleasures and displays. London even suffers sometimes from the particular type of American millionaire, who will spend thousands of pounds upon transforming the courtyard of his hotel into a lake, and feeding his friends in gondolas,— but these visitations are rare and hardly ruffle the surface of social life. There are however, permanently in its midst, men who possess special commercial aptitude, but who have no peculiar social qualifications. Their wealth enables them to erect palaces, dine delicately and expensively inside them, whirl about in magnificent motor cars, hire splendid moors and forests, and these people, though they could not have done so fifty years ago, palpably influence modern social life. A standard of luxury and pleasure is set up, far beyond the power of ordinary well-to-do people to attain — some struggle to compete, some acquiesce and give up the effort, but all enjoy what they can of the rich man's table. Every door is open to him; his character, his conversation, his manners are seen through a golden haze — he is asked everywhere — he is flattered and imitated. It may possibly occur to him at depressed moments that he is not quite inside the inner circle; that certain great houses only remember his existence once a year, and that there are always some people, not devoid of influence, who prefer simpler friends, and simpler modes of life. But he will be easily consoled; there will always be the many others, his children will marry what is called the best in the land, and he himself will finally, if his ambition so prompt him, take his seat proudly as a peer of the realm.

Keeping in mind then, these two characteristics,— restlessness and love of riches, a description of the methods of intercourse, and incidentally the pursuits adopted by the pleasure seekers will help to give a more complete picture.

The practice of eating together, it need hardly be said, still obtains, and on the whole, the amount consumed in spite of much that is said and written, varies very little in quantity. It certainly does in quality — French cooks and French dishes have invaded London and the consequent expense and variety make it difficult for small households to compete with the restaurants. The habit therefore of eating simple food at home, and of entertaining friends at the Carlton or the Ritz has taken strong hold. Not so very long ago it was difficult to get a really good and choice dinner except at a private club — now a sovereign or two in the pocket will secure it on any evening of the year. The enormous increase in theatres is a subsidiary effect — a party cannot sit forever round a table, and they drift to some place of amusement. The habit of sitting together and talking is on the wane, «causerie» is becoming a lost art, and in private houses the theatre is replaced by bridge tables, and occasionally by music.

Letters have altered in much the same way as conversation. The old fashioned correspondences, the full, leisurely chronicling of great and small events, has given place to telegraphic and telephonic communication. Those people who are not in the telephone book inevitably drop out of the busiest ranks of the pleasure seekers, just as those who do not possess motor cars have to abandon the chase after distant golf links and country luncheon parties.

A week's visit in a country house is now a rarity — the longest shooting parties begin on Tuesday and end Saturday, and the throng hurries back to London, or goes on to one of the usual Saturday to Monday hospitalities. But in spite of this curtailment, and in spite of the rush of a week-end party — the country visit remains the best method of intercourse. There is a greater freedom — youths and maidens walk, ride, play games, and in the intervals talk together, and their elders when released from their own athletics and cards can also exchange ideas. Marriages are promoted far better in this way than in the mazes of the dance, and many of the best marriages have been made by girls who are little known in London. This is greatly due to the decay of town life which is gradually setting in — out of door pursuits and games absorb people more and more, and the ease of transit make them able to combine a certain amount of town dissipation with country life. The girls are tall, strong, well-developed, they hunt and play golf and bicycle — they join in whatever may be the game of the moment, with the keenest zest, and improve their figures and their general health, and indirectly the whole physique of the race by this custom. The part which girls and women thus take in the amusements of the other sex, is only one of the many invasions which women have practised. They share to the fullest extent in the work and struggle of their husbands — in politics they take an increasing part, many of them now speaking on political platforms, besides doing humbler work in constituencies. Women, with their gift for detail and their organizing power exert great political influence on all kinds of subjects — an influence which is too impersonal and diffused to be ascribed only to the usual cause. The old Aspasian influence, however, always has existed, and always will, for no change in social methods will diminish or increase the eternal power of sex. The political salon has disappeared, chiefly because of the vast size of political and social circles, but the women who make the right men meet at the right hour, who place the derogatory or the praising word at the auspicious moment, who avert unpopularity or create it, are as powerful as they have ever been. Therefore while women leading social lives certainly read, think, and even work more than they used to, there is no falling off in the efforts after personal adornment. On the contrary, the same thing has happened with dresses as with dishes — both are now made expensively by the French. Probably a smart lady of our day spends three times as much upon her clothes as her mother or grandmother did. This is not only because she lives in a more extravagant age — it is also because she does many more things for which she has to be appropriately dressed, and because the standard of technique in this difficult art has been gradually rising. A smart English woman will often spend from £2,000 to £3,000 a year on her outfit, which has to contain for town life, morning gowns, afternoon gowns, dinner and ball gowns — even House of Commons gowns, and for country life, golfing, shooting, and walking skirts, driving coats, motor coats, furs, tea gowns and evening gowns. To all these must be added the endless supernumaries of veils, gloves, handkerchiefs, scarves, umbrellas, parasols, walking sticks, hats, shoes, boots. Every new pursuit in a social woman's life means a new dress. Skirts hamper athletics in any case, therefore they must be specially made—the gown in which it is fitting to open a bazaar looks vulgar in a drawing-room, the evening gown is not quite in tune with the House of Commons, and so on. The men are spared the greater part of these trammels, but they would not be pleased to see their wives lacking in any of the so-called essentials.

People often wonder whether smart society is more or less immoral than it was — an obviously hopeless comparison to attempt, for the facts are not adequately known or recorded. If a set of very rich people who have not got enough to do, spend their lives in various frivolities, this description undeniably applies to a section, though a small one, in England — it is only to be expected that some fall into follies, and some get caught in the grip of passions with which they have been playing. But on the whole the tone is good, the decencies are observed, and the unfaithful wife or the complaisant husband are not admired. It is considered more intelligent to get on together as man and wife, and if a harmony is sometimes preserved only by an organized tolerance or blindness, it is at least a tribute to the prevailing fashion.

Insensibly an article about Society in London becomes an article about women,— and with reason — for women make it, guide it, sustain it. It is they who organize many of the pleasures for the other sex, it is they who arrange parties for the most brilliant of their acquaintance, male or female, it is they who select and discard the members of their circle. A dull man is often accepted by hostesses for the sake of his clever wife — but a clever man is rarely able to successfully float a dull or tactless woman. He must either go out without her, or drop from the ranks, for a dull woman is far more difficult to swamp or absorb owing to the social custom of deference to women, than is a dull man. Natural selection is as ruthless here as in other matters. There is a greater number of pretty and intelligent, leisured and therefore charming women in London than there is of clever, interesting men. It is one of the disabilities of Empire, that the outlying possessions claim year by year many of the more adventurous, thoughtful, and ambitious of England's youth. If a man is not the eldest son of a great house, and has no desire to go to the Bar, or enter politics, he is almost certain to get to India — or to one of the great colonies. After governing kingdoms, after fighting savage tribes or building railways which change the destinies of continents, these men come back to London as strangers — they are often run after, flattered, and feasted, but they do not stay — they return to their distant and strenuous lives and leave society very much as they found it. They rarely have the opportunity of marrying into it, which may or may not be a loss for them, but is undeniably one for the girl who would have found in her husband's career a fitting outlet for her own energy, enthusiasm and ambition. The growing interest in the problems of empire which make women admire men of this calibre, the greater freedom of intercourse allowed, and above all the habit of constant and extended travel, will alter these conditions, and there may in time be far more intermarriage between England and her colonies than now exists between England and America. American women have started the fashion of travelling — and incidentally that of marrying out of their own land. Their English sisters being able to satisfy hankerings after titles and other social amenities at home, will probably extend their choice almost entirely to men of their own race.

No description of social life would be complete without some mention of its duties and claims. The feudal dependence upon great families, the claims of poor relations, the patronage of struggling authors and artists, these things exist no longer as institutions to which all must submit, whether they wish to or not. Instead has come a far wider sense of responsibility, including these claims, and many others as well. Hardly a social man or woman exists who does not give time and work to his or her particular charity or league. Many great reforms have been initiated in this way — the attempt to redress coming from the very class carelessly dubbed as heartless. The efforts are sometimes futile and unfruitful, but a surprising amount of devotion and ability exists, and in times of national crisis, like the Boer War, social men and women come to the front, and reveal powers of organization and work little suspected. Many women spend all their leisure in promoting various causes — many men rob themselves of well-earned rest to help in definite philanthropic work.

In attempting to give any picture of Society as a whole it must always be borne in mind that there are circles within circles in London: there are houses where you can get brilliant talk, political and social; there are houses where people who belong to various choirs and choral societies meet to sing through old madrigals and part-songs; there are hostesses who provide perfect concerts, who give balls, who arrange card parties, and there are others who attract round them the literary flavor of the moment.

Large, flashing, many-sided, English Society of to-day deserves much adverse criticism, but it is also worthy of study and of admiration. From its ranks are drawn many of the nation's most famous men and women — and to its ranks are welcomed every day all and any who have distinguished themselves. The bright gaudy pattern is woven on a plain and sober ground of solid work and achievement. Society in England is adapting, expanding, altering with the general state, and is therefore not a mere excrescence on the national life, but an integral part of its organism.

Edith Lyttelton.

33. Great Britain — Sport. Sport occupies at the present time, as indeed in all periods of English history, a space in social organization which those who would understand national life and character cannot possibly ignore. Speaking generally, in most of the forms which it has assumed, sport represents the survival of those instincts and aptitudes developed by primitive man to cope with the two imperious necessities of his existence; defence against his fellows and the quest for animal food; and war and the chase, which were the expression of these necessities, demanded qualities of very similar character. Both necessities exist at the present time, but war is of far less frequent occurrence and the pursuit of wild animals is rare in old and civilized countries. But in the less advanced provinces of the Empire adventurous Britons find the older conditions still prevalent, and there, as in times of war nearer home, large opportunity and recognition is accorded to those qualities which are characteristic of the best sportsmen — courage, cheerfulness, discipline, the faculty of command, the corporate sense, the spirit which, forgetful of self, rejoices in the power and cohesion of the crew, the regiment and the team. A school of reformers whose eyes are bent at the present time on national efficiency in war are disposed to deny the value of sporting qualities in modern warfare, and preach with conviction the necessity of the training of our youth in drill, rifle-shooting and other exercises more closely related to military science. It is doubtful whether these views are harmonious to the national tastes, and whether if they prevailed, the training suggested would ultimately produce better material than the less organized physical discipline of field sports and games. Be that as it may, sports and games have a great, perhaps too great, a vogue in England. Not unfrequently they have become an end in themselves, and as perhaps is natural in a period of ever increasing wealth and leisure, men pass from cricket, tennis and polo in the summer to hunting, shooting and golf in the winter, believing that they are attaining, as doubtless they are pursuing, pleasure; but they carry on their countenances the negation of their expectancy and furnish living proofs of the existence of the law of contrast prescribing that pleasure must take its roots in foundations of strenuous and often irksome industry. Recreation, which sport in its true sense represents, is that which refits and recuperates man and renders him more capable to do his work, and the nation which has seized this conception of sport, lives up to it and narrowly observes its tests, has little to fear from the joyless exaggerations of pleasure, or the nervous morbidities of industrial excess. But when the basis of industry is firmly established, those gain most from recreative sport, and get most efficiency from its pursuit, who are the most absorbed and strenuous, put forth for the time being every faculty and energy into the affair of pleasure, and whose ardor for success is limited only by the canons of the highest chivalry, and by the resolve that while every nerve must be strained to defeat him, an antagonist, whether man or beast, must have all the courtesy and honor of war.

The seriousness of Britons at play is often the wonder of amused and tolerant foreigners, but much can be urged to justify it; if realities have for a time to be banished, the phantoms pursued in their place must have their semblance and fashion; the problems of politics, law and business, the cares of every day life absorb and wear the brain; to exclude them there is need of substitutes which will really engross other faculties than those normally in use.

Few will dispute that the Britons have carried sport further and cultivated the sporting spirit more assiduously than any other civilized race. This energy is in part accounted for not by the greater prevalence in ancient days of war and the chase in England, but by the peculiar social conditions absent elsewhere, but which obtained in earlier days in England. Looking backwards only so far as the days of the Stuarts, before Puritanism had set its ban on many of the pastimes of our forefathers, we find that while in France the Court encouraged the noble to assert his plea in society by living in Paris or Versailles, the Stuarts regarded the status of country gentlemen as a profession in itself. The squire was expected to keep open house, administer local justice, relieve want and furnish employment. These functions, enforced by a shrewd purpose from above, confirmed a not unwilling class in those duties which were not so onerous as to prove any serious bar to much sporting. The deer in the enclosed parks were deliberately chased to the cry of hounds "slow in pursuit but matched in mouth like bells" hunting 'at force' ranged over wider spaces — the otter was speared, the badger trapped, the hare coursed and the fox hunted by the squire who owned his own hounds. But if these sports were the peculiar domain of the well-to-do, the less wealthy enjoyed with a whole heart fishing, then open to nearly all, and games of all sorts. The country lay ever at the townsman's doors, and wrestling, where life and limb were in jeopardy, jumping, pitching the bar, dancing and nine pins were native customs, while football enjoyed a popularity which emulates that of the present time. The husbandman, when the fat swine were killed on the approach of winter, got the bladder and blew it out great and thin, and "tried it out at football with the shins." The simplest of all games, it was played with local rules suited to the nature of the ground, often across the stream and up the length of the village. King James forbade it at Court as "meeter for the laming than the making able of his liege subjects," but all classes commonly joined in the scrimmage to the good old cry of "all fellows at football." The causes, partly economic and partly political, which attached the rural gentry to the land received renewed impetus from the Napoleonic wars and the great appreciation of prices of agricultural produce of that period; and the honorable opinion that obligations should accompany social privileges in rural life, is happily to this day widely felt throughout the land. Local government and administration and minor judicial work still remain, and the police, notwithstanding the activity of County Councils, are largely controlled by the experience of country gentlemen, and so long as there is this solid background of usefulness for them, field sports will continue to be enjoyed by the gentry, but for whose presence in rural England they would soon perish. But it is natural and inevitable that with the growth of population, and above all of the perpetually increasing facilities of locomotion which make that population so mobile, hunting, fowling, stalking, and shooting, owing to the competition for them, tend to be the sports of a relatively diminishing portion of the population. Fox hunting does indeed (wild stag hunting is now so rare as to be almost a curiosity) despite the inroads of civilized life still retain a leading position in England sports, but railways and motors are making and will make its pursuit more and more difficult by temporarily concentrating into particular places most adapted for the sport such large numbers of people living at a distance that the agriculturists, who formerly never repelled and often welcomed the advent of hounds, now require large compensation for the kindly hospitality which they extend to their passage over the land. This is not surprising when a field of 500 horsemen, many of them strangers to the district, accompany the hunt whose progress ravages both crops and fences in spite of a dictator's authority freely accorded to the master and exercised to the general good. The attachment of Britons to the greatest of all sports is attested by the expenditure, cheerfully borne by men often not rich, which of necessity follows on the track of such damage, but it is to be feared that in the coming years other obstacles to hunting more difficult to overcome will follow in the wake of more specialized and scientific agriculture.

Shooting is enjoyed under more advantageous conditions as the great natural wheat lands and pastures of the world come more completely into use. Deer forests and moorlands are less likely to be required in the future than now for the purposes of pastoral or agricultural industry. The driving of both grouse and partridge has, contrary to expectations, resulted in a wonderful improvement in the health and reproductive power of these birds. The Battue of pheasants, though probably requiring greater skill from the individual in the technique of actual "gunnery," is by reason of its artificiality lacking in the highest interest and excitement of sport, but for that very reason it can be conducted in places where nature has been most obviously civilized. Partridges, though wilder than pheasants, if let alone will seldom go beyond the limits of two or three fields, they need not the silence and the calm of the moors, and are not averse to the frequent presence of man; thus partridge shooting is a popular sport and on the first of September, the echoes are answering a dropping fire from John O'Groats to Lands End.

Driving, usually postponed till three or four weeks later, requires large estates and much organization, drilling of beaters, etc., but there remain many lively days of more desultory sport widely enjoyed by modest folk, sometimes advancing in line over the fields, sometimes using the dogs who were formerly indispensable. Geese, snipe, duck and woodcock are rare in any considerable numbers, but the rabbit's white tail vanishing into the burrow is one of the most familiar spectacles of the rougher and less highly cultivated countries. Fishing is even more democratic and is pursued by great varieties of men of all conditions and all ages, but salmon and good trout fishing are already beyond the reach of modest incomes, even in Scotland. This sport, which in the opinion of many great judges, is second to none, is connected with many disappointments and has infinite varieties. The element of uncertainty and risk enter into it to a degree sufficient to answer the expectancy of the most exacting, but like hunting it is greatly to be feared that the enjoyment of its exquisite pleasures must be more and more restricted, and the pursuit more and more detached from universal national life. In truth those causes against which no expert can be of any avail and to which reference has already been made, the fast filling up of the island, the limited area unoccupied by the presence of man, machinery and locomotive facilities of all kinds are slowly tending to draw the vast majority of the people from the chase to those games whose enjoyment is independent of the existence of wild nature, and whose arena is accessible to all. Cricket, football, racing and golf occupy a truly astonishing position in the public mind. Even in Scotland, where cricket is, comparatively speaking, little in vogue, the leading newspapers devote daily, five or six columns to accounts of these pastimes, while it is noticeable that English journals whose leading articles contain austere exhortations against gambling, and denunciation of the undue dominance of sport, are forced by the struggle for existence to chronicle at wearisome length the very subjects whose popularity they deplore. Racing has become so commercial and statistical that it may be said to have, for many of those who are prominently engaged in it, many of the characteristics of business, and it affords great pleasure and excitement to innumerable speculators who without seeing the races, or knowing anything of horses, hazard sums of money varying in amount under the guidance of "tipsters" in newspapers on the issues of remote contests. In the north of England and sporadically in the Midlands and South there exist many genuine lovers of horses deeply interested in the science of breeding for speed, and enjoying without pecuniary stimulant the glorious sensation of pride and admiration which the victory of a horse bred at home and reared with affectionate and anxious solicitude inspires.

Gambling has not entered to so considerable an extent into cricket or golf, though it is said to be making its way into the wide regions where football holds sway. But the commercial spirit is tending to invade the arena of popular games. Cheap excursion trains concentrate vast crowds of spectators in the large cities; so many as 100,000 gather to see the most important football engagements; and during the three days occupied by a cricket match 50,000 or 60,000 frequently pay sixpence or a shilling for a pleasure which to men engaged in hard manual toil throughout five days of the week has the deepest attraction. The press is compelled to give large spaces to description of contests which arouse such widespread interest and stimulate such extensive circulation among a public who but for the sporting cohesion would never dream of purchasing the cheapest journal. The opportunity of a good livelihood pleasantly earned is, as a result, extending itself to a larger and larger number of professional players, and if the worthiness of an occupation is to be measured by the different pleasures which it conveys, a professional cricketer or footballer is earning his bread in at least as meritorious a manner as many other craftsmen against whose calling no criticism has ever been made. But irritation is aroused at the disproportionate celebrity which is attached to skill in these pursuits, and to the ambitions which they excite among amateurs, and to the place given in national life to things which should be the variants and not the principal motives of energy. A powerful temptation is continually presenting itself to young men just at the time when the real business of life should begin to earn popular applause and distinction by making a game the staple occupation of their time. The result often is that at the age of 35, when physical powers for these purposes begin to lose their first bloom, men who have had much excitement and have awakened much popular notice fall into an enforced and unwilling idleness which is often difficult, after so long a delay, to disperse by the practice of a profession or entrance into business. Criticism is heard far and wide of this exaggeration of a natural and manly taste, but no remedy will ever be of the slightest avail unless it be accompanied by an alteration in public opinion and estimate of the value of proficiency in games.

At present no evidence of such a change is perceptible in the Anglo Saxon race. In America, though less widely diffused, games are prosecuted with an intensity characteristic of an energetic people. Australia, New Zealand and South Africa are more deeply inoculated with their attraction than the mother country. In one province leading statesmen vie with civic dignitaries in applauding and welcoming with honors the dashing batsman or the "demon" bowler; in another the expenses of the all-conquering football team are placed on the estimates and cheerfully voted by an enthusiastic Parliament. Few anticipate a diminution, many expect an increase in the popularity of sport, and the historian of the future will probably be able to institute an interesting comparison between those nations who are trained more consciously for war and those who are learning some of its lessons in sport. The phrase "play the game" has passed into the language as a symbol of honor, unselfishness and veracity; we may hope that the sources of these virtues will be untainted by commercial standards and will refresh and preserve national manliness.

Alfred Lyttelton.

Formerly Secretary of State for the Colonies.

34. **Great Britain — The Fine Arts.** The earliest records of British art are concerned with the decoration of palaces, churches, costumes, arms, furniture, and domestic utensils. But we find the point of transition from the useful to the fine arts in the shrines, such as those erected by Edward I. to the memory of Queen Eleanor, the monuments, tombs, painted tablets and portraits on glass and in illuminated MSS. of the 15th century. From the 15th century onwards oil painting became the chief medium in which the memory of important persons and events was recorded. All the important work of this kind was, however, till the 18th century, in the hands of foreign artists, who were attracted to England by the munificence of the kings and nobles; hence, with the possible exception of Holbein's and the best of Van Dyck's portraits, it reflects the national instincts and sentiments only from an external and superficial point of view. But the distinctively British school of painting, which sprang into existence during the 18th century, owed much to the influence of these foreign artists and their works, and to the numerous collections of pictures by celebrated continental artists which collectors like the Earl of Arundel and Charles I. had formed. These provided a kind of university in which native-born artists could educate their taste and master the manual secrets of their art. The English artists had only to assimilate the traditions of the great foreign schools and to use the technical skill thus acquired for the expression of those more intimate nuances of the national character which foreign artists—whatever their artistic gifts — were incapable of sharing. Hence, the astonishing rapidity with which the English school of painting developed, the absence of technical experiments which marked its first stages, and the very high standard of executive ability which the earlier men possessed.

PORTRAIT PAINTING.

The first English portrait painters seem to have seen their sitters through the eyes of the foreign masters under whom they had studied or on whose works they had formed themselves. The very skilful miniatures of Nicholas Hilliard (1537–1619) and Isaac Oliver (1564–1617) show the influence of Holbein and the French miniaturists. Robert Streater (1624–1680) was a pupil and imitator of Dumoulin, William Dobson (1610–1646) and John Haylis. (—— 1679) of Van Dyck. John Greenhill of Salisbury, (1649–1676) of Sir Peter Lely. Samuel Cooper (1609–1672), whose fine portrait of Cromwell is well known, and John Riley (1646–1691) were the first to express a more distinctively national point of view in their portraits. Jonathan Richardson (1665–1745), Riley's pupil, had great influence in directing attention to the intellectual and imaginative aims of paintings.

William Hogarth (1697–1764) is the first great English artist. In a series of paintings like 'The Harlot's Progress,' 'The Rake's Progress,' and 'The Marriage à la Mode' (National Gallery), he brought the whole drama of contemporary life into pictorial art. Such pictures contain abundant evidence of the artist's powers of observation and memory, but Hogarth was not content to observe life merely from the outside. He does not choose a series of situations and proceed to visualize them as they would appear to an indifferent spectator, but, as Charles Lamb has pointed out, he seizes his subjects with such an extraordinary power of imaginative intuition that they seem to direct him, and his paintings, instead of confining themselves to external matters, become a revelation of and a commentary on the unseen qualities—the moral and intellectual attributes—of his characters. To do this the whole of the artist's personality has to be engaged in his work of dramatization, and it is inevitable that the result should bear the impress of his temperament and convictions. Hogarth has been censured, especially by continental theoricians, for allowing his moral emotions to appear in his work; but the place his art has taken in the life of the English people depends almost entirely upon the warmth and thoroughness with which he made himself an exponent of their instincts, sentiments, and aspirations. There can be no doubt that Hogarth is as thoroughly national in what have been called his moralistic prejudices as in the completeness and sharpness of his observation, his rollicking humor, and the animation, vigor, and bitterness of his satire. With such gifts it is not surprising that Hogarth has left us some excellent portraits. His own portrait, in the National Gallery, and that of Captain Coram, in the Foundling Hospital, are generally considered his most successful efforts in this branch of art.

Thomas Hudson (1701-1779), a pupil of Richardson, was a successful rival of Hogarth as a portrait painter. His merits have, however, been obscured by the achievements of his pupil, Sir Joshua Reynolds (1723-1792). Certainly no painter has ever entered so subtly as Reynolds into all varieties of the English heart and mind. His portraits have such a striking air of individuality that they carry instant conviction of their veracity. This commanding quality is largely due to the completeness with which he identified himself with the aspirations and instincts of his countrymen, as this determined the principles of selection and rejection in his observation. We have Northcote's authority for saying that lovers "used to tell him (Reynolds) that after seeing his portraits of their ladies, they thought the originals handsomer than before; the reason of this was," he adds, "Sir Joshua seized upon some particular quality that he liked and made it more palpable than it was in nature, and which afterward served as an index to point it out to them." But while differentiating the essentially poetic or imaginative intuitions of the artist from the exhaustive and impartial observation of the man of science, we must be careful to point out that Reynolds's felicity of perception is just as clearly distinguished from the arbitrary constructions of fancy. They are real men, women, and children that he gives us, not mere figments of his imagination.

With such gifts, sedulously cultivated by unremitting practice and an exhaustive study of the works of the Italian and Dutch painters, Reynolds has taken his place amongst the greatest artists of modern times. Among the finest of his portraits of children we may mention 'The Age of Innocence,' 'Heads of Angels,' 'The Infant Samuel,' and 'Robinetta' (all in the National Gallery), and 'The Strawberry Girl' of the Wallace Collection. The 'Portrait of Nelly O'Brien' (Wallace) and 'Mrs. Siddons as the Tragic Muse' (Duke of Westminster) are among the best of his portraits of women. The superb 'Portrait of Lord Heathfield' (National Gallery), together with those of Dr. Johnson, Goldsmith, Burke, and himself are all fine examples of his grasp of men's character.

Thomas Gainsborough (1727-1788), the great rival and contemporary of Reynolds, was less varied in his portraits than that master. He approached his sitters with a stronger subjective bias and he was not so profound an observer. The charm of pathetic tenderness and melancholy which he gives to all his sitters belongs rather to the painter's own character than to theirs. His instinct for physical grace and beauty was probably keener than Reynolds's, but there were certain aspects of life in which he was little interested. Hence, his portraits convey a less concrete idea of his sitters than those of Reynolds. But this tendency toward abstraction enables him to express the qualities he is interested in with great clearness and emphasis, so that his pictures often give more intense and immediate pleasure than those of Reynolds. Among his most remarkable portraits are the 'Mrs. Siddons' (National Gallery), 'Mrs. Sheridan and Mrs. Tickell' (Dulwich Gallery), the 'Blue Boy' (Duke of Westminster), and the 'Hon. Mrs. Graham' (Edinburgh). Gainsborough's landscapes are at least as fine as his portraits, but we will defer speaking of them till we come to deal with landscape painting.

The tendency toward one-sided and arbitrary abstraction which we notice in Gainsborough is still more pronounced in the works of his contemporaries and immediate successors. George Romney (1734-1802) was so much impressed with the examples of Græco-Roman sculpture he saw in Rome that he took them as models for his own work. He betrays a constant striving to make the women and children who sat to him look like animated statues. This predominant concern with the external side of art led to the neglect of the intellectual and emotional sides of life. The idea of the sitter conveyed in Romney's portraits is therefore less capable of taking its place in any fully articulated conception of reality than is the case with Reynolds. But within his own limits Romney's works have a vivid consistency which gives them high rank as works of art. The very popular 'Parson's Daughter' (National Gallery) is freer than usual from the painter's besetting tendency to impose a pre-conceived ideal on his sitters; his own portrait (National Portrait Gallery), though unfinished, is a most interesting and characteristic work. Sir Henry Raeburn (1756-1823), a brilliant and successful artist, who worked principally in Edinburgh, painted nearly all the celebrated Scotch men and women of his time, with the exception of Burns. John Hoppner (1759-1810) was chiefly concerned to make the faces of his portraits pretty, and only as a secondary consideration to make them like his sitters. Sir Thomas Lawrence (1769-1830), with whom the great school of British portraiture may be said to have come to an end, used his great mechanical cleverness in the service of the false elegance and false sentiment fashionable in his day at the court and among the associates of the Prince Regent. There is less metricious affectation in his male portraits.

The school of humorous genre, founded by Hogarth, was developed in the direction of caricature by the water colors and engravings of Thomas Rowlandson (1756-1827), Gillray (1757-1815), the two Cruikshanks, Isaac (1756-1811) and George (1792-1878), John Leech (1817-1864), etc.; in the direction of prettiness and domestic sentiment by painters like Wilkie (1785-1841), Mulready (1786-1863), Webster, Newton, William Collins, Frith, etc.

LANDSCAPE PAINTING.

It is, however, in the domain of landscape painting that English artists have won their chief triumphs. If the English school of portraiture was the only great school of painting in Europe in the 18th century, the English school of landscape painting, which culminated in the works of Turner and Constable, may be said to have enriched poetic art with a new form of expression and to have revolutionized every form of modern art.

Richard Wilson (1713–1782) is generally regarded as the first of the great English landscape painters. His fame still suffers from the large number of canvases by pupils and imitators which are passed off under his name in most of the public and private collections. When at his best his feeling for breadth and quality, for tone and light and color, has been rarely equaled. He was one of the first painters of delicate morning effects of misty blue and silver. His designs have a freshness and beauty, and a majesty or serenity of atmospheric effect which even Corot and Turner have equaled but rarely. No other artist influenced Turner so much. In Gainsborough's (1727–1788) landscapes we find the same tendency toward abstraction which we noticed in his portraits, but here his sense of physical beauty and the peculiar charm and tenderness of his temperment find freer play. Of his four important landscapes in the National Gallery, 'The Watering Place' is the most celebrated. In such pictures Gainsborough struck an intimate personal note which was new in landscape art, but which had much in common with the note of lyrical Nature-worship, which was beginning to make itself heard in such poems as Thomson's 'Seasons.' No less essentially poetic is the art of John Cozens (1752–1799), the first great English water color painter. He is a poet of a more austere stamp than Gainsborough. His drawings are generally low in tone and subdued in color. He preferred Nature's "most silent eloquence."

J. M. W. Turner (1775-1851) began his career as a topographical draughtsman and water color painter. But soon after he was 20, under the influence of Wilson's and Cozens's work, he repudiated topographical art altogether in favor of a more poetical treatment of landscape. It became a principle with him that mere imitative landscape, painted as it might be photographed nowadays from a fixed point of view and embracing all that could be seen from that point of view, and no more, did not even represent the place so fully as a more general treatment would do. He therefore made a point of bringing any buildings and objects into his pictures, which from their importance or singularity were especial features of the place, even though they were hidden from his point of view or out of the field of his picture. Thus, Redgrave tells us, "he would say that no one should paint London without Saint Paul's, or Oxford without the dome of the Bodleian"; and constantly in his pictures he would move a building of importance considerably to the right or left, to bring it into what he considered its best place in the picture. "And this," Redgrave adds, "is quite consistent with reason, for no one but an artist views a town or any scene from a rigidly fixed point of view." We may add that this is merely the application to landscape painting of the principles upon which Reynolds invariably worked, and which he has formulated in his 'Discourses.' In the fourth Discourse he states that "even in portraits * * * the likeness consists more in taking the general air than in observing the exact similitude of every feature." This is because art addresses itself to the imagination; and this end is best secured when the artist makes all the details of his picture subordinate to his own imaginative intuition of his subject.

In the whole of his long career, during which his style underwent a series of startling transformations, Turner remained inflexibly faithful to Reynolds's conception of poetic art. His work is always an attempt to express a poetic conception or intuition, never an inarticulated collection of dispassionate observations. The differences in his style are the result of the changes which took place in his attitude toward life. Between 1800 to 1820 he gives us works which suggest comparisons between the dominant moods of Milton's and Wordsworth's poetry, after 1820 his works become possessed of a Byronic recklessness and sensuousness, with vague aspirations toward the unlimited. As typical examples of the earlier period we may mention 'The Frosty Morning,' 'Abingdon,' and 'Windsor' (National Gallery). These incomparable works show us that Turner could, as Prof. Raleigh has said of Wordsworth, "feel deeply and sanely and wisely in the presence of things seen." Though dealing with ordinary aspects of English life they have an unforced beauty of design and color which has few equals in the artist's work, and a tenderness and sincerity of feeling which makes the beautiful Gainsborough, which hangs opposite to two of them, seem almost rhetorical. In the later period the artist's chief aim seems to have been to astonish and dazzle the public. The restraint of the earlier works is abandoned for a loose suggestiveness, sincerity to a strange mixture of gorgeous rhetoric and childish naïvety.

The most characteristic works of John Constable (1776–1837) form a striking contrast to Turner's later pictures. Constable's subjects are conspicuous for their simplicity; they generally consist of a farm, a few picturesque cottages, a village church or green, or peaceful rivers wandering through luxuriant meadows. He treats such subjects with rare intimacy and sincerity. His pictures are characteristic of lowland England, and of "English homes" with "dewy pastures, dewy trees." Though Constable had not Turner's range or exquisite sensibility of temperament, he infused such a wealth of genuine affection into pictures like 'The Corn Field,' 'The Hay-Wain,' and 'The Valley Farm' (all in National Gallery), that they have long taken their place among the masterpieces of the English school. With Constable and Turner must be classed Crome (1769–1821), Cotman (1782–1842), Cox (1783–1859) and De Wint (1784–1849).

With these landscape painters what may be called the classical period of English art came to an end. In portraiture, landscape and genre-painting it had succeeded in expressing the best qualities of the English race; its high seriousness and imaginative force, its healthfulness and strong simplicity. But while universal in its substance it had remained individual in its form. The artists, while animating their work with their own personal convictions and emotions were yet so happily characterized as to stand as types of their fellow-countrymen. Their individual modes of impression and conception were those of all their countrymen, only freed more completely from the bias of exclusively selfish interests. There was no specially artistic point of view. The chief characteristic of most subsequent art — of Academic, Pre-Raphaelite, Realistic and Impressionistic art — is that it is the expression of a specially and artificially developed manner of perception. Modern English art is therefore less national than the art of Reynolds, Gainsborough, Turner and Constable; it makes a narrower appeal, is more of an exotic, a thing of coteries and faddists, requiring a specially developed system of apperception for its enjoyment.

ACADEMIC ART.

The distinguishing characteristic of Academic painters like Benjamin West (1738–1820), Barry (1741–1806), Herbert, Horsley, Long, Ward, Armitage, etc., is the substitution of intelligent plagiarism for spontaneity and creative force. Technical accomplishment takes the place of personal emotion. Such artists' works are generally arrangements after celebrated models; simplicity, directness of feeling, and all peculiar national stamp give way to an empty rhetorical manner and a blind worship of routine and processes.

THE PRE-RAPHAELITE SCHOOL.

The Pre-Raphaelite movement, which began about in 1848, was a well-meant and in some respects successful protest against Academic plagiarism. A band of young artists, of whom Holman Hunt and Millais were among the most prominent, resolved to do their uttermost to root out of their practice the influence of their teachers and of all the approved examples of their art, and to base their work on a fresh and personal study of Nature. The change thus inaugurated was primarily a technical one. The subject-matter of their pictures differed little from that of their older and Academic rivals. The difference was to be found in their methods of exact and elaborate representation. When the arrangement of the picture was settled every object to be represented was studied separately and painted direct from Nature. As Mr. Hunt has told us, "direct application to Nature" was made "for each feature, however humble a part of foreground or background this might be. I justified the doing of this thoroughly as the only sure means of eradicating the stereotyped tricks of decadent schools." Typical pictures of this kind are Hunt's 'Light of the World,' 'Jesus in the Midst of the Doctors,' and Millais's 'Ophelia.' Pre-Raphaelite theories also exercised a powerful influence on the black and white work produced between 1850 and 1870, notably in the wood-engravings designed by Rossetti, Sandys, Millais, Houghton and Pinwell.

REALISTIC SCHOOL.

It is not at first sight easy to distinguish the Realistic school of painters from the Pre-Raphaelites, of which they are strictly speaking an off-shoot. With Hunt and Millais the principle of direct and elaborate representation was always intended to be kept in subordination to the interests of imaginative art ("— it cannot be too clearly reasserted that Pre-Raphaelitism in its priority was the frank worship of Nature, kept in check by selection and directed by the spirit of imaginative purpose.") (H. Hunt, 'Pre-Raphaelitism' II. p. 452). In the works of realists like Thomas Seddon (1821–1857) and John Brett (1832–1902) this "frank worship of Nature" became an end in itself. The chief aim of Seddon's 'Jerusalem and the Valley of Jehoshaphat' (National Gallery), and of all Brett's pictures, is to give trustworthy information about the scenes represented.

IMPRESSIONISTIC PAINTERS.

This attempt to abstract physical reality from its setting in human consciousness was carried still farther by the Impressionists. The naïve vision of the Pre-Raphaelites had drawn attention to the importance of local colors in nature, the later works of Turner had directed attention to the transformations which atmospheric conditions exercise upon these colors. Impressionism makes the study of the atmosphere the main object of each picture. The Pre-Raphaelites had eliminated black and brown from their palettes; the Impressionists, partly owing to their example, partly out of deference to some questionable optical theories, have deliberately confined themselves to the use of the seven colors of the spectrum. The chief Impressionistic painters have been Frenchmen, but they have exercised considerable influence on recent English art. Among the more prominent Impressionistic painters in England are Mr. P. Wilson Steer and Mr. Wynford Dewhurst.

It has already been remarked that all these artistic sects are concerned mainly with technical questions, so that though each had had and still has its coterie of enthusiasts and initiated, none has enjoyed the whole-hearted support of the mass of the educated public. Each sect has no doubt voiced certain aspirations common to a large number of their fellow-countrymen, but as a whole their works reflect the national mind and temper in a fitful, fragmentary, and more or less arbitrary fashion. There are, however, three artists belonging to the latter half of the 19th century, who stand outside this war of artistic sectaries.

G. F. Watts (1817–1904), an artist of lofty ambitions, deliberately appointed himself the exponent in imaginative art-forms of all that seemed to him noblest and most worthy of admiration in his age. What he might have done had his great gifts of grandiose and monumental design had free play can be seen from his magnificent fresco in the hall of Lincoln's Inn, and from such paintings as 'Love and Death,' 'Hope,' 'Eve,' etc. As a portrait painter he belongs to the great school of Reynolds; portraits like those of 'Lord Shrewsbury' and 'Joachim' show the same greatness of conception and the same supreme gifts of imaginative intuition. His statues, like 'Clytie' and 'Vital Energy', have given him a great reputation as a sculptor.

D. G. Rossetti (1828–1882), though associated with the Pre-Raphaelites in the earlier stages of their movement, was essentially an emotional or romantic painter. Among his more important works are 'Beata Beatrix' (National Gallery), 'Dante's Dream' (Liverpool Corporation Gallery) and 'The Bride' or 'The Beloved.'

F. Madox Brown (1821–1893) was also at one time a member of the Pre-Raphaelite group. In his designs for the decoration of the Manchester Town Hall, and in such pictures as 'Work' (Manchester Corporation Gallery) and 'The Last of England' (Birmingham Corporation Gallery) he proves himself an artist of sincere and unbending talent, passionate in conception, impressive and convincing in execution.

With our limited space we cannot speak in detail of the beautiful and expressive work of the English Water Color painters, like Sandby, Hearne, Rooker, Cozens, Turner, Girtin, Cotman, Cox and De Wint.

SCULPTURE.

Sculpture has never flourished in England owing, it has been said, to adverse climatic conditions. The only really great sculptor England has produced is Alfred Stevens (1817–1875). Among other distinguished sculptors the names of Flaxman, Armstead, Thornycroft, Brock and Gilbert may be mentioned.

ARCHITECTURE.

It has often been questioned whether Architecture should be ranked among the fine arts, which are concerned primarily with the expression of intellectual and imaginative ideas, not with the production of objects of utility. The present tendency among architects to reduce architecture to a matter of good, sound, and convenient building emphasizes this objection. But there can be no question of the supreme artistic beauty of the Gothic cathedrals of England. As examples of the early English style (1189–1307) Salisbury Cathedral and the Nave of Lincoln may be cited; the choir of Lincoln is a typical example of the decorated style. The reigns of Henry VIII. and Edward VI. (1536–1540) saw the erection of a large number of grammar schools and colleges; that of Elizabeth the inauguration of the era of the erection of the great domestic mansions. In these buildings the late Gothic style was modified and gradually developed under the influence of the old classical architecture into the Anglo-Classic of Inigo Jones (1572–1652). In the buildings of Wren (1632–1723), such as Saint Paul's Cathedral and the Sheldonian Theatre, Oxford, French influence is more apparent. The 19th century saw a battle for pre-eminence between the Classic and Gothic styles. The restoration of a large number of cathedrals and churches and the erection of an immense number of new churches greatly aided the Gothic revival, but for public buildings the classical style, modified by modern French and Italian ideas of the Renaissance, has generally been adopted. In the latter part of the century the works of Norman Shaw, Nesfield, and Philip Webb initiated a movement in favor of the Queen Anne style, or Free Classic as it is sometimes called. As examples of this style we may mention Mr. Shaw's 'New Zealand Chambers' in Leadenhall street, and a number of country houses. Mr. Shaw's influence on the design of the smaller buildings in the suburbs and country by the erection of houses, etc., at Bedford Park, Chiswick, has been considerable.

ART INSTITUTIONS.

The establishment of the Royal Academy of Arts and state and municipal schools of design and art galleries, has undoubtedly exercised considerable influence on the later developments of British arts; whether this influence has been on the whole beneficial has sometimes been questioned.

The Royal Academy of Arts in London, as it was at first called, was established in 1768. It was an offshoot of an older professional society known as the Incorporated Society of Artists in Great Britain, which had come into existence as the result of the first public exhibition held in London (in 1760) of works by contemporary artists. The constitution of this society was of too democratic a character to suit some of the members. They therefore set about the establishment of a new society of a less representative character, and, as they were fortunate enough to secure the patronage and financial assistance of George III. and were thus enabled to obtain the co-operation of Sir Joshua Reynolds, their exhibitions gradually ousted those of the older society in the favor of the public. The Royal Academy has since maintained itself as the most wealthy and powerful art society of Great Britain; its influence among the better educated of the public has, however, been steadily diminishing of late, and it cannot be said at the present time to be really representative of the body of art workers in this country.

It consists of 40 academicians, mostly painters, with a few sculptors and architects. There is a second order of probationers, called associates, whose numbers vary from time to time, from whom alone the vacancies that occur among the academicians can be supplied. It supports and manages schools for the training of painters, sculptors and architects, the instruction in which is gratuitous. The cost of these schools during the last 30 or 40 years has averaged from £5,000 to £6,000 a year. The total number of students admitted between 1769 and 1900 was 4,697, giving an average of about 36 a year. The distribution of charitable funds is confined to its own members or to exhibitors at its annual summer exhibitions. The average annual amount distributed among its members "has been latterly," to quote a semi-official statement made in 1900, "about £2,000"; the donations to distressed artists who have been exhibitors at the Academy, their wives, and children under the age of 21, has averaged from £1,200 to £1,500. The whole of the funds at the disposal of the Academy are derived from the profits on the annual exhibitions, to which about 1,200 non-members contribute works and about 65 members and associates. The fact that the Academy is thus forced to put the making of a large profit out of their exhibition in the forefront of their activity may possibly account for the disfavor into which they have fallen with a number of the more serious of the younger artists.

The neglect of the art of engraving and of what are often called "the minor arts" of design by the Academy induced the government to open a school of design at Somerset House, London, in 1837, and in 1840 grants were made to establish similar schools in five of the more important provincial towns. In 1852 a Department of Practical Art was instituted, and the formation of a museum was begun which developed into the present Victoria and Albert Museum at South Kensington. About 1880 a growing conviction of the inadequacy of the governmental schools led to the establishment of new technical schools in the principal towns. The municipality of Birmingham established a singularly well-equipped and organized school, as did also the municipalities of Manchester, Glasgow and Leicester.

The British National Gallery, though the collection is small and modern, is among the most representative of European state galleries. It was founded in 1824, by the acquisition of the Angerstein collection. Its accessions are governed by a parliamentary grant of £5,000 to £10,000 a year, but it benefits by a large number of gifts and legacies, the most important of which have been the Vernon gift in 1847, the Turner bequest in 1856, and the Wynn-Ellis legacy in 1876. The galleries contain few poor works and all schools are well represented, with the single exception of the French school.

The National Gallery of British Art (known as the Tate Gallery) is devoted to modern British pictures. The Victoria and Albert Museum has also a number of British pictures, especially in water color. The National Portrait Gallery was founded in 1856, the National Gallery of Scotland in 1850, and the National Gallery of Ireland in 1854. There are also important municipal galleries at Birmingham, Glasgow, Liverpool, etc., and few large towns are without a permanent gallery of some description.

Bibliography.— A history of British Art showing the place it has occupied in the life of the people is a work which has not yet been undertaken, at least with any considerable degree of success; the details of the private lives of the artists have generally attracted more attention than the effects of their works. The only moderately successful attempt to present a reasoned account of the vital influence exerted by the national art is to be found in Richard Muther's 'Geschichte der Malerei im XIX. Jahrhundert' (3 Bde., München, 1893–4), of which an English translation has been published (London 1895–6); the parts dealing with British art have also been brought together and slightly amplified and published separately under the title 'Geschichte der Englischen Malerei' (Berlin 1903). Much valuable information is to be found in Ernest Chesneau's 'The English School of Painting' (Eng. Tr. 1885), R. and S. Redgrave's 'A Century of Painters of the English School' (London 1866), and D. S. McColl's 'Nineteenth Century Art' (Glasgow 1902).

A large number of volumes dealing separately with the works of all the more prominent artists, or with particular schools or periods have, however, been published. The most penetrating criticisms of Reynolds's work are to be found in Northcote's 'Memoirs of Sir Joshua Reynolds' (London 1813–15); 'Conversations of James Northcote' by William Hazlitt (London 1830), and 'Conversations of James Northcote, R. A., with James Ward,' ed. by Ernest Fletcher (London 1901); for details of the artist's life, the 'Life and Times of Sir Joshua Reynolds,' by C. R. Leslie and Tom Taylor (London 1865), should be consulted.

The standard work for the earlier periods of British Art is Horace Walpole's 'Anecdotes of Painting in England' (1st ed., 1762–71, 5 vols.) For the lives and works of the principal artists the following volumes will be found useful: 'William Hogarth' by H. Austin Dobson (London 1902); 'Gainsborough and His Place in English Art' by Sir Walter Armstrong (London 1898); 'Romney' by Humphrey Ward and W. Roberts (London 1904); 'Sir Henry Raeburn' by Sir W. Armstrong, with Introduction by R. A. M. Stevenson (London 1901); 'Sir Thomas Lawrence' by Lord Ronald Gower, with Catalogue of the artist's works, compiled by A. Graves (London 1900); 'The Life of J. M. W. Turner, R. A.' by W. G. Thornbury (London 1862), and 'Turner' by W. Cosmo Monkhouse (London 1879); 'Constable and His Influence on Landscape Painting,' by Prof. C. J. Holmes (London 1902), and 'Memoirs of the Life of John Constable,' ed. by C. R. Leslie (London 1843); 'Dante Gabriel Rossetti as Designer and Writer,' by W. M. Rossetti (London 1899), and 'Rossetti Papers, 1862 to 1870,' compiled by W. M. Rossetti (London 1903); 'Memoir of Madox Brown' by F. M. Hueffer (London 1896); 'Pre-Raphaelitism and the Pre-Raphaelite Brotherhood,' by W. Holman Hunt (London 1905); etc.

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A. J. Finberg,
Author of 'English Water Color Painters.'

35. **Great Britain — English Newspapers.** The English newspaper has scarcely so long a pedigree as some others in Europe. Several German towns had their news-sheets or news-letters in the 15th century, and the Venetian Republic started its official gazette in the middle of the 16th century. There are legends of an 'English Mercurie' published in 1588 under Queen Elizabeth's patronage, but the 'Weekly News' and the 'London Weekly Courant,' both produced in 1622, and after these the numerous 'Mercuries' published by various parties during the civil war are the real beginnings. The censorship of the Restoration killed independent journalism for the next 30 years, and left the field clear to the official 'London Gazette.' A crop of new journals arose on the abolition of the Press Licensing Law in 1695, and in 1702 the first daily newspaper, the 'Daily Courant,' a small sheet printed on one side, made its appearance. But, though the censorship was withdrawn, governments retained the weapon of taxation, and for the next 130 years the history of English journalism is that of a perpetual struggle against heavy and arbitrary imposts. At the beginning of the 18th century, many news-sheets were sold for a halfpenny; in the year of Waterloo (1815) and for nearly 20 years afterward the taxation was four pence a copy, and the usual price to the public six pence or seven pence. Newspapers in those days had a great many readers per copy. News agents let them out for a penny an hour, and sold them in the provinces at a reduced price, when a few days old. In 1836 the stamp-duty was reduced to one penny the sheet, and in 1855 it was abolished, together with the advertisement tax, which was scarcely less oppressive. The paper duty was also diminished during these years, and its final repeal was achieved by Mr. Gladstone in 1861 after a memorable struggle with the House of Lords. It was this complete relief from taxation which in Mr. Gladstone's words "called into vivid, energetic, permanent, and successful action the cheap press of this country."

Certain of the great English newspapers, notably the 'Times' (1778) and the 'Morning Post' (1772) have been continuously in existence since the last years of the 18th century, and their proprietors, especially Mr. John Walter of the 'Times,' rank high among the pioneers of modern journalism. The 'Times' was first printed by steam as early as 1814, and greatly improved its position by its enterprise in this respect. Happily the abolition of the "taxes on knowledge" came in the nick of time to enable the English press to take full advantage of the development of railways and telegraphs. In later days the organization of the press has followed much the same lines in England as in America, a leading feature in both countries being the establishment of agencies for the joint collection of general news. The leading English newspapers have, however, shown great enterprise in foreign, special, and war correspondence. No English journalists have made a more conspicuous mark or are better remembered than the chief correspondents in these various departments, such as Sir William Russell and M. de Blowitz of the 'Times'; Mr. Archibald Forbes, Mr. Laurence Oliphant, and Mrs. Crawford of the 'Daily News.' The English newspapers, like the American, have been able to spend lavishly on their news and correspondence by reason of the large revenues which they have drawn from advertisements. Herein they have the advantage of French, Italian, and even German newspapers, which have not succeeded in developing that side of their business to anything like the same extent. For this reason British and American newspapers greatly resemble each other and differ from all others in their large sheets, numerous pages, and heavy proportion of telegraphed matter.

English newspapers are accustomed to describe themselves as "organs of opinion" and have always taken pride in their power of influencing opinion through their leading articles. Men of great ability and literary accomplishment were employed on this part of their work during the last half of the 19th century, and the chief morning papers regularly presented their readers with three or four leading articles, each a column long and in the conventional form of three paragraphs to each article. The centre page containing these articles was perhaps the most characteristic feature of Victorian journalism. The principle of anonymity was jealously guarded during this period. No one knew the names of the leader-writers, and it was contrary to the etiquette of the profession for any writer to claim the authorship of his article. The opinions expressed were accepted by the public as the opinions of the journal and not the opinions of any individual member of the staff. The aim of the writer under these conditions was to be grave and well-informed, rather than lively or brilliant. The exclusion of the personal element and the constant use of the editorial "we" compelled a rather ponderous pose, and the rigidity of the form and length for all subjects, whatever their importance, led to a certain diffuseness and monotony of treatment. In spite of these defects, the journalism of opinion was never more powerful than in this period and no newspapers ever had a steadier or more continuous influence on public affairs than the 'Times,' the 'Morning Chronicle,' the 'Standard,' and the 'Daily News' during the middle years of the last century. The leader-writing tradition is still powerful, but the old hard and fast conditions have been relaxed. In the last 30 years of the last century, two or three powerful individuals, notably Mr. Frederick Greenwood, first editor of the 'Pall Mall Gazette,' and subsequently editor of the 'Saint James's Gazette,' Mr. John Morley, who followed him as editor of the 'Pall Mall Gazette,' and Mr. Stead, who followed Mr. Morley on the same journal, obtained a personal influence which broke through the anonymous tradition. These writers still used the anonymous form, but there was a quality in their writing which revealed them and gave new life and color to the leading article. At the same time the 'Daily Telegraph' was breaking through the solemnity of morning journalism and bringing a great many subjects, previously thought too trivial for treatment by responsible newspapers, within its range. Mr. L. A. Sala invented a new kind of leading article to which nothing human was alien, while Mr. Andrew Lang (in the 'Daily News') wrote of books and literature with a delicacy and skill which quickly took the public fancy. In the early 80's Mr. Stead came on the scene as editor of the 'Pall Mall Gazette' and introduced many new features, including "the interview," which were regarded at the time as daring innovations from American journalism but most of which have since been adopted by the older established newspapers.

In the 10 years from 1890 to 1900 the changes in the English press were many and rapid. The cheapening of paper, the introduction of typesetting machines, and the improvements in printing machinery — many of them introduced by American firms — led to the starting of many new journals and the enlargement of most existing journals. The 'Daily Mail,' established in 1896, set a new fashion in halfpenny morning journalism which was quickly followed in London and the provinces. Two of the old-established morning papers, the 'Daily News' and the 'Daily Chronicle' subsequently reduced their price from a penny to a halfpenny, and there are now no less than six halfpenny morning journals published in London. In the provinces the penny morning papers still hold the chief position and are conducted with great skill and enterprise, but the halfpenny evening paper has an immense vogue with all classes.

The new conditions have to some extent changed the character of the English press. Sport, fashion, and business as well as amusements and entertainments of all kinds compete powerfully with politics for the attention of the reader. The old verbatim reports of Parliament and public speeches give way to short summaries and descriptive sketches. The Parliamentary sketch-writer is a regular and most important member of the staff. Editors of the old school, like Barnes and Delane of the 'Times,' who directed their journals primarily with a view to influencing public affairs, have grown scarcer in these days, and their successors are more often than not described as "editor-managers." They are expected to cultivate a great variety of interests and to be constantly in touch with the business departments of their journals. The question whether the influence of the press is not seriously diminishing has been much debated in England during recent years, but it is scarcely possible to answer it in general terms. The word "press" covers a great many types of journals and periodicals. There are newspapers conducted with the greatest skill and enterprise which aim rather at reflecting than at influencing opinion and which have great power in emphasizing the prevailing sentiment in times of excitement. But there are still a great many others which directly influence statesmanship and administrative policy by serious, independent, and expert criticism on public affairs. In its literary style the English press stands midway between the American and the French press. The English journalist stops short of the vigorous popular manner of the American, and he scarcely achieves the deftness and subtlety of the French. But on the whole the standard of writing has improved in spite of the introduction of popular features. The newspapers tend to widen the circle of their contributors and to rely less exclusively on their own staffs. There is scarcely any eminent man or woman of letters who is not an occasional writer for the press, and signed articles by experts fill a large space in the daily newspapers. There follows a certain competition of interests which somewhat detracts from the old editorial unity of the English journal, but a greater variety of clever writing is now possible than in the old days when an anonymous staff did all the work.

At the present time (1906) 18 morning and six evening papers are published daily in London, the former including three financial and two sporting journals. In addition to these 76 morning and 138 evening papers are published in the provinces of the United Kingdom. The daily newspapers do not appear on Sundays, their place being taken by special Sunday journals.

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J. A. Spender,
Editor of 'The Westminster Gazette.'

36. Great Britain — The Trend of Thought and Literature in the 19th Century. *General Characteristics.*— An almost unprecedented development or expansion of intellectual energy characterized the opening years of the 19th century in Great Britain. The emancipating influences, which had produced the French revolution, were then working in England at their acme of strength, and were generating an intellectual as well as a political and social reformation, which steadily gathered force as the century grew older. The new tide of thought found at the outset its loftiest manifestation in purely imaginative literature. The mighty revival of imaginative literature, amid which the century opened, is only comparable with that of the age of Shakespeare. The highest intellectual energy of the nation seemed to find, at the beginning of the epoch, its complete and most congenial expression in the departments of poetry and fiction. Between the years 1800 and 1825 the works of Wordsworth, Shelley, Byron, Coleridge, Keats, Jane Austen and Sir Walter Scott were the chief triumphs of the intellectual movement which was clarifying man's mental vision and remodelling his aspirations.

After the first quarter of the century the creative literary activity of England showed some signs of exhaustion. But the ebbing was then of short duration. The tide of intellectual energy in the sphere of literary endeavor quickly rose again. The torch that had been lighted by

Wordsworth and Shelley, Byron and Scott, Lamb and Coleridge, soon flamed anew in the hands of Tennyson and Browning, of Dickens and Thackeray, of Macaulay and Carlyle, of Ruskin and Matthew Arnold.

With the sixth decade of the century, a radical change came over the intellectual horizon of the nation. The intellectual spirit no longer contributed the whole of its richest sustenance to the field of great imaginative writing. It long continued to nourish splendid imaginative effort; only when the century closed did the purely imaginative energy, which had flowed on almost continuously from the first, grow sluggish and tame. But midway through the century the intellectual spirit proved fertile enough to produce in new glory and luxuriance a second and a very different type of intellectual fruit. During the last five decades, the intellectual spirit gave a fresh and unexampled impetus to scientific inquiry and to speculation concerning the character and capacity of all animate and inanimate nature. For a generation the poets and novelists, the critics and historians, divided the honors of intellectual exertion with scientific investigators like Darwin, Wallace, Huxley and Tyndall, and with philosophers like John Stuart Mill, Herbert Spencer, Thomas Hill Green, and Leslie Stephen.

When the century was reaching its end, the spirit of scientific inquiry was producing no triumphs so heroic as those associated in the middle years with the names of Darwin and his disciples. But scientific energy was at the close of the epoch still giving notable proofs of activity, while literary energy was comparatively torpid. In the last half of the period science and pure literature may fairly be credited with having slowly changed their relative places in the empire of the British intellect. Pure literature which held the place of predominance at the beginning of the era yielded it to science before the end. The mass of available intellectual energy which had gone at the outset to the making of poetry and fiction, of history and criticism, was ultimately diverted to the cause of science. In general terms, the gradual and peaceable succession of science to the throne which had been occupied by imaginative literature may be said to mark the trend of British thought and literature in the 19th century.

Homogeneity of the Imaginative Effort.— For the purpose of detailed study of the literature of the century it might be convenient to divide it into four chronological sections — each corresponding with one quarter of the period. But there is an essential homogeneity about the whole of the century's literary effort, which renders chronological division undesirable in a brief survey. Specious grounds may be urged for separating the century, in however rapid a general view of its thought and literature, into at least two periods, the one ending and the other beginning at the accession of Queen Victoria in 1837. In 1837 the literary giants of the opening years of the century either were dead or had ceased to write. Among poets, Byron (1788-1824), Shelley (1792-1822), and Keats (1795-1821) had passed away. Wordsworth (1770-1850) had ceased to be a poetic force, save in the sight of admirers more zealous than discreet. Of writers of fiction, Jane Austen had been dead 20 years and Sir Walter Scott five. Among essayists whose work conferred on the literature of the century one of its most distinctive charms, Charles Lamb, the genial king among such literary artificers, did not survive beyond 1834; Hazlitt died in 1830, and although De Quincey and Leigh Hunt lived more than 20 years longer, their best work was done in the pre-Victorian Epoch.

But there is no genuine philosophic ground for detaching the work of these heroes from that of their successors. The writers of eminence, who have exclusive right to the epithet Nineteenth Century or Victorian, prove after allowance has been made for individual idiosyncrasies which in great literature count for much, to belong in spirit to the age of their immediate predecessors. They sought expression for their thought in forms not essentially different from those to which their predecessors devoted their energies, and their thought showed no new departure. It still breathed that faith in the dignity of mankind, in its inalienable right of rational liberty and in the greatness of the human destiny which was the outcome of the French Revolutionary spirit, at the same time as it paid respectful homage to surviving tradition of the great art and literature of a more distant past.

Tennyson (1809-92) who shares with Robert Browning (1812-89) the first place in the poetry of Victorian England, is nearly at all points Wordsworth's successor. Like Wordsworth he was in sympathy, through his prime, with the political and philosophic enlightenment of his era. It was this which he sought to interpret in his verse. He was a careful observer and a sympathetic expositor of inanimate nature. He had Wordsworth's command of poetic diction and melody, and also, it is to be admitted, Wordsworth's tendency to bathos and commonplace, in spite of his keen ear and sense of form. Browning — the twin-peak with Tennyson in the range of Victorian poetry — presents a stronger individuality. He is less closely allied to the writers who flourished in his early youth. But in many of his most striking characteristics,— in the subtlety of his power of psychological analysis, in his robust optimism, in the universality and activity of his interest in current life and literature, in his predilection for study of past history and biography, and even in his indifference to the graces of form which degenerated with him at times into a barbarous grotesqueness — in one or other of these regards Browning betrayed kinship with Coleridge, Byron, Landor and Scott.

Third in the list of those Victorian writers of the imagination, whose lives wholly belonged to the 19th century, stands Matthew Arnold (1822-88). As a poet Arnold marched under the banners of Wordsworth and Shelley; as a critic in prose he was at some points more subtle and less sympathetic, and at other points clearer-eyed and less prejudiced than Lamb or Hazlitt. But the distinctions between Arnold and the earlier essayists of the century are due not so much to difference of epoch or of innate temperament. They are attributable rather to the idiosyncrasies that come of accidental divergences in youthful training and environment. Arnold's native heritage of genius bore an academic impress owing to his association with

Rugby, a great public school of which his father was a distinguished headmaster, and with Oxford, the University whose traditions and temper he permanently assimilated as a young man. Had Lamb and Hazlitt enjoyed Arnold's youthful experiences, their style and sentiment are likely to have worn Arnold's colors. They were at one with each other in their ultimate conception that the æsthetic sense was the sense best worth developing in human life and thought.

The three poets whose genius first blossomed midway through Queen Victoria's reign, Dante Gabriel Rossetti (1828–1882), William Morris (1834–1896) and Algernon Charles Swinburne (b. 1837), all to some extent inherited and developed the tradition of Keats. Rossetti and Morris were painters as well as poets. The former was a leader of the pre-Raphaelite movement, which sought to reproduce in art the simple beauty which distinguished pictorial effort of the early middle ages. As poets, Rossetti and his friend Morris sought their affinity in the sphere of mediæval romance, whence both Keats and Sir Walter Scott had drawn with differing motives much inspiration. Rossetti was almost as great a master of the sonnet as his teachers Wordsworth and Keats, and he and Mr. Swinburne improved on Keats's and Tennyson's aptitude to suggest in metre new and subtle harmonies of music. Swinburne, at the opening of his career, seemed to graft on the sensuous influences of Keats the voluptuous temper of Byron. He cherished the wild aspirations which were bred of the French Revolution. The poetry of Mr. Swinburne's youth ranks among the century's literary glories. He alone of his poetic school still survives. But his late work has hardly sustained the promise of his rebellious early years. The unimaginative spirit of the second half of the century would seem to have discouraged and repressed his poetic development.

The seventh great master of Victorian literature, whose work in spite of the varied aim may best be classed with literary products of the imagination, was John Ruskin (1819–1900), who in that field survived all masters of his generation, save Mr. Swinburne. Ruskin has, like Rossetti and his friends, some claim to be numbered with the disciples of Keats. He devoted himself to expounding an æsthetic philosophy, the germ of which is discernible in Keats's poetry. He gave a very wide interpretation to the attributes of beauty, which he identified with excellence in every kind of human endeavor. In his voluminous writings he sought to define the place that beauty and its manifestation in art ought to fill in human economy. His clarity of style, imaginative insight, and assertive personality invested all his literary work with fascination. But he owes his chief importance in the history of 19th century thought and literature to his masterly interpretation, analysis and application of the æsthetic principles which underlie the most characteristic achievements of the great writers belonging to the generation that preceded or was coincident with the date of his own birth.

Fiction and Drama.— In fiction it might appear as if the spirit which colored manifestations in the early years of the century perished before the later or even the middle years were reached. The centre of gravity may seem at any rate to have shifted somewhat violently between the dates of 'Sense and Sensibility,' 'Waverley' and 'Vivian Grey' on the one hand, and of 'David Copperfield,' 'Adam Bede' or 'Vanity Fair' on the other. Still wider may seem the interval between 'Romola,' 'Esmond,' and 'Barnaby Rudge,' and 'Harry Richmond,' 'Jude the Obscure,' and 'Dr. Jekyll and Mr. Hyde.' But all the masterly fiction of the century aims, through different avenues, at a like goal. It seeks the exact, the vivid, the sympathetic and for the most part the optimistic representation in narrative of the complexities and perplexities of human life and feeling. Whether the novelist rear his structure on historical research or on autobiographical experience, on careful observation of contemporary society, or on imaginative speculation into human potentialities, his success is due to his power of combining in his chronicle artistic presentment of facts of experience with sane and practical interpretation of thought and impulse.

None of the great novelists of the 19th century failed at one or other period of their careers to emulate Sir Walter Scott's method of seeking in history material through which to work out their ambitions. Scott concentrated on the historical novel a mass of learning and a wealth of intuition which no successor inherited. But the spirit which animated his achievements in the art of fiction lived, albeit in attenuated condition, in the labors of Charles Dickens (1812-70) and William Makepeace Thackeray (1811–63), of George Eliot (1819–80) and Robert Louis Stevenson (1850–94). Thackeray reached the highest point of his career as an artist in fiction when he produced 'Esmond,' a story of the time of Queen Anne. Dickens in 'The Tale of Two Cities' and in 'Barnaby Rudge' brought all the vigor of his genius to vivify historic episodes of the century preceding his own. George Eliot proved herself more scholarly and more laborious, and therefore less successful than Dickens or Thackeray, when she sought in Romola to evolve a romance out of the history of the Florentine reformation. Robert Louis Stevenson, master of the most picturesque style among novelists since Laurence Sterne, made his most sustained bid for reputation by pursuing in the chronicles of Scotland the historical trail. The same category embraces the most notable work of lesser luminaries like Bulwer-Lytton, Charles Kingsley and Charles Reade, with each of whose names an historical novel of eminence has to be associated.

Not that the novel of current experience failed to flourish in increasing luxuriance as the years of the century grew. The cultivation of fiction, which reflected the foibles and aspirations of contemporary society, absorbed throughout the epoch literary genius of the most varied and conflicting types. The most conspicuous laborers in this field of endeavor were, during the early years, Jane Austen and Disraeli, while their successors included Charlotte Brontë, Dickens, Thackeray, Trollope and Charles Reade during the middle years of the century and George Meredith and Thomas Hardy during the last years. The century's yield of fiction in all its forms far exceeded in quality and quantity that of any earlier epoch. The stream was continuously replenished and it maintained till near the end a level approximating to that of the first days. But even in fiction the creative energy failed in intensity as the epoch closed.

The drama was the only field of imaginative literature in which England of the 19th century failed to secure conspicuous and lasting triumphs. The standard of excellence which Shakespeare set in the 16th and early 17th centuries was not likely to be reached again. But the dramatic productions of the 19th century proved of smaller value than the efforts of the 17th or 18th century, which, despite their inferiority to Shakespearean drama, maintained a level of permanent interest. No writer of comedy in the 19th century is comparable with Sheridan, not any writer of tragedies with Dryden or Otway. Writers like Browning and Mr. Swinburne, who devoted poetic genius to tragic or romantic drama, never acquired mastery of the true dramatic temper which belongs to the art of the theatre. They proved themselves capable of fine poetic declamation and were skilled in the use of poetic language, but their efforts resulted in the production of dramatic literature for the study rather than of drama for the stage. Bulwer-Lytton, Sheridan Knowles, Tom Taylor and T. W. Robertson are the only English playwrights of the early or central years of the 19th century any portion of whose work lived after its original production in the theatre. Taylor and Knowles essayed romantic drama. Lytton and the rest won their chief fame in the comedy of manners. But immortality was denied them. None of these men courted with any effect the muse of tragedy. Such plays of theirs in the vein of comedy or romance as retained their vogue in a succeeding generation quickly lost the savor of freshness and seemed to breathe in a very short space of time an antiquated or a faded atmosphere. Their fame soon flickered. A chief cause of the failure of drama to attract during the 19th century any substantial or efficient part of the literary genius of the era doubtless lay in the competing claims of the novel. The growing complexity of life and thought rendered it increasingly difficult to give, in the brief and graphic terms of drama, permanently satisfying expression to the complexity of current aspiration and speculation. The art of fiction is freer of conventional restrictions than dramatic art, and gives fuller scope to endeavor, which seeks to interpret variegated experience and manifold human effort.

Carlyle and Macaulay.— The 18th century not only won its literary triumphs by virtue of the exercise of the imagination in poetry and romance. Throughout the century history and criticism, in which the imagination plays a more limited part, were flourishing conspicuously. Henry Hallam (1777-1859) produced between 1818 and 1837 three solid historical works, which anticipated many of the characteristics of the new historical school in England. They were for the most part genuine studies of original authorities and although they betrayed a whig political bias were conscientious endeavors to present the facts fairly. A robust common sense atoned for the lack of sympathetic imagination or broad philosophical temper. But Hallam's labors stand apart and lay for the most part outside the main contemporary currents of intellectual effort. The two representative practicers of the arts of history and criticism in the 19th century — Carlyle and Macaulay — were possessed of far greater literary genius than Hallam and exerted a wider influence. Both were long lived. Their work was well begun before Queen Victoria commenced to reign; it continued long after. Carlyle was born five years before the end of the 18th century and died in 1881. Macaulay was born in the first year of the last century and died in 1859.

Carlyle is one of the most distinctive figures in the whole range of literary activity in the 19th century with which his life was almost coterminous. He was thoroughly imbued with the large ideas of man's social perfectibility to which the leaders of the French Revolution gave expression in their cry for liberty and fraternity. But he was at the same time a potent and censorious foe of many of the social tendencies which the French Revolution set in motion. He warned his contemporaries of the dangers inseparable from the levelling spirit of a democratic age, with a greater practical effect than any man of letters has compassed before by dint of mere passive penmanship. To Carlyle's essays and lectures may in part be attributed that definite recognition of the limitations inherent in a purely democratic ideal, to which, in the earlier decades of the century, the eyes of the mass of Englishmen seemed closed.

Carlyle's finest literary work was done in the fields of history. He toiled complainingly in the dry-as-dust repositories of historical learning, but he did not take so wide a view of the historian's fiction as the greatest of the British historians, Gibbon, nor were his researches so exhaustive or so multifarious as the more recent scientific standard of historical investigation prescribes. But by force of a rare imaginative insight into human action and character, Carlyle recalled to life a series of episodes of the past, with a truth and realism which no poet or novelist, working with unlimited right and power of invention, has excelled in pith and moment. Carlyle's 'French Revolution' (1837) and portions of his 'Frederick the Great' (1858-65) set before the reader historic episodes with something of the dramatic intensity of the historical plays of Shakespeare.

At the same time as Carlyle was working out his destiny, Macaulay was also making masterly contributions, of not altogether dissimilar calibre, to the literature of the century. Macaulay's knowledge of books and records was as great as Carlyle's, if not greater, but his historical achievement remains on a lower plane. He possessed far less imaginative intuition. His mental horizon was limited by temporary conditions of current political conflict. His conception of historic fact was colored by partisan prepossessions, which, viewed in relation to the great destinies of the human race, seem puny, and in a historian, tend to unveracity. Carlyle and even Gibbon had strong prejudices, but their native sentiment was cast in a larger mould. Their preconceptions left the historical spirit in the main unclouded.

In style Carlyle and Macaulay were as the poles asunder. The spasmodic irregularity of the one has nothing in common with the disciplined orderliness of the other. Macaulay's influence on the English prose style of the century has been far greater and on the whole more beneficial than Carlyle's. Carlyle's style was a bow of Ulysses, which none but himself could bend. In other hands it became an implement of burlesque. Macaulay's style which was less impracticable, inherited and developed many of the best features of the prose of the 18th century. It was mainly characterized by a directness and an emphasis which often grew into brilliant and stirring eloquence, although it inclined at times to monotonous rigidity, and at times to declamatory violence. It proved a dangerous style for purposes of servile imitation. The habit of insistent emphasis is apt to degenerate among the incompetent into bombast. At the same time the discreet and intelligent assimilation of Macaulay's prose tends to clearness and point without appreciable sacrifice of grace. Toward the end of the century a passing reaction set in against the metallic clearness of Macaulay's diction, and efforts were made to invest English prose with a subtle elegance and cloudy preciosity to which it was not naturally adapted. The most remarkable of such filigree workers in prose was Walter Pater (1839–94). Another conscious artist in prose was Robert Louis Stevenson but he was endowed with a fertile imaginative power which preserved his style from the vices of pedantry and kept its lucidity intact. Pater devoted himself to æsthetic criticism which he clothed in a delicate and ornate verbal garb. Pater often achieved beautiful effects. But the methods were inseparable from affectations and conceits, which often render his prose difficult to read with understanding. The irresistible vogue of Macaulay's prose style ordained that none should be widely acceptable which failed at any point in perspicuity. John Ruskin, whose æsthetic criticism covered a wider field than Pater's, proved, too, that perspicuity in English prose was not incompatible with artistic beauty and pliancy. Affected prose consequently met with small encouragement; it was cherished by coteries and did not color the broad currents of the century's literature.

The Scientific Tendency.— The trend of English literature and thought was profoundly affected by the scientific and philosophic spirit of inquiry which received a triumphant impulse from the publication of Charles Darwin's 'Origin of Species by Means of Natural Selection' in 1859, and from the inception of Herbert Spencer's 'System of Synthetic Philosophy,' in 1862. The earlier literary work of the utilitarians, Jeremy Bentham (1748–1832), David Ricardo (1772–1823), James Mill (1773–1836), and above all, John Stuart Mill (1806–73), only indirectly touched the imaginative temper of the times. The topics which the utilitarians handled were practical matters of social and political reform, some of which had been suggested by the French Revolutionary movement. The larger conceptions of man's physical or spiritual destiny were for the most part overlooked. The statute book of the realm between 1840 and 1874 reflected the economic principles which the Mills and their disciples disseminated, but neither the great poetry nor indeed the great fiction, bore, in any appreciable degree, trace of the reforming activities or enthusiasm of the utilitarians. Dickens occasionally expanded in his novels the practical suggestions of the utilitarians, but it was elsewhere, it was in the literary presentation of universal features of human nature, that he rendered his most memorable service to literature. The scientific and philosophic movement gathered its greatest force in the years which followed the revelations of Darwin and Spencer. Then at length the scientific spirit spread to the nation's literature and affected the matter as well as the manner. On prose style it exerted an immediate influence. It insisted with a greater force than Macaulay's example commanded on perspicuity as the main virtue of expression, and effectually discountenanced whatever was subtle, obscure or deliberately affected. One scientific writer, Thomas Henry Huxley, who championed and developed the Darwinian doctrine, lived on till 1895. Huxley was gifted with an exceptional clarity of thought and expression, and his range of interest in current affairs secured for his writings a wide general audience. Huxley's labors may be regarded as an efficient agent in the national development of plain-speaking prose.

As far as the new scientific spirit affected pure literature, it may be said to have exerted a hampering effect on imaginative effort. Both George Eliot and Tennyson in their later work showed proclivities to philosophic or scientific speculation, which encumbered their imaginative deliverances with scientific terminology. Till the end of the epoch scientific or philosophic speculation inclined to divide the allegiance of men who were endowed with poetic genius and to dissipate their energies. William Morris, whose poetic gifts enabled him to conquer rich fields of pure romance, devoted most of the energy of his late life to developing theories of social regeneration which had their root in current scientific and philosophic inquiry.

Not that the scientific tendencies of the century went forward without check. Religion at times called literature to her aid in order to rally her forces for conflict with science. A specially vigorous attempt was made in religious circles by the Oxford movement, of which John Henry Newman (1801–90) was the chief literary leader, to stem at the outset the tide of the scientific advance. Newman was a great man of letters whose imaginative powers were combined with great delicacy of style in both poetry and prose. He made contributions of lasting value to the literature of the century. But his reactionary efforts failed to restrain the scientific and philosophic impulse of his era, if they did not by their open defiance of scientific progress consolidate the champions of free scientific speculation, and accelerate their victorious march. An endeavor to effect, on more pacific lines, a compromise between the opposing forces of science and of the imaginative sentiment of religion was made by leaders of another school of thought which was known as the Broad-Church. That school of thought had no greater sympathy with Newman's unbending conservatism than with the revolutionary independence of scientific and philosophic inquiry. The Broad Church leaders, Frederick D. Maurice and Charles Kingsley, were ready and voluminous writers. But their theological or philosophic position was logically unsound, and they failed permanently to affect the trend of contemporary thought, which finally accepted the scientific sway beyond risk of relapse.

It was in the field of history, of all departments of literature, that the scientific spirit most resolutely planted its standard. Workers in history grew in number as the century closed. But only one English historian of the period deliberately persisted in the literary tradition, which Carlyle and Macaulay had dignified. James Anthony Froude, who died in 1894, alone practiced history as a branch of great literature. In his historical work he gave free play to a natural gift of style and a sense of the picturesque. He treated accuracy of detail or judicial impartiality as comparatively of small account. For the time being, Froude is the last representative of the great literary school of historians.

It was in the middle of the century that the scientific spirit invaded the province of history and developed a new view of its aims. Facts were to be accumulated and arranged so as to illustrate and explain the evolution of civilized progress. The scientific method of historical inquiry was first put in practice by Henry Thomas Buckle (1821–62), whose unfinished 'History of Civilization' excited great public interest. The first volume appeared in 1857, the second and last in 1861.

The substantive value of Buckle's labors proved less than he or his admirers anticipated. The field of observation, which he sought to survey, proved too wide for any one man's capacity. His method depended for its success on mastery of minute detail touching every department of human endeavor. The quest of omniscience proved fatal. Many of the generalizations, in which Buckle's scheme compelled him to take refuge, were either disputable or were confuted by more specialized research. But though Buckle's historical work failed long to sustain its authority, its influence was permanent. It encouraged the application of scientific method to historical investigation. It raised the standard of historical accuracy. It promoted specialized research. It encouraged concentration of industry in narrow fields of historical inquiry.

Six men, Seeley (1834–95), Lecky (1838–1903), Freeman (1823–92), Stubbs (1825–1901), Creighton (1843–1901), and Gardiner (1829–1902), were the most conspicuous representatives of the tendency to pursue in history the methods of scientific accuracy. The order in which the names are placed here indicates the progressive ascendancy of specialization in historical research. The six men's modes of work differed in detail among themselves. Seeley and Lecky sought to graft a broad philosophic tone on their historical investigations. Freeman, Stubbs, Creighton, and Gardiner rarely suffered their minds to stray from their endeavors to accumulate and to test the facts which illustrated the evolution of politics or political institutions. As a consequence the writings of Seeley and Lecky assimilated a finer literary spirit than those of their associates. While the permanent value of the scientific treatment of history is now admitted, there is risk of repelling students by too severe a presentation of the results of research, and it may be that the new method stands in need of a greater infusion of literary art before its credentials will be accepted universally. Gardiner, the latest of the 19th century historians to pass away (d. 23 Feb. 1902), labored with rare self-denial within a narrow range of English political history, the early and middle years of the 17th century. He made small endeavor to cultivate the literary graces.

Another indication of the progress of scientific method in the province of literature is found in the energy which has of late years been applied to textual criticism of standard authors and to the publication of historic documents. The British government has undertaken the issue of state papers, of the muniments of great families and of official records. Private voluntary societies have coöperated in such endeavors, and with their aid local archæology has especially been investigated with an unexampled thoroughness. Other private literary societies, like the Early English Text Society, and numerous private publishing firms, following the examples set by the presses of the great universities of Oxford and Cambridge, have placed at the disposal of the public, accurate texts of the great literary monuments of the country. In undertakings like the Dictionary of National Biography and the Oxford English Dictionary, efforts have been made to coördinate and codify on a large scale the hitherto scattered fruits of historical, literary and philological research. All these enterprises are tributes to the ascendancy of scientific method. They bear testimony to the trend of 19th century thought and literature, which shows during the last half, decay of the purely imaginative impulse, and advance of the purely scientific. But there is nothing in the nature of the present situation to preclude the revival in due time of such imaginative energy, as distinguished the first half of the century. Scientific and imaginative achievements are complementary fruits of the intellect. They need not be mutually exclusive. The future is likely to bring to light an accommodation of their respective pretensions to mastery in the realms of thought. There is small reason why science and pure literature should not flourish in perfect development side by side.

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EXTERNAL RELATIONS.

37. **Great Britain — The British Navy.** In one of his essays Emerson drew a vivid picture of the historic association of the English people with the sea, an association which falsified Virgil's famous line about the poor Britons being cut off from the world, by proving the sea to be the ring of marriage with all the nations. "England," he said, "resembles a ship in its shape, and, if it were one, its best admiral could not have worked it, or anchored it in a more judicious or effective position. . . . The shop-keeping nation, to use a shop word, has a *good stand*." Then, with true symbolism, he declared that the white path of an Atlantic liner was the avenue to the king of England's palace front. The king would consult his dignity if he gave audience to foreign ambassadors in the cabin of a man-of-war. That the British people have occasionally lost sight of this identity of their destiny with the sea is sufficiently shown by quite recent periods of their history and instances such as when in the reign of Charles II. the Dutch fleet sailed up the Thames. Byron's lines in Don Juan describe a similar state of affairs:

> Nelson was once Britannia's god of war,
> And still should be so but the tide is turned;
> There's no more to be said of Trafalgar
> 'Tis with our hero quietly inurned;
> Besides the Prince is all for the land service
> Forgetting Duncan, Nelson, Howe and Jervis.

There has, however, never been such distrust of the navy as exists in the case of the land forces, which is the origin of the fact that the Army Act has to be passed through Parliament each year in succession so that theoretically no standing Army can be said to be maintained.

Periods of maritime apathy on the part of the people have always synchronized with naval inefficiency afloat, a coincidence lending some countenance to a saying of the late Lord Salisbury which excited ridicule at the time, to the effect that the people and not the government are responsible for military efficiency. The education of the people is therefore a factor in the continued naval supremacy of Great Britain, for the reason of this occasional straying from the path of safety is probably to be sought in the fact that of all civilized nations the English are the least imbued with history. Again and again the sailor has been at issue with the statesman as when Torrington made his prophetic protest that the government would be afraid when the danger was past remedy. Hood was superseded for the vigor of his protests concerning the Mediterranean Fleet in 1793. Half a century later Rear-Admiral Berkeley threw up his post at the Admiralty as a protest. In 1867 two Lords of the Admiralty resigned. Again, in 1888, a Lord of the Admiralty resigned; and in 1893 abdication on the part of the Board of Admiralty was threatened; all these cases being caused by penurious treatment of the Navy by the government of the day. Gladstone penned truer words than he knew in the Edinburgh Review in 1870 when he wrote of the vast advantages the English people derived "from consummate means of naval defense" and how when exceptional and peculiar advantages are the lot of a nation there is often a counterpoise in insensibility to their value. In this connection it is significant that historians, beginning with Raleigh and ending with Mahan, have been the best advisers. Raleigh it was who first preached what is now known as the blue water school doctrine in the following words: "He who rules the sea rules the commerce of the world, and to him that rules the commerce of the world belong all the treasure of the world, and indeed, the world itself." Take again his appeal to His Majesty "to employ his good ships on the sea, and not trust in any entrenchment on shore." Kinglake in a fine passage of his work on 'The Invasion of the Crimea' cites the unsuccessful bombardment of Sebastopol as an instance of how so unspeakably precious a heritage as the renown of the Royal Navy can be made "second to an ephemeral policy." As a historian he recognized the necessity for regarding the navy as too sacred to be experimented upon or sacrificed to mere expediency. The fact that the country since the battle of Worcester in 1651, has for so long been free from such internal dissensions as cause eyes to be turned inwards instead of outwards over the surrounding sea, or to a land frontier instead of the probable enemy's coast-line, has been an enormous advantage in enabling a fairly consistent naval policy to be pursued.

For some time the policy took the form of laying down two battleships for every one laid down by France. It was clearly shown by the Treasury Committee of 1859 that the result of their inquiries into the relative state of the navies of England and France was to show that England had nearly always been twice as strong in battleships and more than twice as strong in frigates. Subsequently, with the Naval Defence Act of 1889, there came into vogue the two-power standard of equality with the two leading European maritime powers combined with a margin of safety for contingencies such as the intervention of a neutral power. In 1899 the First Lord of the Admiralty after specifically stating that British naval expenditures simply rose and fell *pari passu* with the new ships laid down by the European powers, offered on behalf of Great Britain to reduce our programme if the other powers would do the same. Since the recent war there has arisen a school which claims, that as policy determines armaments, the Russian navy having for the time being vanished, and relations with France being friendly, the British Cabinet need only consider Germany. Against this it is urged with some force that as it takes two years to build a battleship and four to six years to build a number of them, it would be folly to neglect the possibility of Franco-German combination. History is replete with instances of the greatest enemies making common cause, as in the partition of Poland or the coercion of Japan by Germany, France and Russia in 1894. As regards the United States the best indication that British naval preparations are not made with any thought of war with that country is to be found in the fact that she does not maintain any squadron on either coast of North America, and has abandoned her naval dockyards in Canada.

Relative Strength.— The old doubling the chief-rival standard and the two-power standard, both appear simple enough, but the bitter controversies in the English press prove the problem of relative strength to be one of some complexity. This will be appreciated still more if ever the details of a disarmament scheme come to be examined. Thus the British official return of the fleets classes both the Dreadnought of 1906 and the Rodney of 1883 as first-class battleships. Count of heads unchecked by age is therefore clearly misleading. Tonnage comparisons are equally so from every point of view. The wood-sheathed bottoms of many British ships adding say, five hundred tons to the displacement, the extra quantity of coal carried for the purpose of keeping the seas do not add in the slightest degree to the fighting power on the day of battle. It is absurd on the face of it to allow as much fighting value to a ton of compound armor in the Royal Sovereign as a ton of the latest Krupp armor when the latter has over twice the stopping power. How misleading is a tonnage comparison can be seen by contrasting the Japanese Asama, which did so well in the war, with the British Kent of 100 tons more displacement. The Asama has two inches more armor, has the same battery of six-inch guns, two additional eight-inch guns, and has equal speed. The Rurik of 10,923 tons was easily defeated by two vessels whose aggregate tonnage was 7,350 tons.

The following is a complete statement as to the strength of three nations in vessels being maintained, and ships building and projected, adopting the classification of the British Admiralty's official return:

	Great Britain.		*France.*		*Germany.*	
Battleships:						
First class.......	57	57.	31	41.	26	39.
Second class....	0		9		4	
Third class	0		1		9	
Large coast defence vessels...	0.		3.		0.	
Armored cruisers.	38.		23.		9.	
Other cruisers excluding unprotected cruisers.	71.		37.		34.	

Taking the first-class battleships which will be built or building according to the programmes by Jan. 1908, we can divide them into five categories and include the United States for comparative purposes.

All first-class battleships built or building on first of Jan., 1908, less than

Nation or Combination.	23 years old.	18 years old.	13 years old.	8 yrs. old.	Laid down or projected 1905-7.
Britain	58.	52.	37.	19.	6.
France	23.	22.	17.	12.	6.
Germany	28.	27.	24.	16.	6.
United States (a)	28.	28.	24.	16.	4a.
France and Germany ...	51.	49.	41.	28.	12.
Germany and United States (a)	56.	55.	48.	32.	10.
British force as a percentage of the 3 Powers	p. c. 73.4	p. c. 67.5	p. c. 56.9	p. c. 43.2	p. c. 37.5

(a) Does not include any programme for the United States in 1907. The Navy Department proposed in November, 1906, an immediate addition of two more battleships.

The cause of the steady decrease in the relative British strength as old ships are discarded lies in the great building efforts of the maritime powers since 1895, as disclosed by the following table dealing only with first-class battleships laid down in the years named:

	1885–9	1890–4	1895–9	1900–4	1905–7
Great Britain..	6.	15.	18a	13.	6.
France	1.	5.	5.	6.	0.
Germany	1.	3.	8.	10.	6.
United States..	0.	4.	8.	12.	4b

(a) Excludes Montagu.
(b) Does not include programme for 1907.

It should be noted that of the 58 British battleships enumerated in the above list, only the most modern 16 have complete armor protection for their water line, whereas all the French and German ships have complete belts. In a seaway the British ships would derive an advantage from their deeper belts amidships. Setting aside the cruisers which have their special functions in war, we may next compare the gun equipments.

It is obvious when a 12-inch gun of a few years ago is out-classed by a modern 9.2-inch gun of to-day, that the total guns according to size or calibre is no measure of strength. The theoretical perforation of the guns using capped projectiles against the latest Krupp armors at 5,000 yards is the best indication of their relative value. Excluding the armored cruisers which have their special functions to fulfill in war, the guns mounted in armored vessels by Great Britain, France and Germany may be classified as follows:

	Capable of piercing strongest armor	Belts of most battleships	A great number of defended positions	Armor belts of most cruisers
Theoretical penetration	17.5″ to 18″	14″ to 1[illegible]″	11″ to 13″	7″ to 10.5″
Great Britain.....	48	84	68	92
France...........	40	[illegible]	110	64
Germany..........	64	..	40	40
France & Germany	104	16	150	104

It is quite clear from the comparison that Great Britain is completely out-classed by 1910 in the best guns for long range. In the table it has been assumed that the press reports as to the armaments of the new German battleships being sixteen 11-inch guns is correct. In 1908 Great Britain will probably lay down at least two battleships or the equivalent of 20 guns, but Germany will also lay down two, with say, 32 guns, and it is an open question whether France will add to her programme.

In the case of cruisers Great Britain is building three 'armored cruisers' each carrying eight 12-inch guns, or guns capable of piercing the heaviest armor afloat; and Germany will lay down similar vessels at the rate of one a year. Setting aside these cruiser-battleships Great Britain has 35 armored cruisers carrying 56 guns capable of attacking any armor in any cruisers afloat, while France and Germany have 31 cruisers with 6 guns equal to those in the British cruisers and 52 but slightly inferior. The British Admiralty have expressed the opinion that the best of the 71 protected cruisers which are still retained must die out in the course of the next few years. It is difficult to see how the seas are to be effectively policed in face of determined attacks by unarmored vessels on the trade routes if reliance is only to be placed on 35 armored cruisers.

Natural Resources.—The introduction of steam and iron ships led to Great Britain becoming the great shipbuilding and shipowning nation and so strengthened her maritime position. Almost everything from the material for the hull to that for the motive power was formerly imported. Even the rapid introduction of oil fuel, for which Great Britain at present only possesses the Burmese supply, is no disadvantage to a power whose dual policy is to command the sea, so insuring safe communications to her oil-fuel steamers, and to keep on good terms with the United States which possesses the only other known oil-fuel supply outside Russia. In addition oil fuel, unlike coal, can be stored without deterioration. The natural tendency of the human mind is to be pessimistic in its outlook as to the effect of change of inventions in the future. It is not surprising, therefore, that in 1830 the Lords of the Admiralty should have issued a circular placing on record that they "felt it their bounden duty to discourage the introduction of steam, as calculated to strike a fatal blow to the naval supremacy of the empire," and in 1850 a Royal Commission should have prophesied that future wars would still be fought under masts and sails. The tendency of invention, as for instance in wireless telegraphy, is to increased reliability and certainty. Such a tendency must necessarily operate more powerfully in favor of the strong rather than the weak. The sea, it has been said, will only tolerate one mistress. While the weapons of war and their adjuncts were uncertain and fitful in their operation, it was, however, the case that a weak power resorting to the tactics of evading direct conflict could prolong an irritating struggle on the sea even as the Boers did on the land in South Africa. The old difficulties in obtaining and transmitting information have, however, practically vanished on the sea. The monopoly of both submarine cables and shipping practically lies in the hands of Great Britain and with them she has a great addition to the power of her navy to control the sea in war.

The Distribution of Naval Force.—If invention has been of main assistance to Great Britain in the provision of naval force it has also aided her in its economical distribution. It was impossible for sailing-ships able to move directly over only five-eighths of a circle at a speed varying with the direction and the force of the wind, and reduced to helplessness on a lee shore, it was impossible for such ships to control a great area of water with the facility of steamships aided by wireless and other forms of telegraphy. To take a simple instance, a sailing vessel endeavoring to make Gibraltar Harbor might be delayed off the Straits for as long as six weeks.

The complications formerly introduced into the distribution of naval force by the fact of small neutral powers possessing fleets, have vanished as the expense has become prohibitive. A Dreadnought costs eighteen times as much as a line of battleship such as Nelson's *Victory* a century ago, and eight times as much as the *Duke of Wellington* fifty years ago. The result has been to confine the business of naval war to seven great maritime powers and has led to the remarkable state of affairs at this moment by which the European powers limit their battleships solely to European waters. The difficulty of maintaining the British policy of sea supremacy in view of heavy expenditure and the relative increase of wealth and population in rival countries, must depend in the not distant future on how far the British colonies, on emerging as nations, are disposed to make common cause with the mother country in the maintenance of the navy.

The distribution of the British fleets, in spite of the relief obtained on the China station in consequence of the destruction of the Russian fleet, vividly illustrates the responsibilities falling to it from an Empire of 12,000,000 square miles with 43,000 miles of coast line. Only 1.1 per cent of the Empire is at the seat of government in Europe. Throughout 1906, the distribution of the Navy was as follows:

	At home in commission or in reserve.	Abroad,	Cruising
Battleships	29.	16.	
Armored cruisers including Diadem and Powerful classes	20.	15.	
Large protected cruisers	10.	8.	10.
Small cruisers.....	18.	15.	
Destroyers	95.	47.	

The German fleet on the other hand, like the German Empire, is to all intents and purposes, concentrated. Having regard to the increasing demands made on the British Navy, the extraordinary stringency of which will become obvious in war when British fleets endeavor to keep the sea while important units incur the ordinary accidents of navigation or are away coaling and refitting, it is very much open to question whether adequate provision is being made for the future. A combination of France and Germany would place 516 torpedo craft and 91 submarines on the sea, or over double what is possessed by Great Britain, and some successes on the part of these craft as well as the dangerous floating mines must be provided for. Taken in conjunction with the dispersion of the British force and the disquieting tables given above, the success of Great Britain in face of a combination is by no means as certain as ought to be the case in view of her military policy. That policy in 1901 provided 435,000 men to defend the country against invasion. In 1905 it was altered to a force to defend against a smaller invasion of 70,000 men. In 1906 the Army was organized for service abroad, its passage to be safeguarded by the Navy, while the Navy was to defend the country against everything but minor raids of a few thousands of men. In other words, the Government while cutting down the relative naval strength, demands from the Navy the absolute certainty of successful defence in war.

Personnel.— In 1903, with some subsequent modifications, a system of providing officers was introduced by which there was established a common system of entry and training for the three great branches of executive officers, marines and engineers commencing at 13 years of age. Specialization for the different branches of engineering, marines, gunnery, navigation and torpedo was to commence at about the age of 22 to 23. It is still in some doubt whether the separation of the three great branches will then be permanent or temporary. At one time in 1905 it was decided that complete amalgamation should take place as is the case in the American Navy in regard to the line and engineer officers, but the new Board of Admiralty, with the change of government in 1906, claimed a free hand to defer any decision. Complete amalgamation was urged by the old Board on the ground that otherwise no volunteers would be forthcoming for the engineer branch, as none of the young officers would forego the chance of commanding fleets and ships. The original scheme of common entry and training was held to be justified in practice by the belief that it had succeeded in America, but serious doubts were thrown on this by later information and by the reports of Admirals Melville and Rae, who succeeded each other as head of the American naval engineering department. Historically it was held that the military officer had always combined his work with that of handling the motive power. This is too sweeping a statement, for the sailing period in history was relatively brief, and in a previous period, when the motive power as to-day was internal to the ship instead of external, the oarsmen were separated from the military element. There were the strongest reasons in the period of sailing ships for combining the two functions. The whole art of fighting consisted in bringing guns to bear with the greatest effect, and this entirely depended on watching the sails, taking advantage of shifts of wind, while the men at the guns, who were necessarily under the control of the combatant officer, had also to be used to work the sails. To disable the motive power of an enemy was equivalent to crippling his gun power. Things are absolutely reversed to-day. The motive power is purely mechanical, is completely protected below the armored deck, and is out of sight of the seaman. The latter cannot follow his calling as a combatant and be in the engine-room at the same time. In addition it was contended that to allow the ordinary officer to take charge of marines would result in the ultimate extinction of the marine whose cost was one-third of that of a seaman, whose discipline was much more reliable, and who, as the annual prize firing returns proved, was the better man at the gun. These in brief were some of the arguments presented by men of such standing and influence that there did not seem to be any likelihood of permanence about the new system of providing officers.

As regards the men, for 50 years they had been entered under a long service system of 12 years. The system has lately been tempered by entering a certain number for shorter periods with subsequent service in the Royal Fleet Reserve, and the latter is also recruited from pensioners who had served their full time in the navy. In 1906 this force numbered 19,500 men. The old pensioner reserve which is to be allowed to die out numbered nearly 6,000 in 1906. In addition there is formed out of the merchant service and fishermen the Royal Naval Reserve of about 28,000 men. Allowing for the Royal Naval Volunteers 3,800 men, and Colonial Reserves in Newfoundland and Australia 1,400 men, we obtain a total of 58,528 in reserve and 129,000 serving in the navy. The tendency is, however, to discourage the Royal Naval Reserve on the ground that it would deplete the merchant service of British seamen during war and that with the large permanent force and Royal Fleet Reserve the country has ample men. It is held that the waste of war is rather one of material than men, and that the result is that if the supply of men in proportion to ships is adequate at the beginning of war it is in excess of requirements after a short period of hostilities, the conclusion being the reverse of that universally acknowledged in the case of land war. Certainly in 1906, following on a policy of rooting out all obsolete vessels the permanent force of 129,000 men was capable of manning all the ships with but slight reinforcement from the reserves. This marks a notable change from the beginning of the 18th century when the manning difficulty was Great Britain's chief concern, so much so as to lead her into a war with the United States rather than sacrifice her system of impressing those who were believed to be British seamen wherever found. At that time enough officers and men were employed on the impress service alone to have formed the crews of half a dozen line of battleships while vessels remained out of commission in war for want of men. The habit of looking to the seafaring profession to man the navy on the outbreak of war resulted in large fluctuations. Thus in 1762 85,000 men were borne, whereas in 1773 when England was at peace less than 22,000 were borne. The next year war broke out and the number rose in 1781 to over 99,000. In 1792 or a few months before the French Revolutionary War it was just over 17,000 men and by 1814 it rose to over 126,000. As a contrast it may be mentioned that at the present time while the regular fleets are concentrated and ready to strike an immediate blow, many of the remaining ships of fighting value have a nucleus crew of all their officers and skilled ratings. To commission such ships for war is a mere matter of a few hours involved in marching the seamen, stokers and marines from the barracks. The skilled ratings being kept in contact with the ships they have to serve in, break-downs should be less frequent if repairs are attended to, whereas formerly these delays were a feature with newly commissioned ships. The progress in training is equally remarkable, the year 1906 being one of what are popularly called "records" in gunnery as well as coaling. It is interesting to note that in this respect there is a friendly rivalry between the British and American navies, the record for the former with the six-inch gun being 12 rounds in 60 seconds with 11 hits, and for the latter the Pennsylvania's achievement of 17 rounds in 90 seconds with 17 hits. The British record with the 9.2-inch gun is the remarkable one of 10 hits in 11 rounds fired in 90 seconds.

The Admiralty.— It only remains in the short space at our disposal to say a few words as to administration. The Board of Admiralty is organized on a constitutional basis, giving complete cabinet control. The First Lord of the Admiralty decides the duties of the different members. As the board never votes, if there is a disputed point, the First Lord decides, and he can lean on the junior Sea Lord as much as the senior, for constitutionally all are of equal status. The arrangement has worked so well that a recent change by which the junior Sea Lords are ordered to consult and report on all important questions with the First Sea Lord has been sharply attacked. This view of Admiralty procedure was well described by a former First Lord of the Admiralty, Lord George Hamilton, in the House of Commons in 1905:

> The Board of Admiralty met for general consultative and advisory purposes, and every Naval Lord was in a position of perfect equality. He attached great importance to that equality of *status*. It had made the Admiralty efficient, and the want of it had made the War Office inefficient. There were always in the Navy two schools—the young school and the old school—and the probability was that the old school would be more represented by the Senior Naval Lord. If the First Lord was a sensible man and had free access to the inner minds of the Junior Lords, he very often got hold of some idea of the new school, which he put forward in his name and which the Senior Naval Lord accepted, though he might not have been inclined to do so had it originated entirely with the new school.

The drawback is that Parliament has no cognizance of the views of the experts as Congress has through the admirable reports of the chiefs of the various naval departments. A commission under the present Duke of Devonshire 16 years ago urged that the American practice should be followed, but nothing has been done. As Parliament has no expert guidance and the navy estimates can be readjusted between the Treasury and the Admiralty after they have been voted, while no particulars are given of the construction programme, which does not even indicate whether the ships are to be battleships or armored cruisers, it is clear that Parliament has been deprived of all effective control. The tendency that results is for individual members to object to the magnitude of the naval estimates rather than to discuss the reasons which have guided the government in presenting them.

Bibliography.— Of late years there has been a great improvement in works dealing with the British Navy. Former histories were mere chronicles of events. The following works may be consulted with advantage: Colomb's 'Naval Warfare'; Mahan's 'The Influence of Sea Power upon History,' 'The Influence of Sea Power upon French Revolution'; White's Cantor Lectures at the Society of Arts on 'Modern War Ships'; 'The Naval Annual' (1886 to the present day); 'Journals of the Royal United Service Institution'; 'Transactions of the Institutions and Admiralty Instructions' (1906); 'The Navy Records Society'; Clowes', 'The Royal Navy' (5 vols.); White's 'Naval Architecture'; The Royal Navy List (quarterly).

Official Publications.— 'The King's Regulations and Admiralty Instructions' (1906); 'The Navy Estimates' (annual); 'Statement of the First Lord of the Admiralty explanatory of the Navy Estimates' (annual 1887 to the present day); 'Report of a Treasury Committee on the Relative State of the Navies of England and France, 1852-58,' No. 182 of 1859; Return No. 168 of 1860, statistics of ships, men and money voted for each year from 1736 to 1859; Returns dealing with relative naval strength No. 218 of 1888, No. 90 of 1889, No. 465 of 1893, and Return of Fleets (Great Britain and Foreign Countries) for 1897 and subsequent years; the Statistical Reports of the Health of the Navy (annual); Cd. (2416) of 1905 showing distribution of work among the Lords of the Admiralty; annual returns are also published as to court-martial and summary punishments, the gunlayers' competitions, and Hydrographer's report as to Admiralty surveys.

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38. Great Britain — The British Army. *The Regular Army.*—The British Army is in many respects like the British Constitution. It has grown, it has not been made. No single idea has dominated its history, no directing mind has prescribed its form or defined its functions. But while the forces, which formed and moulded the British Constitution, and made it from time to time the reflex of the prevailing opinion of the British people, have exercised a constant pressure—a pressure which has never been relaxed—the forces which have produced the British Army of to-day have been intermittent and irregular. The history of the British Army is a long record of the vicissitudes of public favor and public neglect. To a nation in whose long history the gates of the Temple of Janus have rarely been closed for a decade, each new war has come as a surprise. Every war, whether it has ended in victory or defeat, has furnished the British people with lessons which they have vowed to learn and never to forget, and which they have invariably forgotten before the ink has dried on the peace preliminaries. Every war has brought with it good resolutions born of anxiety and alarm, and every peace has produced the apathy, the neglect and the self-confidence which are the outcome of real or fancied security.

It would be unjust, and untrue to historical teaching, to infer from these facts that the British are an unwarlike, or, in all their public concerns, an improvident people. The population of the United Kingdom is composed of warlike races, and in regard to the conduct of public affairs it cannot be said that England has been behind the rest of the world. But it is possible to be a warlike without being a military nation, and there can be no doubt that the scientific evolution of a consistent military policy in the United Kingdom has not kept pace with other branches of national development.

The reason is not far to seek. An insular position and the immense protection afforded by a powerful navy have relieved the inhabitants of the British Islands from the dangers which ever threaten the great nations of Continental Europe whose long land frontiers expose them to attack by an ambitious and unfriendly neighbor. For nearly 300 years the people of England have been spared the knowledge of what war on their own soil actually means. While from Brest to Moscow, from Bergen to Gibraltar, every part of Europe has rung to the tramp of hostile soldiery, and has been the suffering witness of the tragedy of war, the dwellers in English counties carry back their immemorial tradition of undisturbed peace to the day when Oliver Cromwell won the last great battle fought on English soil on the field of Worcester.

Once, and once only since the creation of modern firearms did the people of England come in contact with the realities of war. In 1645 Parliament in conflict with the king found itself confronted by the necessity of fighting, or surrendering to an implacable enemy. Following the custom of the country, the House of Commons sought at first to meet the emergency by the aid of amateur soldiers, maintained by voluntary contributions. But the logic of facts soon convinced them that war cannot be trifled with. The "New Model" Army was called into existence by Act of Parliament, funds were provided by vote of the House of Commons, compulsory service was imposed when volunteering failed to produce the required number of men; and the recalcitrant were hanged. A Regular Army was called into existence, and that Regular Army almost immediately became a "Standing Army." It is from the days of the "New Model" that the history of the Standing Army of England really dates. War on English soil taught its lessons to a practical people. To the Commonwealth England owes, not only the establishment of her Standing Army, but the actual groundwork of the military institutions of the present day. One of the most famous regiments of the British Army, the Coldstream Guards, came into existence at this time; and the very establishment of the modern British Cavalry and Infantry regiment is practically what it was made by Oliver Cromwell and the soldiers of his day.

In 1651 the Civil War ended. In 1658 Oliver Cromwell died, and a military *Coup d'etat* placed Charles II. on the throne. Never since that day has a British Parliament legislated for the army with a knowledge of war borne of experience. A generation grew up which had forgotten the lessons of Marston Moor and Worcester. The reaction was prompt, and its effects far reaching. The army soon came to be regarded as an evil, scarcely a necessary evil. The soldier soon learnt that the utmost he could expect was toleration. The accession of a foreign king surrounded by Dutch guards increased that antipathy to the army, which for the next two centuries marked the proceedings of Parliament. In 1689 was passed the first Mutiny Act. The primary object of the Act was to confer upon the sovereign the right to punish certain military offences not dealt with by the ordinary law; but the Act contained a section of a totally different purport. The words which have become famous run as follows: "The raising or keeping of a Standing Army within the United Kingdom of Great Britain and Ireland in time of peace, unless it be with the consent of Parliament, is against law."

The law as passed in the time of King William III. is to this day solemnly re-enacted every year by Parliament, and the illegality of maintaining a Standing Army is palliated by a special Act of Dispensation for one year only. This annual performance has become a meaningless anachronism. The necessity for maintaining a Standing Army in time of peace is no longer questioned or questionable, and the army itself has long ceased to be the instrument of a sovereign, and has become the servant of the nation. But the original passage of the Act and its renewal by many succeeding Parliaments is typical of the tone and temper of the Legislature toward an institution which is as essential to the safety and welfare of the State as Parliament itself.

The result of this want of sympathy between Parliament and the army is very noticeable. The favor of the Legislature, and the funds which that favor can alone provide, have been available during periods of crisis and national danger: They have been grudgingly given or withheld in those intervals of peace which ought also to be intervals of preparation. As a result there has been an absence of continuity, and of deliberate adaptation of means to ends, which has greatly interfered with the proper development of the military power of Great Britain, and have provided her with military institutions which bear upon them the unmistakable evidence of their having been created at haphazard, altered to meet political rather than military exigencies, and adapted to meet a single emergency rather than to deal scientifically with the work of a world-wide empire.

Under these circumstances the services which the Regular Army of Britain has rendered are indeed a marvel. In every land and under every sky, against the highly trained armies of Europe, against the half disciplined hosts of Oriental princes, against savage tribes, formidable by reason of their fanaticism, courage and numbers, the Regular Army of Britain has fought with varying fortunes but with never failing tenacity and devotion. There is no soil which does not cover the grave of the British soldier. In the broad valley of the Danube, on the plains of Belgium, on the shores of the Black Sea, in the passes of Spain, among the vineyards of France they are to be found. The "Redcoats" have fought and died on the plains of India, under the walls of the imperial cities of China; on the heights of the Saint Lawrence; in the valley of the Hudson; under the ramparts of New Orleans; in South American cities; before the stockades of the Maori in

New Zealand and in innumerable islands in every sea. On the great African Continent, North and South, East and West, from the Pyramids to Table Mountain; from the blazing shores of the Red Sea, to the swamps of the Gold Coast and the Niger, they have obeyed orders, and laid down their lives for "the safety, honor and welfare of their Sovereign and his Dominions." But they have not died in vain. If it be true that the tap of the British drum follows the rising sun round the world, it is true also that the planting of the British flag in five continents is largely due to the patient heroism of the British soldier. Rarely commanded by generals of exceptional genius; almost invariably suffering from the apathy and neglect of Parliament in peace time, and from the faulty administration in war which is the certain result of neglect in time of peace; the British soldier by dint of certain great qualities which he possesses has held his own. To the Regimental Officers and to the Non-Commissioned Officers credit is above all due. They have been, and still are, the true strength of the British Army.

What is the nature of this Army which has suffered and accomplished so much? In its character and composition it is as unique as the circumstances which have created it. There may be better armies than the British, there are undoubtedly worse armies, but there is no army like it. It shares with the Army of the United States the peculiarity of being recruited by voluntary enlistment and not by compulsion in any form. It has a further peculiarity which, until recent foreign conquests planted the Stars and Stripes in the China Seas, distinguished it even from the Army of the United States. Nearly half of the Regular Army of Britain is maintained on a war footing in time of peace, is maintained in distant lands, and to a large extent in tropical or sub-tropical countries. The population of India is 300,000,000 and the military force which defends the great Peninsula and keeps the peace from Quetta to Cape Camorin does not exceed 231,000 all told. Of these 78,000 are British soldiers enlisted within the United Kingdom; the remainder are the troops of the Indian Army, 152,825 natives commanded by British Officers. There are also 14,917 "Imperial Service" troops raised by Native States and held at the disposal of the government; 20,731 Reserves of the Native Army, and 31,966 white volunteers. South Africa, the Mediterranean fortresses of Gibraltar and Malta, the distant Eastern Ports of Singapore and Hong Kong, make further demands upon the Regular Army. On 1 Oct. 1905, there were 142,203 British troops serving abroad. It is the necessity for maintaining this great force abroad that makes the British Army essentially a voluntary Army. Conscription for service abroad in time of peace is impossible. The young soldier cannot endure the climate of India, and a youth enlisted at eighteen, must perforce remain for two years at home before he becomes physically qualified for foreign service. This fact not only makes it necessary that the service should be voluntary, but that it should be long and that it should greatly exceed the limit of two years which is the term now accepted in the principal conscript armies of the world.

For this voluntary Army there are enlisted on an average 38,000 men a year. The total is sometimes exceeded; there is rarely any difficulty in reaching it. There is no reason why there should be a difficulty. The old prejudice against military service due to the savage conditions of the soldier's life, his scanty pay, his squalid surroundings, lived long and died hard; indeed it is not altogether dead yet. But the life, pay, and prospects of the British soldier at the present day are such as may reasonably attract young men of spirit and ambition. The pay itself, though not excessive, is good. An Infantry private of 20 years of age serving at home receives on an average, week in and week out throughout the year, 11/7d. ($2.50) in cash after every deduction has been made for "stoppages" compulsory and voluntary. When the soldier receives his pay every need has already been provided for. He has been clothed, fed, housed, doctored, and educated; his general health has been looked after, his amusements furnished. If he chooses to remain in the Service his pay increases with every step in rank; and, if his conduct be good, he may look forward with certainty to retirement at the age of 39 with a life pension. It is not true to say that all the recruits who enter the Army are good, or that they all become useful soldiers. Many are not good, and never become so. But the unfit are soon eliminated and the quality of the special branches, the Royal Engineers, the Royal Artillery, the Cavalry and the Guards is very high. A British regiment returning from India after a long tour of service in that country, will bear comparison with any body of fighting men of equal numbers in the world.

The composition of the Regular Army at the close of the year 1905 was as follows:

STRENGTH AND COMPOSITION OF THE REGULAR ARMY (ALL RANKS), WITH THE COLORS ON OCTOBER 1, 1905.

	All Ranks.
Household Cavalry	1,360
Cavalry of the Line	19,149
Royal Horse and Field Artillery	30,550
Royal Garrison Artillery	24,174
Royal Engineers	10,718
Foot Guards	8,055
Infantry of the Line	150,955
Colonial Corps (on Brit. Estab.)	6,220
Army Service Corps	6,944
Royal Army Medical Corps	5,049
Army Ordnance Corps	2,423
Army Pay Corps	856
Army Veterinary Corps	*149
Total	†266,658

*There were in addition 6,475 officers and men borrowed from India for garrison and expeditionary purposes, borne on the British Establishment at the date named.

†The Secretary of State for War has recently announced (July, 1906), that he proposes to reduce the regular army by 10 battalions of infantry and nearly 4,000 officers and men of the Royal Artillery, making 20,000 men in all, exclusive of reserves.

STRENGTH OF THE ARMY RESERVE ON OCT. 1, 1905, *94,770.

DISTRIBUTION OF THE REGULAR ARMY, OCT. 1905.

United Kingdom	129,930
India	78,061
Colonies and Egypt	63,185
Crete (temporary)	977
Total	272,153

*Since increased to over 120,000. This increase is temporary only, and due to exceptional causes.

The ordinary period of Color Service in the British Army varies from six to nine years, but the Brigade of Guards are enlisted for three years with the Colors, the men having the right to prolong their service to eight years. Soldiers are generally permitted, if their conduct has been good, to extend their first term of service and to remain with the Colors for 12, and in some cases, for 21 years. In addition to the men with the Colors there are the men forming the Army Reserve. The Army Reserve is an outcome of the great reform accomplished by Lord Cardwell in 1870. That distinguished War Minister was the first to divide the soldiers' service into two periods, the first with the Colors, the second in the Reserve. The Reservist is liable to be recalled to his Regiment in case of war or national emergency only.

The recruits for the Regular Army are drawn from all parts of the United Kingdom, the figures for 1905 being as follows:

	Total number of recruits approved.
England and Wales	27,314
Scotland	3,842
Ireland	3,166
Total	34,322

It must not be forgotten, however, that many Scotsmen and Irishmen enlist in England. In theory and to a considerable extent in practice the Army is "territorialized." Each Infantry Regiment is associated with a particular County or district, and the recruits in many cases, though not in all, are drawn mainly from that district.

The Auxiliary Forces.— It must not be supposed, however, that the Regular Army exhausts the number of soldiers available for the service of the nation in time of war. The "Auxiliary Forces" largely outnumber the Regular Army. They are composed of the "Militia," the "Imperial Yeomanry" and the "Volunteers."

One great line of demarcation separates the Regular from the Auxiliary Army. The officers and men of the former are liable by the terms of their engagement to serve abroad both in peace and in war. The officers and men of the latter are under no such liability, either in peace or in war. The distinction is important. The protection afforded by the sea and by a powerful navy suffices in the opinion of many authorities to secure the British Islands against any serious invasion. If this view be correct, and it is the view which has been officially accepted by both political parties in the State, the value of the Regular Army is greatly enhanced. An army whose functions are limited by law to the performance of duties which will never be imposed upon it, has evidently not attained its full sphere of usefulness. It is the perception of this fact which has led to the acceptance of the view that the Militia should in future be made liable to serve abroad in time of war, and that the Volunteers should be encouraged to regard themselves more as a reservoir from which the Regular Army can be replenished in time of war, than as a force capable of operating independently, or of taking the field with the units of which it is composed in time of peace.

It is evident that the policy by which a nation which admittedly requires its army for service outside its own territorial limits, has allowed two-thirds of its force to be tied to the soil, is not a scientific one, or one which would have been sanctioned if the situation, as it ultimately developed, had been dealt with as a whole, and provision made for it on business principles. But, as has been pointed out, the spirit of scientific organization has never directed the military policy of Great Britain; and the development of the Army has been due more to chance and to the incidents of successive campaigns, than to any recognized and guiding principle.

The Militia.— The Militia, the oldest force in the realm, was called into being at a time when the danger of invasion was real and pressing, and when the building up of the British Empire had scarcely begun. The organization was appropriate to its original purpose, the service in the Militia was local, and was, or at any time might be rendered, compulsory by the enforcement of the ballot. The old law, though in abeyance, still exists, and can be put into operation at any time at the will of Parliament; it embodies the principle of compulsory service, but in a form which makes it unsuitable to modern conditions. The Militia at the present day is raised and maintained under later statutes in which the principle of compulsion does not appear. Service in the Militia is voluntary; the training of the recruit is for 49 days, and the annual training is for 28 days. In the year 1905 the strength of the Militia was as follows:

STRENGTH OF THE MILITIA (BY ARMS) IN THE YEAR 1905.

Royal Field Artillery	428
Royal Garrison Artillery	14,909
Royal Engineers	2,504
Infantry	77,881
Royal Army Medical Corps	881
Total	96,603

The Militia is dwindling under the pressure of adverse conditions which will continue to operate until a change is made in the constitution of the force. Free Trade, and the perpetual and increasing burdens laid upon landed property, have done much to cripple the landowners who were at one time the mainstay of the Militia, and to reduce the number of farm laborers who provided its best recruits. Changes in the organization of the Army have brought the Regular regiments into sharp competition with the Militia, and thousands of recruits for the former are drawn from the ranks of the latter; the Militia is "bled" for the benefit of the Line. By universal admission some change must be made in the organization of the Militia if it is to be preserved as an effective force. The tendency of the present time is to effect this change by bringing the Militia into closer relation with the Regular Army, and by enforcing upon recruits, and upon all men in the ranks, who will accept the obligation, the duty of serving abroad in time of war.

The Imperial Yeomanry.— The Yeomanry is a force of mounted men, raised under the same statutes as the Militia but on different conditions of service. The force rendered good service during the South African War, for which several thousand men volunteered. The value of the Yeomanry was fully recognized, its numbers were increased, and it received the title "Imperial" thus connecting it with the contingents furnished by other parts of the Empire. The Yeomanry is well officered and efficient, the annual training in camp is 10 days, the weapon of the Yeomanry is the rifle. The strength of the force in 1905 was 25,341.

The Volunteers.— The Volunteers are the largest section of the Auxiliary Forces; their numbers and constitution on Nov. 1, 1905, were as follows:

STRENGTH OF THE VOLUNTEER FORCE. NOV. 1, 1905.

Royal Garrison Artillery	39,882
Royal Engineers	17,736
Infantry	184,627
Royal Army Medical Corps	3,417
Bearer Companies	1,839
Motor Volunteer Corps	147
Total	247,648
Permanent Staff	2,023
Honorable Artillery Company	483

Service in the Volunteers is voluntary; a specified number of drills must be performed by each man — 30 drills in his first year, 10 in subsequent years. A large proportion of the force attend camp for a week or a fortnight each year.

The origin of the force is remarkable, it was raised in 1859 when the nation was alarmed by threats of invasion by the French under Napoleon the Third. It was recognized that the Fleet was insufficient and ill-equipped, and that the British Army compared with that of France was a negligible quantity. The country was thoroughly alarmed, a number of patriotic and energetic men appealed to the manhood of the nation to "volunteer" for military service to resist the threatened invasion. The Government approved and endorsed the appeal. There was an immediate and adequate response; corps were formed throughout the length and breadth of Great Britain, and the force thus created has continued to attract the interest and command the confidence of the public until the present day. Important changes have taken place in its character and organization. On the whole the changes have been in the direction of increased efficiency. The Volunteer Force undoubtedly contains some of the best military material in the United Kingdom. At the present time it suffers somewhat from the lack of trained officers, and from the absence of any precise function in time of war. That if the task of organizing the armed forces of the United Kingdom in the most effective manner were now to be undertaken for the first time the Volunteers would exist in their present form is not probable. But, having been created in the absence of any directing policy, they nevertheless form an integral part of the national forces, too important to be disregarded and of too great potential value to be omitted from any scheme of organization for war upon which the military authorities may decide, and of which Parliament may approve.

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Formerly Secretary to the Admiralty and Secretary of State for War; Author of 'The Citizen Reader,' 'A History of England,' 'In a Conning Tower,' 'Our Home Army,' etc.

39 (a). Great Britain — England and Europe. It is the purpose of these observations to explain, as clearly and as briefly as possible, the policy of England in Europe as it has been, as it is, and as, most probably, it will be. In order to elucidate the problem, it is necessary to look, in the first place, exclusively at Europe, and then to turn our eyes to England.

For about five centuries after the fall of the Roman Empire, that is, from the 5th up to the opening of the 11th century, there was one absorbing issue before Europe. That issue was whether European civilization was to continue to exist or not. During that time the Moslems on the South, the Danes, Swedes, Goths, and Norwegians from the Cattegat, and eastward the Slavs and Hungarians swarmed round the dissolving limbs of Christendom, so that Christendom bade fair to disappear. As Baronius said, "it was as if Christ slept in the vessel that bore mankind." The 10th century brought Europe nearest to destruction. But about the year 1000 an almost magical change began to operate. Invasion ceased. Europe was saved. Since that time external barbarism has often threatened, but never with overwhelming force.

The next epoch of Europe has lasted from the 11th century up to our own day and is not yet concluded. Europeans are busy finding a solution for a problem which has haunted them for eight centuries. That problem is the reorganization of Europe after its almost complete destruction by the barbarians. To the most profound minds two ways of reconstructing Europe have presented themselves. The first was to amalgamate this small continent under one supreme authority, and to do what the statesmen of China and of America have achieved so admirably for China and the United States. Great prestige has attached to that solution because the Romans had carried it out to a large extent already with fair political results. But the solution has derived its fundamental authority from the fact that there is a certain amount of reasonableness and utility in the idea of having one sovereignty to control the peninsula which Europe is.

The chief exponents of this great idea can easily be named. First, there was the mediæval Papacy which, springing up in the 11th century, claimed universal sovereignty as a right. As Pope Gregory VII. said at that date, the Papacy is the Master of Emperors. Then in the 13th century, when the mediæval Papacy had fallen, the French monarchy made a similar attempt. Mathew Pavis, Peter Dubois, and Jandun all agreed that France was the new claimant to universal power. Later Pope Urban, in 1382, pointed out that "France desires the universal monarchy of the world."

The next successor in the field was the House of Hapsburg. That family fought for this idea during two centuries, from the middle of the 15th to the middle of the 17th century. "Austria's mission is to rule the world," was their motto, and their greatest prince was Charles V. They came in course of time to rule both at Vienna and at Madrid. The two branches of the house were intertwined together. Together they fell. The decline of the German branch was registered by the peace of Westphalia in 1648, and that of the Spanish branch by the peace of the Pyrenees in 1659.

The next power which strove to raise from the ground the broken sceptre of the Cæsars was France again, under Louis XIV. Louis inaugurated their policy in 1661. This dream of French supremacy in Europe was consistently pursued by France up to 1815. Its consummate exponent was Napoleon, who claimed to be the heir of the Cæsars. In the summer of 1808 he attained the nearest to his ambition when he told Talleyrand that he was now "master of Europe."

After Napoleon had fallen in 1815, Russia succeeded to his aspirations. In 1812 she had extinguished the ambitions of Napoleon in the Russian snow. The last two centuries had been a route march for her, East as well as West, South as well as North. Her day had come she thought. But that is not so certain. The Crimean War showed her to be not so strong as she imagined, and since that date, Germany, under Prince Bismark, has arisen to dispute the title. Michelet once described Germany as the India of Europe, vast, vague and unsettled. All that was ended by the man of blood and iron. We will not pronounce whether European supremacy rests at this moment with Russia, at the head of the Dual Alliance, or with Germany at the head of the Triple Alliance. Probably it inclines toward Germany. However that may be, the struggle for the supremacy lies at present between these two powerful champions. Of the two, Germany appears to claim it with more zest and resolution.

But in spite of all these constantly renewed ambitions to grip the supremacy of Europe, all aspirants to supreme dominion have failed. No one has been strong enough to reconstitute the empire of Rome. What force has thwarted this consummation? It is the force of nationality. The issue before Europe has been the issue between despotism and freedom. Freedom has won. Europe has chosen to organize herself into a number of mutually independent nations, some 20 in number, rather than to place herself in subjection to one supreme authority, whether of Pope or of Emperor.

The definite appearance of the national spirit, and therefore of nations, may be dated from the 13th century. At that time a whole cluster of young nations appeared on the horizon, like a group of islands, Hawaiian or Philippine, descried far out at sea. Some were powerful, such as France, or insignificant, such as Austria; some monarchial, such as Castile, or republican, such as Florence; some Slavonic, such as Poland, or Romance, such as Aragon; or Teutonic, such as Holland; some dying like the Arelate, or full of the germs of progress, like Brandenburg, or precarious, like Hungary. What a bewildering scene! What an inextricable task to follow the dance of these atoms for seven centuries up to our own day, as they coalesce and disperse and again amalgamate into the nations which we know so well!

Enough has been said to make quite plain what the main history of European politics really is. It consists of a conflict between two theories of government embodied in men's passions. One theory proclaims the advantage of unity under one authority. The other theory announces the goodliness of nationality of freedom, of a Europe split into many independent sovereignties. Since the 11th century Europe has been rent by this question. Wars innumerable have been fought over it. Such has been the fearful legacy of ambition left by the Cæsars to the barbarians.

Having now indicated the nature of the politics of Europe, let us turn to England, this minute speck of an islet off the European coast. What has been her policy as regards this continent? Japan, an island similarly situated, has enjoyed an easy time, because China, on the coast opposite, has been the most peaceable neighbor in the world. But, as for us, we have been faced by the most savage and quarrelsome races, the scum of Asia, almost always at war. Therefore, we have had perforce to take our part. We have had imperatively to say whether we should side with autocracy, as represented by the Pope, by the Spanish Armada, by Louis XIV., by Napoleon, by the Czar Nicholas, and by Bismark; or whether we should side with the force of freedom ever ready to resist these powers. It has been somewhat a hard choice. We have often tried to shut our eyes and take no part. We have sometimes taken the side of power and authority, as James I. did in siding with Spain, or as Charles II. did in siding with France. But, on the whole, since the days of William the Conqueror we have sided with freedom. For the liberties of Europe ever coincide with the interests of England.

Our reason for siding with the liberties of the Continent has been a practical business reason. We know perfectly well that the day of the amalgamation of Europe under one authority is the day of our destruction. We are not strong enough to maintain ourselves against a whole hostile continent. We fell inevitably before Rome, as soon as Rome had mastered the West. It was only by the most strenuous effort that we saved ourselves from the latest heir of the Cæsars,— Napoleon. Hence it is that we have opposed the Papacy, and Spain, and Louis XIV., and Napoleon, and the Czar. Hence to-day our profound anxiety at the progress of

German ambition toward Austria and toward Holland. Hence our love of the balance of power in Europe which is a conception rooted in our history, and was as familiar to Henry VIII. and Wolsey as it is in our own hour to any of our foreign ministers. Hence our instinctive love of small states, of Holland and Belgium and Portugal, and Switzerland, each of which is a bar against autocracy and a pledge of European freedom. Hence our "perfidiousness," that is, our aptitude ever to abandon the company of a too dominant star. Hence at this moment our love of France whom we disliked ever since the rise of Louis XIV., but whose successive falls in 1815 and 1870 have brought us at last to her side. Hence our profound and fundamental indifference to European politics, so long as no power is visibly in the ascendant across the Channel. Hence, too, the predominant part which, in all the real crises of European history, England has played. Who but they thwarted the Pope, and the Hapsburgs, and Louis XIV., and Napoleon? Who but they have proved the ultimate obstacle to Czars and Kaisers?

For Americans all this has a good deal of significance. What is to be the policy of the United States in Europe? The interests of the United States in Europe are nothing like so vital and immediate as those of England; but subject to that consideration, they run on parallel lines. It can never be the interest of the United States to be faced across the Atlantic by an united and amalgamated Europe. For, first, that would mean the conquest of England; and next, the power thus organized would be a menace to the greatness of the United States. Just as the United States desires the open door and the balance of power in the Far East, so, and for the same reason, she needs a Europe in which national freedom prevails, rather than a Europe armed under one authority and dictatress of the world. That consideration is not yet materialized in the American mind. But the day will come when it will be materialized and then it will be seen that the identity of the European policy of England and of the United States constitute yet another link between the two nations.

The future of Europe and of England's policy in Europe remains to be considered. At first sight it would seem that never before has the principle of nationality, of freedom, been so firmly established in Europe, or so much revered. There seem so many nations, and all so strong. The project of universal dominion would at first sight appear hopeless. Where Napoleon failed, is it likely that anyone can succeed? If all this be so, then England may rest at peace as regards Europe and devote herself wholly to her duties oversea. Is it so? It is not so. The old problem of eight centuries is still with us, and still must regulate our policy.

First, though nationality has won, Europe is paying a fearful price for this victory. The nations have had to arm to the teeth. They are groaning under their armaments, necessitated by the ambitions still glowing in the soil of our volcanic continent. Hence, on all sides, there is observable beneath the surface a profound reaction against nationality. Those who thus react are called Socialists. Socialism is the reaction against nationality. It proclaims the brotherhood of man, the disarmament of nations, the unification of labor, and universal peace. The socialist is not a patriot of France, or Germany, or Italy. He is, or thinks he is, a patriot of the world. Such men are the precise stuff of which revolutions are made. They beat down the barriers of Nations. But in so doing they commit a revolutionary act, and clear the ground not for a Mirabeau, but for a Napoleon. This is the foremost danger of which England has to beware in Europe.

Let me put the same fact in a somewhat different light. The pace in Europe is terrific at the present time. The stress of rivalry in armaments is too much for some nations to bear. A progressive nation like Germany can hold out longer than a stationary nation like France, or than an undeveloped nation like Russia, or than a disorganized nation like Austria. Here are the seeds of a European cataclysm. Some nation, fainting in the race for life, may become the footstool of its neighbors and in a moment the balance of power may be upset. Then again will come the call for the power of England.

Against this bad outlook there are two powerful considerations to be set. Socialism, if guided by statesmanship, may, in its detestation of armaments and their evil consequences, achieve a great good. The nations may be induced to draw back in time from their insensate haste to arm. Perhaps the hour of mutual limitation of fleets and armies is nearer than may be supposed. For if things go on in Europe without check as they are now going, men will come to loathe nationality as much as they once came to loathe feudalism. They will tear up its title deeds even as they tore up those of the barons. But it is quite likely that nationality will not thus perish, and that suicide is not to be the sole end of Europe. To arrive at some such happy solution should be a part of our policy in Europe, for, indeed, upon its achievement our ultimate safety depends.

There is a second consideration, pointing the same way. Most of the great nations of Europe and several of the small ones have acquired empire over sea. These empires are inhabited by alien races who, as time goes on, will be found to grow more and more impatient of their foreign masters. Even were it otherwise, and even were the natives to be forever docile and obedient, here is a vast and adequate scope for the energies of Europe which would be thus far better occupied than in the domestic broils which occupied Holy Roman Emperors and most Christian Kings. Besides, the whole wide world east and west, in regions never known by Cæsar, will laugh us out of court for wrangling over the legacy of the Cæsars, now that it is grown so small by comparison. Thus perhaps the new world is solving, slowly but effectually, by distracting our attention to greater issues, the problem of how we Europeans can live together in amity, and how nations may combine peace with freedom. Thus nations will continue to exist and will justify the policy of England in defending them. For humanity, divided by reason of its very greatness, will not soon find its unity once more.

George Peel.

Author of 'The Enemies of England'; 'The Friends of England'; etc.

39 (b). Great Britain — Foreign Policy in India. In writing about India one is too apt to presuppose a certain amount of knowledge of the historical, geographical and ethnographical facts of that vast continent, but in the space allotted to this article a large presumption of familiarity with the main circumstances of the British occupation of India is inevitable. There is no time for even a brief sketch of the marvellous story of the British wooing and winning of the great peninsula, which contains nearly one-fifth of the human race. A glance at the map of India will show that others also wooed, but did not win, and will indicate that all paid their addresses at three important points on the long coast line, so singularly lacking in harbors. Near Bombay on the West, the Portuguese still hold the beautiful land of Goa; near Madras on the East, the French retain Pondicherry, and up the Hooghly river above Calcutta, the tri-color still flies over the little settlement of Chandernagore. Dutch and Danes no longer have settlements in India, but these, too, have left their traces. From Madras, Bombay and Calcutta — isolated and unconscious — strenuous traders generated the force, which was in the course of time to create and consolidate one of the most remarkable Empires which the world has ever seen.

There is no time to dwell on the romantic deeds of Clive and Warren Hastings, nor to second the achievements of the various Governor-Generals, who seemed compelled, in spite of themselves, and in spite of their merchant-masters in London City, to advance and advance. Warren Hastings, Lord Wellesley and Lord Dalhousie were the great builders of the huge fabric, known as British India.

Another glance at the map will show that only three-fifths of the Indian continent are colored red. The remaining two-fifths belong to the Indian Princes and are not British territory. If the policy so keenly followed by Lord Dalhousie had not been arrested by the convulsion, known as the Indian Mutiny, it is possible that a considerable portion of the territory now belonging to the Indian Feudatories would have passed by lapse or other causes into British possession. But happily by the wise grant of the right of adoption to the Indian Princes the danger of further annexation disappeared. It will be noticed, if reference again be made to the map of India, that the territories of the Indian Princes are widely scattered. There are large countries belonging to Princes, such as the Nizam of Hyderabad and the Maharaja of Mysore in the South, and there are vast areas held by groups of chiefs such as the congeries of states known as central India; where the great Mahratta dynasties hold sway — Rajputana where the Rajput Princes rule, and the large tract in the Punjab where the Sikh states lie. It is difficult to define the exact relation of the Indian Princes to the crown, but the King of England and Emperor of India may in a sense be styled a "Ruler of Princes." The ties which bind the Indian Princes to the British crown have been described by Lord Curzon:

"They are peculiar and significant, and, so far as I know, they have no parallel in any other country of the world. The political system of India is neither Feudalism nor Federation; it is contained in no constitution; it does not always rest on a treaty and it bears no resemblance to a league. It represents a series of relationships that have grown up between the Crown and the Indian Princes under widely differing historical conditions but which in process of time have gradually conformed to a single type. The sovereignty of the Crown is everywhere unchallenged. It has itself laid down the limitations of its own prerogative. Conversely, the duties and the service of the states are implicitly recognized, and as a rule, faithfully discharged."

With Lord Dalhousie passed away the policy, and, indeed, the necessity for annexation. The conquest of Upper Burmah, postponed by him and carried out by Lord Dufferin, was under the circumstances unavoidable. There have also been changes in Baluchistan of a political rather than a territorial nature. But with these exceptions, India, from the time when it passed out of the hands of the company of merchants into the keeping of the Crown, has remained content with the frontiers which nature had suggested and Lord Dalhousie had secured. They are good frontiers, and enable a comparatively small force of some 230,000 men to keep the peace, internal and external, of some 300,000,000 people. India has been likened to a "fortress with the vast moat of the sea on two of her faces and with mountains for her walls on the remainder." For the Hindus the "black water," as they call the ocean, was protection enough until the navies came out of the west, while to the north stood the stupendous mountains of the Himalaya. But to the northwest, the frontier, difficult and dangerous though it was, admits of passage, and through the defiles which occur in the marches between Peshawar and Quetta the waves of invasion have often found their way. And so long as Great Britain holds command of the sea, it is only through the northwestern frontier that India can be threatened.

Since 1857, the year of the Indian Mutiny, the chief preoccupation of the Viceroys has been the internal development of the vast and varied continent, split up into so many distinct countries and peopled by races of extraordinary diversity. The terms "India" and "Indian" are too often used with most misleading results, and it would be as safe to predicate anything of "India" and the "Indians" on any subject ranging from politics to weather, as it would be to generalize on Europe and the Europeans. The only thing in India which is the same and universal is the system of Government, and many are of opinion that in this sameness and uniformity there is danger. But uniformity on the whole tends to efficiency and is economical, and since India passed under the direct control of the Crown the exigencies of finances have rendered strict economy essential. It would be difficult to find any part of the world, where government is carried on so cheaply as in India. Some 1,000 officers of the Indian Civil Service manage the affairs of some 230,000,000 people in British India, and have occasionally an indirect influence on the welfare of the remaining 70,000,000 who live in the territories of the Indian Princes. British India is divided into large administrative areas known as Districts, and in the whole world there is no such work as that of the District Officer. Often isolated from his countrymen he toils day and night for the people committed to his charge. They look to him for everything and in their own language he is their Mabáp — their Mother and Father. His one idea is that they should not be harassed or worried whether it be by tyrannous neighbors, by exacting underlings, or by an over-zealous Government. He is usually conservative in his views, and his one hope is the hope of his clients that the rain shall fall in due season, and that there shall be a bumper harvest. The District Officer at his best is rarely seen except by the people away in the villages. Viceroys and distinguished travellers cannot see him at his real work, but for all that they quickly learn that the good Government of India ultimately depends on the good District Officer. Perhaps the best critics of English administration in India are the French, and they have borne generous testimony to the system, and wonder at the fewness of the Civil servants. As it is in the Civil Service, so it is in the other many efficient departments of official work: the British officers are few,* and their work and responsibilities are enormous. It is due perhaps to the responsible nature of the work that the strenuous life prevails in spite of climate and solitude.

Far away from the Districts, from the canals, railways and forests, where men live their solitary lives on salaries none too generous, there is a military cantonment with a mixed Brigade of British and Indian troops. Strong as may be the District Officer, and unquestioned as may be his authority among the people, the knowledge that there are soldiers of the fair faces and guns within a few hundred miles undoubtedly acts as a sanction, and a steadying influence on the unruly spirits and latent forces of disorder, ready in every District to spring if there be the least sign of weakness.

The Oriental respects most of the respectable qualities, but to him the great quality is strength. And though we pride ourselves on justice, though we labor to make the Indians more prosperous, though as trustees we spend India's money on railways, irrigation, canals and education, though we toil to remove all real grievances, and tax our brains to defeat famine and plague, it all goes for nothing unless there be strength — power manifest and actual. There is a word in use throughout India — Ikbál. If the Ikbál of the Sirkar is good, that is if the prestige of Government stands high, all is well. But if it is shaken all the splendid structure which the British have raised in India will also be sorely shaken. It is the knowledge of this prestige and its power, and the sense that it must be inviolate, that brings anxiety and pause to a Viceroy and his Government, when some reform really touching the people or some military operation to quell a turbulent clan on the frontiers is under discussion. In India risks must be run, but caution is the characteristic of the Indian bureaucracy. It is this same knowledge of prestige and of what is connoted by the loss of it, which has hitherto made for continuity of policy, and has kept India out of the arena of party strife in England. For, once belittle a Viceroy, a Lieutenant Governor, or even a District Officer, and a blow is struck at authority which reverberates through the astonished minds of millions. Authority, power, prestige are all summed up in the word Ikbal. That is the word on which the astonishing miracle — the rule of 300,000,000 by a mere handful of men — rests. Justice, benevolence, an almost missionary zeal to improve the condition of the people are mere incidental attributes.

It is a commonplace to say that the average Englishman knows nothing of India and its problems, and it is rare to find a man who can visualize the Indian people unless he has visited the East. The statesman with the poetic imagination and the literary gift may sometimes project himself into the jungle of India religions, tribes, castes, languages and customs, but the Burkes, the Max Müllers, and the John Morleys occur but seldom. And yet no Government is richer in official literature than the Government of India. There are mines of information awaiting the student, for every official is perforce a writer of reports. There will shortly be published a work known as the Gazetteer of India which will give to the world the conditions and vital statistics of the most remote parts of the Continent. Every ten years there is published the report of the Census of India, and a very cursory reading of that most interesting work will reveal the curious and complex charge which devolves on the Viceroy and his Government. The student will be staggered when he learns the number of religions, languages, tribes and castes which exist in India. He will recognize that India is a vast conglomeration of innumerable differences. But he must see the people before he can realize the gulf which lies between the Sikh and Pathan, the Mahratta and the Bengali. Lord Curzon explained it in his speech at the Guild-Hall in 1904: "We have to deal in India with races that are as different from each other as the Esquimau is from the Spaniard or the Irishman from the Turk; with creeds that range between the extreme points of the barest animalism on the one hand and the most exalted metaphysics on the other, and with standards of life that cover the whole space between barbarism and civilization."

It is no easy task to give equal justice to all these varieties of the human race, but the task is fairly faced, and the wise rule of religious tolerance, and the scrupulous respect which is paid to Indian customs, make possible the Government of India. But though the differences are great there are solvent forces at work which may at no very distant date make for homogeneity in certain localities, and the close of one century and the beginning of another seems by some curious reason to be the signal for change. Some few years ago it was the fashion to suppose that the people of the two great religions of India — the Hindus and the Mussulmans — would never work in harmony. It was similarly supposed that the manly races of the Punjab would never co-operate with the unwarlike people of lower Bengal. Undoubtedly many of the propositions which used to be accepted without challenge must be modified. Railways, travel in

* The work of the Civil administration of India is carried on by [illegible] British, either brought from abroad or recruited in India, and by 21,800 Indians. These figures leave out all on lower pay than £60 per annum.

Europe, education and a free press have worked important changes, and it is plain to the writer, who has had opportunities of revisiting India after periods of absence sufficiently long to enable him to notice changes, that the Government of the future will have to reckon not with an homogeneous India, but with an increasing number of educated Indians scattered over the continent who are groping after ideals. It will be the problem of the Indian statesman to find them these ideals, and to give them some safe scope for their activities. The progressive Indian realizes that India depends on the British connection. He wishes to take part in the Government of India, and to enable India to take her place among the self-respecting nations of the world. He points to Japan, and the defeat of Russia and the Anglo-Japanese alliance have naturally caused a ferment in India. But the progressive Indian — like the ordinary Englishman — will not grasp the radical point, that there is no India and no nation of Indians. If political power is to come to the educated classes — the microscopic minority of the millions, it must first come from small beginnings, from the village and the town. They cannot jump at once into the control of an Empire. The progressive Indian is, so far as he can be judged by his conversation and his public speeches, loyal to the Crown, but unfortunately his organ — practically the whole of the native press — is undoubtedly preaching sedition and poisoning the mind of the rising generation against the Government. With some honorable exceptions, there is no sense of responsibility, and still less of dignity in the native press, and though the editors are in some cases merely making believe and ploughing the sands, their teaching tends to conflagration, and they must know that they are playing with fire. Yet the leaders of the progressive party would deplore a conflagration, for they and theirs would be the first to be overwhelmed. It needed no prophet to point out as did Mountstuart Elpinstone years ago that bureaucracy and a free press were incompatible, but the problems of finding the ideal for the intellect of India must now be grappled with and the good humored indifference of a strong Government toward a virulent and hostile press is no longer safe. This somewhat lengthy but still incomplete preface to the subject of my article, «Foreign Policy in India» is necessary since it is impossible to deal with the Foreign Policy of India as a thing separate and apart from India. Up to the end of the 19th century Indian foreign policy was treated with great reticence. There may have been some policy, but it was known to few. But at the beginning of the present century Lord Curzon, Viceroy of India, who believed in taking the people into his confidence, departed from the old-fashioned reticence, and in several memorable speeches formulated the problems of the defence of India. No one was ever more qualified to expound these problems. He had made them his life study, and his intimate knowledge of the countries beyond the frontier, acquired by travel, coupled with his wonderful grasp of every detail of Indian affairs, enabled him to co-ordinate isolated facts and events, and to establish India's position on the board of British foreign policy. He pointed out that up to the last 15 years the foreign relations of India were practically confined to her dealings with Afghanistan and to the designs or movements of the great Power beyond, and the foreign policy of India had little to do with any other foreign nation. «Now all that is changed and events are passing which are gradually drawing this country, once so isolated and remote, into the vortex of the world's policy, and that will materially affect its future.» Consolidation on the frontiers involved more direct relations with the countries beyond, but more than that. «Europe has waken up, and is beginning to take a revived interest in Asia. Russia with her vast territories, her great ambitions, and her unarrested advance, has been the pioneer in this movement, and with her or after her have come her competitors, rivals and allies. Thus, as all those foreigners arrive upon the scene and push forward into the vacant spots, we are slowly having a European situation recreated in Asia, with the same figures upon the stage. The great European Powers are also becoming the great Asiatic Powers. Already we have Great Britain, Russia, France, Germany, and Turkey; and then, in place of all the smaller European kingdoms, and principalities, we have the Empires and States of the East, Japan, China, Thibet, Siam, Afghanistan, Persia, — only a few of them strong and robust, the majority containing the seeds of inevitable decay. There lie in these events and in this renewed contact or collision, as the case may be, between the East and the West, omens of the greatest significance to this country.» Again, «A land frontier 5,700 miles in length, peopled by hundreds of different tribes, most of them inured to religious fanaticism and hereditary rapine,— a single outbreak at a single point may set entire sections of that frontier ablaze. Then, beyond it, we are brought into direct contact with the picturesque but perilous debility of independent, or quasi-independent, Asiatic States, some of them incurably diseased and hastening to their fall; and behind them, again, are the muffled figures of great European Powers, advancing nearer and nearer and sometimes finding in these conditions temptations to action that is not in strict accordance with the interests which we are bound to defend.»

But after all English foreign policy in India is largely a matter of finance, for it must be based on the contentment of the people. It can be asserted with deliberation that the system of taxation in India is fair and considerate, but there are millions who live on a very slender margin. In normal years when the rains are favorable there is rude plenty in the land; but when the rain fails, and when, later, famine is declared, the numbers who flock to the famine camps are proof that among the poorer classes there is little or no reserve. It is, therefore, incumbent on the Viceroy — whose duty is to keep India safe and contented — to ensure peace on his long land frontier of 5,700 miles. He can engage in no policy of adventure and he cannot lightly undertake even a small expedition, for he never knows whether a local disturbance may not set the frontier in a blaze for hundreds of miles. He has to consider the revenues and the economic requirements of India, the policing of the Provinces, and the obligatory garrisons, and he knows that if his calculations are correct that he has only a certain amount of force for the extended defence of the Indian Empire. Those fierce critics of Government — the editors of the native press — who write at the safe harbors where shots have not been fired for generations, maintain that the military forces of India are excessive, and they point with some justice to the fact that during the war in South Africa and the operations in China the garrison of India was seriously depleted. It was a risk, but no Viceroy can hesitate when the British Empire calls, and the splendid conduct of the people and Princes of India justified the confidence reposed in them. But the army, judged by whatever standard,—by the size of the continent, by the population, or by the trade and wealth of India,— is none too large, and if operations of magnitude ever take place on the Northwestern frontier, the forces which can be spared from the obligatory garrisons will merely be able to hold on for a limited period until reinforcements arrive from over sea. The Army of India is composed of British and native troops. Experience demands that the proportion shall be one British soldier to two Indian sepoys, and that the artillery shall be entirely British. The British soldier in India is expensive, the Indian sepoy cheap, perhaps the cheapest and for his pay the best and most efficient soldier in the world. Life in the army has hitherto appealed to the manly tribes. It was an honorable career, it was possible to save, and there is a pension at the end of the service. But the general rise in wages throughout India, the comparatively speaking lucrative employment which is offered in various directions, and the certain chances presented by agriculture in the canal colonies have somewhat changed the prospects of service in the Army. Simultaneously the great efforts which have been made of late to obtain a high standard of efficiency have diminished the amenities of the sepoy's existence, and it is possible that the difficulties of recruiting which beset the authorities in England will ere long appear in a modified form in India. At any rate, in spite of the fact that India is still, notwithstanding the changes wrought by civilization, and the *Pax Britanica*, rich in man power, the sepoy will become more expensive, and however menacing the situation on the frontiers may be, it will be difficult on India's present financial basis to increase the standing army. There are, however, other forces than those of the Regular Army in India. On the frontier Lord Curzon, chiefly from political reasons,— the policy of conciliation instead of exasperation,— has offered to the wild youth of the frontier service in Militia Regiments, while many of the greater Princes have voluntarily contributed highly trained troops for the defence of the Empire. These forces are trained by British officers, and have won high praise on service. They are known as the Imperial Service Troops, and are quite as efficient as the regiments of the Regular Army. But in spite of India's resources in man power, in spite of the loyal co-operation of the great Feudatories, the Indian Government cannot be expected, single-handed, to provide for the defence of what has been truly called the "strategical frontier" of the British Empire. India must look to Great Britain in times of supreme danger, and in the matter of foreign policy India is merely an agent of the British Government. The Viceroy and his Government are responsible as local agents for Indian territory where it marches with Turkey, Russia, China and France, for the Persian Gulf, and for relations with Afghanistan. The ideal is that the glacis of the fortress should be sterilized or neutralized, but with European powers pushing East, and with decaying and moribund Asiatic States as our neighbors, this ideal will not be realized save by armed preparation and a resolute front. Opinions differ as to the policy on the Northwestern frontier. The scientific soldier is in favor of daring measures and would occupy advanced posts in Afghanistan to check a Russian invasion, and apart from military consideration there is an obligation to defend the Amir of Kabul from attack, and there is the belief that the advance of Russia to the near neighborhood of India would injure the prestige of Government in the eyes of the Indians. Against this policy is the awkward fact that as things are at present the advance of British troops into Afghanistan would be regarded with hostility by the subjects of our ally, the Amir, and that it would be the signal for the rising of the independent tribes who hold the hills between India and Afghanistan. But above all is the question whether the Army of India is fitted, either by its size or its nature, to undertake protracted campaigns at great distances from the present frontier. It is always difficult for men who have been brought up in a school of great tradition to abandon the faith, and among the traditions which have made this splendid Indian Empire have been courage, a belief in the British mission in the East, and undaunted advance. For generations Afghanistan has been a will-o'-the-wisp, and for the purpose of keeping that miserable abode of robbers from extinction, we have spent blood and money and are still spending money with very little return. Few would like to throw up the Afghan policy, yet few are satisfied with it. The abandonment of our relations with the Amir of Kabul would mean the absorption of Afghanistan by Russia. Her railways have reached the Afghan frontiers and she can penetrate more easily than England can. But the policy of sterilizing the glacis does not end with Afghanistan, or Thibet, where the policy was recently applied. We have to consider Persia and Seistan, and later there may be a dangerous glacis to be provided for at the head of the Persian Gulf. Where is it all to end? Nature has indicated a very respectable frontier — our present frontier. No frontier is now impregnable, but with railways and ample supplies, with military works, and an army well fed and unexhausted by marches through hostile country, the existing Indian frontier would serve. While there is no question of the enormous importance of prestige in India, the advance of a European force to the frontiers of India would perhaps not weaken our prestige as much as a protracted and uncertain campaign out in the treacherous mountains of Afghanistan.

Bibliography.—Of the two important sections of the Indian frontier we hear less of the

Burman borders than we do of the Northwestern frontier. India marches with China (Yunnan) on the Northeast, with Siam on the Southeast. For about 100 miles between the point where the Anglo-China boundary ends, and the Anglo-Siamese boundary begins, the British border along the Mekong river touches French Indo-China. The Government of India has relations with the local authorities of these three Governments.

The boundary with China was settled by the conventions of 1894 and 1897 from the Mekong river in the South to latitude 25-40° n., and the greater part has since been demarcated. The Mekong boundary with French Indo-China was settled by the Anglo-French convention of 1896. North of latitude 25-40° we have always claimed that the basins of the Irrawaddy belongs to Burma and that the boundary with China up to the confines of Thibet should be the watershed between the Irrawaddy and the Salween. And this northern part of Burma from the watershed to the borders of Assam is inhabited by wild Kachin tribes, British relations with whom, outside of administrative territory, is managed by the Indian Government through the local government. So also with the semi-independent tribes—Chins and Lushais, who inhabit the hilly tracks between Burma and Assam, and Chittagong. Among works which contain information regarding the frontiers of Burma may be mentioned: John Nisbet, 'Burma Under British Rule and Before'; Shway Yoe (Sir G. Scott), 'Burma as It Was, as It Is, and as It Will Be,' and 'The Burman, His Life and Notions'; Sir Arthur Phayre, 'History of Burma'; A. R. Colquhun, 'Among the Shans'; E. G. Harmer, 'The Story of Burma' ('Stories of the Empire Series').

The literature on the Northwestern frontier of India is large and increasing. The following books may be consulted: R. I. Bruce, 'The Forward Policy and Its Results'; Valentine Chirol, 'The Middle Eastern Question'; Lord Curzon, 'Russia in Central Asia,' 'Persia and the Persian Question,' 'The Pamirs and the Sources of the Oxus'; Wm. K. Daly, 'Eight Years Among the Afghans'; Sir Herbert Edwardes, 'A Year on the Punjab Frontier'; Dr. Gray, 'My Residence at the Court of the Amir'; Colonel Sir T. Holdich, 'The Indian Border-land'; A. H. Keane, 'Asia'; H. Lansdell, 'Russia in Central Asia'; O. Olafsen, 'Through the Unknown Pamirs'; Sir Henry Rawlinson, 'England and Russia in the East'; F. M. Lord Roberts, 'Forty-One Years in India'; Earl of Ronaldshay, 'Sport and Politics Under an Eastern Sky,' and 'On the Outskirts of Empire in Asia'; M. M. Shoemaker, 'The Heart of the Orient'; F. H. Skrine and E. D. Ross, 'The Heart of Asia'; Sultan Mahomed Khan, 'Laws and Constitution of Afghanistan,' and 'The Life of Abdul Rahman, Amir of Afghanistan'; A. C. Yate, 'England and Russia Face to Face'; C. E. Yate, 'Kurasan and Seistan,' and 'Northern Afghanistan.'

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40. Great Britain — The Free Trade Movement. *Introduction.*— I desire to put shortly before the American people why the British are Free Traders, and why they hold it vital to their interests to maintain Free Trade. Before considering their reasons for favoring such a policy, it is necessary to ask what an Englishman means by Free Trade. He does not, of course, mean that the government ought never to take any toll from traders or lay any taxation whatever upon imported goods. In a modern state it would be absolutely impossible to support any such contention. The enormous revenues which have to be raised to carry on the work of government make indirect taxation an absolute necessity. The principle upon which the British Free Trader insists is that any tariff imposed upon goods entering his country shall be imposed for revenue purposes only. That he holds is the sole object which the Government must entertain in levying its customs. But it follows from this that duties ought not to be levied at the ports on goods produced abroad which are also produced in England. To levy such duties encourages the consumer to buy the home and untaxed goods rather than the foreign and taxed goods, and so diminishes the yield of the tax. Needless to say, this principle is not adopted out of any hostility to home-made products, or from any desire to favor the foreigner. If he thought he could do so without injury to himself, without loss of revenue or without diminishing trade generally, the Englishman would of course prefer that the goods made by his fellow citizens should sell better than those made by foreigners. One of his objections to protective duties (that is, to import duties on articles which are also made at home) is that such duties are not good "drawing" taxes. Unless the State levies excise duties equal in amount to the customs duties, and such excise duties can only be levied profitably in a few instances, the home manufactured goods which escape taxation are, speaking in a strictly fiscal sense, defrauding the revenue. In other words, what ought to go into the public purse is going into the pockets of the protected manufacturers. The more efficiently a tax protects, the worse tax it is for the purpose of filling the treasury — the true purpose of all taxation. It is then, in the opinion of English Free Traders, neither wise nor in the true interests of the State to interfere with the course of trade on any other ground than that of producing revenue.

The Economic Argument.— It must next be explained that the Englishman objects to interference with the course of trade, not out of any pedantic feeling in regard to the abstract "rights" of the trading part of the community, but because he believes that such interference must involve economic waste and so cause material loss to the nation. He believes that to forbid or interfere with exchanges between man and man always results in a diminution of national wealth. The Englishman adopts, and has adopted during the past 50 years and more, the principle that all exchanges are and must be a *mutual* benefit. They are transactions which are twice blest. They bless him that buys as well as him that sells, and benefit the man who exchanges gold for corn as much as the man who gives corn for gold. Hence it has become an essential, nay, an almost instinctive, belief on the part of the great majority of Englishmen that it is to their interest to stimulate and encourage exchanges in every possible way. They hold that to reduce the volume of exchanges must necessarily cause waste. But Government interference with trade by means of customs duties is bound to reduce the number of exchanges. Therefore they will only allow that interference in obedience to the imperative needs of the treasury. They realize that foreign exchanges benefit the individuals of a nation, and so the nation, quite as much as home exchanges, and feel that as long as exchanges are being made freely and are increasing, that there can be nothing wrong, at any rate in the commercial condition of a nation. Only allow free commercial intercourse, free buying and free selling and free access to the ports of a country, and its trade, and so its prosperity, will take care of itself. To allow the maximum of exchanges is to increase the wealth of a nation. To prevent or lessen exchanges is to waste its wealth.

The "Bleeding to Death" Hypothesis.— Further, English Free Traders hold that there is no necessity to be anxious as to whether the imports into a country are greater in value than the exports out of it. They hold that the relations between the imports and exports must necessarily adjust and equalize themselves. Human nature, they contend, has passed an ordinance to the effect that "he that will not buy, neither shall he sell." Thus, instead of fearing that imports, even of goods which can be made in England, will reduce the amount of labor, and so injure home trade, they regard all imports into Britain as orders for British goods to be produced and paid in exchange for those imports. Imports are physical orders for goods, and so for the labor that is employed to make the goods. And they have this advantage: the payment arrives with the order.

At one time the British public, it must be admitted, was not so confident as it is now in regard to the propositions just set forth. The opponents of Free Trade declared that Englishmen were living in a fool's paradise when they supposed that trade could look after itself, and that imports and exports must really be balancing though the statistics *seemed* to show that many millions' worth more goods came into England every year than went out of it. Nobody, they argued, will give something for nothing, and therefore if your imports exceed your exports by, say, a hundred millions a year, you must be paying the difference in some way or other. "There is only one way in which you can be paying it," ran the argument, "and that is by sending away the capital accumulated in years of better trade. In fact you are living on your capital and bleeding to death. Because you have been very rich in the past, the process may take a long time to work out, but some day you will find that you have no more blood left in your veins, and that you have reached the point of economic extinction." That line of argument was first used in the "Fair Trade" agitation in the years 1882–1885, and was revived some three years ago. The simplest answer is found in the fact that if exchanges do not balance and if the British people have been in truth living on their capital and bleeding to death, they ought by now to be a trebly ruined nation. In the course of the last 25 years imports have *apparently* been so much in excess of exports that the loss in that period must have been nearly £2,000,000,000 of capital. But it is notorious that we have suffered no such loss. Though statistics as regards the accumulation of capital, both in home and foreign investments, are by no means complete or satisfactory, it is manifest that instead of bleeding to death the nation has become more, not less, full blooded from the capitalist point of view and that the total capital, instead of diminishing, has vastly increased in the course of the last quarter of a century. Instead of having £2,000,000,000 less capital, we have many hundreds of millions more and are a very much richer people. In other words, experience has shown that the bleeding to death theory will not bear examination, and that whether on other grounds or not protection may be a good thing, free trade is certainly not driving Britain to bankruptcy or reducing her capital resources. In fact, regarded as a means for increasing and maintaining the material wealth of the nation, Free Trade must be admitted to hold the field.

The Imperial Argument.— Though there is no doubt a great deal of difference of opinion in regard to the best way in which to maintain and develop the British Empire, the nation is virtually unanimous on one point. It is for the benefit — moral, political and economic — of the peoples who compose it that the British Empire shall be maintained. It is asserted on the Protectionist side, however, that the Empire cannot be maintained under a Free Trade system, and that unless that system is changed the Empire will fall. That argument has hitherto not made any impression upon the masses of the British people. Instead of accepting the formula "No Preference, no Empire" they are much more inclined to accept the opposite dictum, "No Free Trade, no Empire" and to hold the opinion that the Empire as it exists to-day is the gift of Free Trade. Up to 60 years ago there was a system of preferential trade within the Empire almost exactly like that which it is now proposed to re-establish. On the one hand the British Colonies were required to give a preference to British manufactured goods and to supply their needs in the British market, and on the other, the British people gave a very large advantage to the products of the various parts of the British Empire in their markets. Yet, strange as it may seem, the result of these attempts to interfere with exchanges on political grounds did not produce a sense of loyalty in the inhabitants of the Colonies or of good feeling toward the scattered parts of the Empire in the United Kingdom. The epoch of Colonial preference was the epoch in which there grew up in England a school of thought and a political party which believed that the connection between the outlying parts of the Empire and the United Kingdom was injurious to both and that it would be to her advantage if Britain got rid of her Colonies and dependencies as rapidly as possible. Even so imperialistic a statesman as Lord Beaconsfield was affected by these views in middle life. He actually described the Colonies as "millstones round our neck" and looked forward to the time when they would all be independent. The abolition of Colonial preference and the adoption of the principle of "tariff for revenue only" may be said to have been accomplished by the end of the first half of the 19th century. It was after 1850 and so in the Free Trade epoch that the strong sentiment in regard to the Empire now existing, both in the Colonies and at home grew up. No one now looks forward, as men constantly looked forward during the preferential epoch, to the time when the Colonies would one by one leave the Empire. This being so, many of the most far-seeing and the most steadfast Imperialists in England regard Free Trade as essential to the maintenance of the Empire.

A further argument for Free Trade as an essential condition of empire is to be found in the fact that from the strategic and military point of view the Empire rests upon sea power, and that sea power in the true sense cannot be possessed by a nation which does not also possess supremacy or something approaching supremacy in the matter of its mercantile marine. A great national navy depends upon a great commercial navy. But a commercial navy cannot exist without Free Trade. It is the nations which encourage all who have anything to sell to come freely to their ports and sell it there without let or hindrance, which most easily develop a large mercantile marine. Britain stands first in the world of shipping, not because she has better resources for shipbuilding, and not because her population is by nature more inclined to sea-faring than others, but because she is a Free Trade nation. Englishmen feel that if they are to keep their empire they must remain a great shipping power, and to be a great shipping power they must maintain Free Trade.

Monopoly and Corruption.— There are two other factors which operate to make Englishmen maintain their present fiscal system. The first is the dread of monopoly which is to be found in the British democracy. They are intensely suspicious of anything in the nature of Trusts or Combines, or of allowing any body of commercial men to be in a position in which they can say "You must either buy the goods we make, or accept the services which we offer, or go without." Dreading intensely the creation of monopolies, they cling to Free Trade, for they realize that it is almost impossible to establish a complete monopoly under their present system. As long as the doors are open, and the traders of every nation in the world are allowed to send what they will to Britain and dispose of it there freely, the task of creating a monopoly in any of the essential needs of mankind is almost impossible of accomplishment. Another reason which weighs not less strongly with the British nation is the dread of political corruption. Rightly or wrongly they believe that there is always a danger under Protection of corruption entering political life. If vast fortunes can be made by the addition of a word or two to the schedule of a tariff bill, they argue that people will take too fierce an interest in politics and that the desire to get those words inserted or to keep them there after insertion will deflect men's minds from what should be their true concern in dealing with public affairs,— the good of the nation as a whole. Politics, in a word, under Protection, become too personal. The British people do not want any man to find himself in the position of saying "I can't listen to what you say about the interests of the people. All I know is that if the words in the tariff Act which protect the industry in which I work, or in which my money is invested, do not remain in that Act, my wife and children may come to starvation. Therefore I mean to work with anybody or any party which will give me the assurance that my livelihood shall not be placed in danger. I am a man and the father of a family first of all." It must not be inferred that the British people consider that a proper regard for national interests can never be found in protectionist states. The history of America shows that in spite of the dangers to which I have alluded, plenty of unselfish patriotism is to be found in countries where protection prevails. The fact, however, remains that the British people do dread very greatly the introduction of protectionist conditions into their political life. Further, they dread the direct corruption of the Legislature by the great commercial interests. They may trust their Members of Parliament in the abstract but they do not wish to see them exposed to the temptations which unquestionably exist when enormous pecuniary interests depend upon the maintenance of a Protectionist tariff. If once a Legislature becomes corrupt, the chief safeguards of liberty are destroyed. Hence, the British democracy feel that with the maintenance of Free Trade is bound up a great deal of what they value most in the political system under which they live. See GREAT BRITAIN — THE BRITISH TARIFF MOVEMENT.

General Conclusions.— To sum up, the British people have established the policy of Free Trade and wish to maintain it on the following grounds: (1) They believe that the abandonment of Free Trade would cause economic waste and so tend to national impoverishment. (2) They believe that Free Trade secures the Empire of which they are so proud, and also gives them that naval strength upon which in the last resort that Empire rests. (3) They believe that Free Trade prevents the growth and spread of political corruption,— the chief danger of modern democracies.

Bibliography.— The main outlines of the early free trade movement can be found in general histories, such as 'The growth of English Industry and Commerce,' vol. II, by W. Cunningham; 'History of British Commerce,' by Leon Levi. But the real relation of the movement to English life and progress is best seen in the speeches of the politicians mainly responsible for the carrying out of ideas into practice. There is ample material of this kind in the 'Speeches' of W. Huskisson (1831); of Sir Robert Peel (1853); in the 'Free Trade Speeches' of Charles Villiers (1883); in the 'Life and Speeches of John Bright,' by G. B. Smith (1881); and in the 'Life of Richard Cobden,' by J. Morley (1881); the 'History of the Anti-Corn-Law League,' by H. Prentice (1853), and the 'History of the Free Trade Movement in England,' by A. Mongredien, also contain much information as to the earlier period.

The revival of interest in the question in the early eighties, the controversy as to the results of English policy and the influence of the example of foreign countries, are illustrated in 'Free Trade and Protection,' by H. Fawcett (1878); and 'Free Trade v. Fair Trade,' by Sir T. Farrer (1885); 'The Free Trade Movement and its Results,' by G. Armitage-Smith (1903); 'Elements of the Fiscal Problem,' by L. G. Chiozza Morey (1903); 'The Tariff Problem,' by W. J. Ashley (1903); 'The Rise and Decline of the Free Trade Movement,' by W. Cunningham (1903); 'The Return to Protection,' by W. Smart (1903); represent from various points of view, the reviewed controversy of the present day. An interesting general view by a disinterested observer is given in C. J. Fachs' 'The Trade Policy of Great Britain and her Colonies,' translated by H. M. Archibald (1905).

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41. Great Britain — The British Tariff Movement: Its Origin, Theory and Prospects. "For more penetrating observers," writes Dr. Schulze-Galvernitz in the latest and ablest study of the British economic situation, "the overwhelming success of the Liberals in the elections of January 1906, was less surprising than the number of votes given against Free Trade." This is the verdict of the searching and candid writer whose prepossessions are all in favor of Free Trade. The remark shows a genuine anatomical knowledge of British politics and may be commended to Americans who wish to penetrate surface impressions on this subject and desire to grasp the underlying facts. My purpose, so far as the brief space permits, is to state the facts, to explain their causes, and to indicate what seems to be their tendency.

The main fact is that England has ceased to be a solidly Free Trade nation, though possessing at the present moment a Free Trade majority of an insecure character. The state of Parliamentary representation does not truly reflect the balance of national opinion. In England and in the United States a small majority of the nation may secure a disproportionate power in the Legislature. Any party which could obtain a one per cent plurality everywhere would obtain an absolute monopoly of representation, although it had secured only a little more than half the votes. Thus, as a result of the recent General Election, the Unionists, or Fiscal Reformers, were reduced in the House of Commons to an unprecedented minority. In Great Britain they secured less than a quarter of the seats; but the important point is that they obtained nearly 44 per cent of the National vote. The balance of opinion disclosed at the polls may be shown in round numbers as follows:

BRITISH NATIONAL VOTING JANUARY, 1906.

		Per cent.
For Liberals (Free Traders)	2,600,000, or	48.2
For Unionists (Fiscal Reformers)	2,350,000, or	43.5
For Labor Party (Independents)	450,000, or	8.3
	5,400,000	

(1) The Labor party is chiefly a Socialist party, though for reasons of policy it declines that title. It is independent in its parliamentary position and independent in its economic opinions. Its support of Free Trade is tactical, perhaps temporary. It assures the masses that Free Trade alone is a failure; that the tariff alone is no remedy; that both are unimportant by comparison with the policy of Socialism; that either may be used to promote Socialist purposes. The truth is, that in a period of trade depression the tariff movement would try to capture the Labor party while the Labor party would try to capture the tariff movement. In any case independent labor is not a fixed Free Trade force; and this being so, a glance at the figures just given will show that Great Britain no longer possesses anything like a fixed Free Trade majority.

(2) The aggregate Liberal vote was less than 50 per cent of the whole, though the pendulum was swinging with very exceptional violence against the late Government for reasons largely unconnected with the Free Trade issue.

(3) The Unionist, or fiscal reform party, secured at the first trial of strength, within less than three years from the beginning of Mr. Chamberlain's tariff campaign, the support of more than two-fifths of the nation. This is the surprising fact, as Professor Schulze-Galvernitz perceives. Seventy years after Adam Smith's 'Wealth of Nations' had appeared; nearly a quarter of a century after Huskinson had commenced to reduce the obsolete tariffs raised to an exorbitant height by the desperate revenue necessities of the Napoleonic wars; seven years after Cobden had started his violent and masterly agitation against the corn duties, the country was still unconverted to the Free Trade principle. It was suddenly moved to throw open its ports by the Irish famine and the crop failure of a disastrous season. "It was the rain," as Mr. John Morley remarks, "that rained away the Corn Laws in 1846."

By these comparisons the rapidity and extent of the progress made by the new movement in Great Britain are to be measured. We have a strong Free Trade party which is at present in power. We have ceased to be a Free Trade nation. That policy formerly depended upon unanimous national support. It now depends upon the odd man. Holding the casting vote under the party system, the odd man is no doubt omnipotent while he remains of the same mind. But he determines the rise and fall of Governments by changing his mind.

The predominant fact, then, of present English politics is the rise of the tariff movement. The history of this fact may be briefly sketched. Its origins were slow and subconscious. Mr. Cobden had always dwelt upon the advantage of an unfettered exchange of cotton for corn. England would manufacture the cotton and other things; America and other countries would grow the corn; there would be an ideal division of labor from the British point of view. Mr. Cobden promised that if England abolished her tariffs there would not be a country in the world within five years but would have followed her example. Sixty years have elapsed; no country has followed her example. A steady rise of national tariffs, as elaborate and powerful as the fortifications of Vauban, has dominated the intervening period. The Far East is about to repeat the example of the United States and the European Continent. Great Britain is only one open island amid the closing markets of the world. Free Trade, therefore,— exchange equally unrestricted on one side and the other as between two nations transacting — has never yet prevailed anywhere. It is an unknown condition. Even England has not had it. She has instead the system of free imports by which foreign competition is admitted without interference to her market, while her own competition is as far as possible suppressed in foreign markets. That is not a satisfactory comparison.

Foreign protective tariffs are a disadvantage to British trade. British free imports are relatively an advantage to foreign trade. The conditions are unequal. Unequal conditions in commerce are not good. Free Trade writers cannot be induced to examine the practical effect of the inequality — pivot-point nevertheless of the British economic controversy. They simply restate, without modification of any kind, the traditional arguments which would apply to a genuine international system of free exchange, but cannot apply in the same measure — and, to a large extent, do not apply at all — to the state of things prevailing in the total absence of that system.

For a prolonged period (1846–1875), British trade expanded with unexampled energy. Agriculture flourished. The economic conditions of the world were transformed by the Californian and Australian gold discoveries; by railway construction in the United States and upon the European Continent; by steam shipping. But America and Europe alike were convulsed by great wars. Their state systems were refunded. Their tariffs were readjusted in the spirit of Alexander Hamilton rather than of Adam Smith. They were equipped with railways and prepared for manufacture. England had remained at peace and her workshops dominated all markets. But her memorable period of uncontested supremacy was over.

In 1878 — exactly a generation after Mr. Cobden's triumph — a period of commercial depression reached its depth. Crowds of industrial workers were unemployed in the cities. The old prosperity of British agriculture was broken and the rural population began rapidly to diminish. From that moment through another quarter of a century of trade fluctuations, the truth of the free import theory was questioned by an increasing number of English thinkers. Popular distrust, however, preceded scientific opposition. The "National Fair Trade League" was started in July 1881, and carried on for more than a decade a formidable political agitation, stimulated by some able controversial literature and a vigorous weekly paper. This protectionist movement, however, failed to find a great leader and died out in the early nineties. Its only chance of success lay in converting one of the great political parties. The Conservative rank and file were generally predisposed to protection. The Conservative leaders patronized the Fair Trade movement while the Liberals were in power, and stifled it when they had obtained office themselves. Nevertheless, other influences continued almost imperceptibly to dissolve Free Trade conviction throughout the country. The British 'Trade Consular Reports' became a serial narrative of the advance of protectionist competition, American and German, in markets where British manufactured exports had recently been supreme. The immense progress of the United States and the new German empire showed at last that free imports, or half-free trade, was not a certain recipe, assuredly not the sole recipe, for commercial success, and that protection was not necessarily a prevention of progress. There was a general mood of profound anxiety as to the position and prospects of British commerce, and a widespread scepticism as to the theoretical truth of Free Trade and the practical advantage of free imports.

All the previous scepticism and mistrust which had existed upon the question of Free Trade were crystallized in 1903 when Mr. Chamberlain created the new fiscal reform movement. His Birmingham speech on May 15 in that year was one of the dominating events of English politics. In the limits of this article it is impossible to trace the history of his agitation. The result has been noticed. There has been a small schism of very distinguished persons. There is some difference between Mr. Chamberlain and Mr. Balfour as to the sort of commercial system to be substituted for the existing one. But the Unionist (or "Conservative" or "Imperialist") party is committed to some form of tariff policy. The Liberal - Irish Nationalist - Independent Labor Coalition which conquered at the last General Election is not morally solid against the tariff. The present writer believes that Mr. Chamberlain's policy is the policy of the future. England, let us repeat the fact, has ceased as a whole to be a Free Trade nation though still containing a great free trade party whose parliamentary predominance rests upon a comparatively slight majority of popular votes.

We now pass from the history to the theory of the movement. Free Traders say: (a) *that tariffs restrict trade.* The reply is that exports and imports alike are increasing in every considerable protectionist country. Germany's break with the Cobdenite system in 1879 — America's adoption of what Englishmen call McKinleyism — have been followed not by commercial restriction, but by a greater expansion of production, foreign exchanges, employment, population, and wealth than has taken place in Great Britain during the parallel period. No Free Trade writers grapple with the fact — few ever notice the fact — that the fundamental principle of a scientific tariff is the free importation of raw material, side by side with the taxation of foreign competitive manufacture. The tariff idea aims at restricting the least advantageous kind of imports in order to develop the most profitable kind. So far from implying restricted trade, it means, when competently adjusted, the largest volume of the best exchanges.

(b) *That imports must be balanced by exports — that goods received must be paid for by goods returned — and that as all inter-*

national exchange will arrange itself in an ideal manner, if you let it alone, the State ought not to interfere with it. The reply to these statements is that they are to a large extent altogether inaccurate, and for the rest are superficial half-truths of a singularly deceptive character. Imports may or may not be completely paid for by exports (including shipping freights and foreign investments). The account may be cancelled by the transfer of securities. An excess of imports may remain as invested capital, the interest only being returned, and the complete "balancing" being indefinitely deferred. England, for instance, formerly sent a steady excess of imports into the United States. The excess remained for the most part as British capital invested in America. America ceasing to be a debtor nation has cancelled a good deal of that British capital by the excess of her own exports in recent years. Thus while imports and exports may appear to balance more or less all the time, according to the conventional Free Trade theory, a movement may be gradually going on under the surface which actually reverses the position of the two countries concerned; and transfers the commanding advantage of economic relations from one country to another. Again, no Free Trader asserts that like is paid for by like — that the import of foreign *manufacture* produces an equivalent export of home *manufacture.* A country which formerly exported raw produce in exchange for finished manufacture may rise in the social scale and export in its turn finished goods to pay for crude material. So far as the maxim tells upon the practical controversy, it tells both ways. Imports and exports do not balance better under free imports than under the tariff. America pays for her imports with her exports and has a probable margin to spare! America entrenches her own trade in its position and makes it as difficult as possible for foreign competition to displace it. The English system makes it as easy as possible for foreign manufacture to displace home industry. Under Free Trade the products of certain industries may pay for the competitive imports which are steadily weakening other industries. To sum up, the tendency of isolated free imports is to undermine the national defensive position in trade after trade. America and Germany under the tariff are making new conquests in trade after trade. "Where organization becomes necessary," said Brunel, "*laissez faire* becomes impossible."

The British tariff movement, however, lays more stress upon its constructive principles than upon its replies to the sophistry of Cobdenite syllogisms. It is maintained that the tariff under British conditions would mean the maximum increase and the best distribution of wealth. An isolated free import system implies the narrowest and least secure market. A competitive import only enters by displacing the home supply against which it had competed. There is a gain to some home consumers but a loss to some producers. The nominally counterbalancing export follows at the second remove, though meanwhile a net injury to the productive power of the importing country may have been inflicted. Home capital may have been sterilized; home labor displaced. How different under the American or German national systems. There, imports are mainly non-competitive; they must either stimulate home production or supplement it. The possibility of loss at this first stage is reduced to a minimum: the return export follows in the ordinary course, and benefit accrues at each stage of the transaction. The percentage of unemployed persons (skilled artisans and laborers) is considerably greater in England than in the United States or Germany. For in the former case the Cobdenite system facilitates slow but steady displacement of home labor and arrests the development of all trades against which foreign finished goods compete. Again, under the present conditions free imports actually restrict British industry to the smallest market and secure foreign competition in the possession of the largest market. America has free sale within her own market and ours, among 125,000,000 of people; Germany has free sale in her own territory and equally in the United Kingdom — a similar double-market of over 100,000,000 of people. England has no free sale for her goods outside her own home market of 40,000,000 of inhabitants, and does not reserve any advantage to herself even upon her own soil. The conditions are not equal; the inequality means a steady discount upon British national prosperity.

The argument may be reviewed succinctly. For the island and the empire fiscal *laissez faire* is now a principle of *minimum* development. We must seek in another policy the principle of *maximum* development. The principle of maximum development in economics demands the maximum efficiency of capital. In every country which admits the raw material of industry free, but discriminates against foreign finished goods, the activity of capital is more decisively encouraged than under Cobdenite conditions, where the British manufacturer is excluded by foreign tariffs abroad, and attacked at his own home base by protected competition. Cobdenism gives away the whole case when it declares that capital under the tariff is stimulated. We are told, it is true, that the stimulus is secured by pillaging the consumer. That is rather demagogically stated than commercially reasoned. For if capital is stimulated at all, its operations must be extended; its efforts in developing the productive capacity of a country must be more powerful; it must create the maximum amount of employment; it must tend to raise wages by the most certain of all methods — that of increasing the demand for labor; and it is not possible, if the chain of reasoning be sound, that the consumer can lose in the long run by the policy of maximum development.

Finally, there is a moral question rather unpleasantly introduced in a manner which can only be called a little insular. It is said that the tariff would introduce corruption. I do not believe it. In economic controversy it is especially desirable to "clear our minds of cant." In spite of free imports, gross frauds are perpetrated in English finance and a considerable amount of petty dishonesty prevails in business. Human nature is tinctured in the ordinary way, and to revive the old pose of superior virtue is a proceeding which appears to be a little deficient in humor. Corruption in America, if I judge aright, is due to the concentrated passion of the money-hunt, to the vehemence of the desire to succeed, and the sheer difficulty of bringing public opinion steadily to bear upon any one aspect of this evil amid a heterogeneous society in a state of violent material development. Corruption rages in every phase of expansion and exploitation. It will be eliminated as the conditions of American society become more settled. Where it prevails it is apt to taint everything. It will taint the tariff if it touches the tariff; but nothing could be more unhistorical or less imaginative than to represent whatever commercial and political corruption there is in America as due to the national economic policy founded under Alexander Hamilton and restored under Lincoln. For the rest the American habit of making public confession under a sounding board creates an exaggerated impression in Europe where the admitted evil is popularly believed to be far worse than it is. Shipping and revenue will be more properly dealt with in another section. The aim here has been to show that the tariff movement in England depends upon a theory of development, not of restriction; that the political prospects of that movement are good; and that the real strength of the foundation of the free-import system, national unanimity in support of it, has irrevocably disappeared.

See Great Britain — Free Trade; Protection.

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42. **Great Britain — Reaction of British Imperialism Upon the Mother Country.** The maintenance of the British Empire is not merely the great problem of the King's dominions as a whole. It is the vital problem of British domestic politics. We shall proceed to regard it under this latter aspect. What the shores of the Baltic were after the fall of Rome, the United Kingdom has been in the last few centuries — a nursery of nations. The area under the flag is about 12,000,000 square miles, or not much less than a quarter of the earth's land surface. Two-thirds of this area consists of territory more or less suitable for white settlement and more or less occupied by white races. These are the "Colonies." The other third includes India, always to be regarded as a world within a world, and the undeveloped tropical possessions. These are the "dependencies." The dependencies present a strict *Imperial* problem. The colonies, on the other hand, present a *Federal* problem. That distinction should be clearly grasped and borne always in mind. These two very different sets of facts have exerted a double and parallel reaction upon insular conditions, mental, moral and material. Great Britain cannot continue to exist as a great power unless she can induce the colonies to enter with her into a political or a commercial partnership; or into a Defence Union and a Customs Union combined, such as the thirteen colonies formed when they adopted the American constitution and became the United States. It is improbable, however, that the British dominion can be consolidated and preserved unless the mother country resorts to an extensive reorganization of her traditional arrangements.

The growth of what is called the Imperial idea in British politics may be rapidly sketched. After the American War of Independence the credit of the old Colonial theories was destroyed in Europe. "Colonies are fruits that cling till they ripen," said Turgot. That a country should facilitate the emigration of vigorous citizens, extend its responsibilities and increase its burthens, in order to create new States certain (as it was thought) to separate when they were strong enough, seemed a proposition of which the folly had been demonstrated once for all at Yorktown. This feeling was naturally most intense in England and continued well nigh unchanged for nearly three generations. By the complete conquest of India trade was increased; national imagination was stimulated; the adventurous and administrative vigor of the race was kept in play. But India remained remote and alien. The English people had no ideal sense of connection with it, although the conviction that mercantile supremacy depended upon the possession of it was widely spread.

The victorious sequel of the struggle against Napoleon was a triumph of the national power contained within the four seas of the British islands. In spite of the loss of the thirteen colonies, England seemed stronger than ever, and toward the close of that era had occurred the war of 1812. After Waterloo, Englishmen with leisure to reflect upon the tremendous vicissitudes of events in the previous half century, felt not unnaturally that colonial enterprise meant a loss of national force and created new perils. This mood deepened throughout the years of the Great Peace. It was now clearly expressed by the father of the free-import system — Mr. Cobden. To him the separation of America seemed not only a necessary political experiment in itself, but a precedent which not only would be, but ought to be repeated in the future. Trade with the United States had much increased and there was no longer any obligation to defend them. That seemed to be an ideal result. Canada, Australia and South Africa were vast wildernesses, supporting little commerce at that time but aggravating military charges. There was a preference under the old protectionist tariffs for West Indian sugar and Canadian corn and timber. The higher duties upon the corresponding foreign products were represented as having been imposed in order to favor the colonies (though it may be doubted whether any duties would have been lower had the colonies not existed) and this was represented as another artificial burden laid upon the consumer. Cobden thought the colonies were useless and dangerous possessions. He thought India was an immoral possession, and that matters would never be well with England until she stripped herself of all these appendages and returned to a strict national basis. His belief is summed up in the well known letter of 1842:

"The colonial system with all its dazzling appeals to the passions of the people could never be got rid of except by the indirect process of Free Trade which will gradually and imperceptibly loosen the bonds which unite the colonies to us."

As to the whole spirit of British history:

"Unlike every other people, we have during seven centuries been fighting everywhere except upon our own soil. Need another word be said to prove us the most aggressive race under the sun?"

In India the position was iniquitous and the prospect hopeless:

"There is no future but trouble and loss and disappointment and I fear crime in India; and they are doing this country the greatest service who tell them the honest truth according to their convictions and prepare them for abandoning at some future time the thankless and impossible task."

Upon the project of Canadian Confederation Mr. Cobden expressed his views with his accustomed plainness and vigor:

"In my opinion it is for the interest of both that we shall as speedily as possible sever the political thread by which we have been connected. I have felt an interest in this Confederation scheme because I thought it was a step in the direction of an amicable separation."

Cobden's opinions were shared in essence even by the majority of the cultivated and aristocratic classes who disliked his unvarnished language. The extracts given illustrate the mood which prevailed almost universally until late in the sixties of the 19th century.

Then the tide began to turn. The reaction was deeply connected with the events of contemporary history and the change in the spirit of international politics. Since the American and French revolutions the ideas of liberty and independence had dominated and inspired men's minds. Henceforth, the idea of *unity* was to direct politics and to penetrate into the sphere of commerce. Italy reconquered her unity after the disintegration and enslavement of centuries. American unity was vindicated in the mighty grapple of the Civil War. The imperial unity of the German race was magnificently restored. Under the British flag the Canadian Confederation, like the Australian Commonwealth later, had been born in peace. Steam had diminished all distances and the unity of the British dominions had become for the first time a physical possibility, bound to become more and more feasible as the rapidity of modern communication developed. But above all, Lincoln's and Bismark's victories (with intent we name statesmen rather than soldiers) had caused people in Great Britain to reflect that the American power and the German power of the future would dwarf Great Britain in the end, politically and commercially, unless the zone of a Britannic Federation could be made to span the world. Australia after the gold discoveries promised to fill up more rapidly than it has done. Russia was now drawing nearer to the Indian frontier; England began to realize that the result of bleeding to death at the extremities might be the same as a thrust in the heart. Imaginations awakened under the apprehension of future necessity. Queen Victoria was proclaimed Empress of India by the policy of Lord Beaconsfield, who knew that democracy only understands the simple and grandiose forms of symbolism. The Prince of Wales (now King Edward) visited India, and his tour, followed with intense interest at home, became a popular education. Next South Africa was the scene of fierce and exciting little wars. Professor Seeley's brilliant little study 'The Expansion of England' had, it is not too much to say, a greater influence upon British political thought than any other book of the same size published in the last two generations. Lord Cromer's masterly administration of Egypt followed and was rightly regarded as a great moral vindication of the history and genius of Imperial Britain. Cobden's view of the ethical aspects of Imperialism was replaced by the opinion best expressed in the late Professor Pearson's 'National Life and Character,' "In India for one war that we have waged we have prevented twenty." Mr. Gladstone's Home Rule policy was regarded as a policy of disruption. Hence his defeat. The Conservative-Liberal coalition which overthrew him and formed the Unionist party emphasized the idea of National and Imperial unity through the 20 years of its almost unbroken rule (1886–1892 and 1895–1906).

All these influences were gathered to a focus in the Jubilees of 1887 and 1897 — memorable celebrations of the fiftieth and sixtieth years of Queen Victoria's reign. Mr. Chamberlain as Colonial Secretary was the strongest and most conspicuous personality in the Ministry. Then came the crucial test of the recent South African War. It was felt that the fate of South Africa and the ultimate existence of the Empire depended upon the issue. When the mother country and the colonies marched together the war was fought as a war for unity. The movement of national sentiment in favor of Imperialism appeared decisive; the ideal remained vague.

In 1903 Mr. Chamberlain resolved to attempt the first constructive steps, by proposing a closer union with the colonies upon a commercial basis. He had hoped in the first instance to create a central Imperial Council to organize Imperial defence. The colonies perceived that representation with that object would ultimately mean taxation for it. For this they were not prepared. But they offered to conclude treaties admitting British goods to their markets upon preferential terms. Canada had already made a beginning in that direction. Other colonies have followed. But the reciprocal condition necessary to a powerful extension of the system has not yet been given—a corresponding preference in the British market for colonial produce.

This would necessitate the introduction of a British tariff. The more the problem was examined the more deeply Mr. Chamberlain became convinced that it must be attacked upon the commercial side, if progress toward its solution was to be made. There we should follow the American precedent and the German precedent. "The Constitution" said Daniel

Webster, "was the child of pressing commercial necessity." And of the resolution upon which the Philadelphia Convention was called the same orator says: "Look at the resolution itself. There is not an idea in it but trade. Commerce, commerce is the beginning and end of it." The North German Zollverein preceded German political unity. It seems fairly clear in the British case that some form of Imperial Zollverein must be established before any form of Imperial Kriegsverein can be created. But Mr. Chamberlain was met, both in his own and the opposite camp, by the contention that the traditional policy of free trade forbade any attempt to enter into preferential commercial relations with the colonies. Mr. Chamberlain then decided that the traditional policy of free trade must go. But it was mainly for political reasons that he assailed the theory of Cobdenism upon the field of national production as well as in the sphere of Imperial trade. A British national tariff upon foreign manufacture would assuredly accompany a system of preferential commercial treaties with the colonies; and this would be an extraordinary result of Imperial influence working back upon insular organization.

The immediate effect of Mr. Chamberlain's agitation has been to give a wholly new direction to a great body of national thought. To repeat here words that the writer has previously used, the security of the King's dominions would be best based upon the power of a white population proportionate in number, vigor and cohesion to the vast territories which the British democracies in the mother country and the colonies control. That surest of all guarantees is obviously lacking to British power. Although we have a quarter of the world under our flag, we are much less numerous than Americans or Germans. We cannot safely believe that we are more efficient. We are not. The home populations of the three great countries chiefly concerned in the future of trade and seapower compare as follows: United States 81,000,000 of people; Germany 61,000,000; and the United Kingdom 43,000,000. So much for the present. What of the future? The Kaiser's subjects increase twice as fast as King Edward's subjects in the mother country. The white population under the American flag increases three times as fast as the white population under ours. By 1920 the United States ought to count considerably more than 100,000,000 of people. The German Empire within its present limits should count 75,000,000. The United Kingdom at the present rate of increase (and that rate slackens rather than accelerates) would number in 1920 only about 48,000,000 of people. The British nation cannot limit its view of economic policy by the insular horizon. Were we compelled once more to lead an isolated life we should realize the disadvantages of being an island,— and a small one! Nature has fixed our bounds. We have no *hinterland.* Railways through Europe and direct shipping services are diminishing our importance to the nearest continent as a warehousing centre and place of transhipment. Were Europe involved in a great war from any cause whatever, a perfectly possible reconstruction might create a pan-German empire with a population as large as that of the United States, stretching from the North Sea to the Mediterranean and perhaps across the Bosphorus (for the Turkish dominions even if remaining unconquered might very well be drawn into a Central European Zollverein) and occupying a political and strategical position unrivalled in the world. Such a development of European politics is no less and no more possible than the events from 1864 to 1871 which led to the hegemony of Prussia in the restored German Empire. Upon the other hand the British self-governing colonies taken together have an area more than twice as large as the United States— but they contain a white population estimated at 11,000,000, or very considerably less than the population of New York State and Pennsylvania taken together. If England desires a more rapid increase of white population in her colonies, she must take some special steps to promote that result. Otherwise even a complete federation with her daughter-states would not enable her to maintain her present relative political and commercial power or to guarantee their safety.

Unless Great Britain can fill up her colonies and form a union with them, her prospects of maintaining the command of the sea by the use of her insular resources will become hopeless. Maritime supremacy, and with it her present imperial and commercial position, would pass away perhaps before the end of another generation under conditions of peace and through the natural operation of economic and social forces. Take the comparison with Germany alone. For armaments and interest on debt, the United Kingdom pays nearly £90,000,000 annually. Germany pays less than £50,000,000 upon the same accounts. The reason is that her national debt is exceedingly small by comparison with England's; her vaster national army is no more expensive; her navy at present no more than one third, at the most, in size and cost. Yes; but look at the figures just given and you will observe the fact that Germany could ultimately maintain a fleet as large as the British while paying less than the United Kingdom pays now for the triple financial services — National Debt, Army and Navy. It is tolerably plain then that the only hope for the island, from a revenue point of view, lies in union and development of the Empire. This view has been authoritatively expressed by Sir Michael Hicks-Beach and Lord St. Aldwyn. He was chancellor of the Exchequer during the South African War, is a firm opponent of Mr. Chamberlain's commercial plans and advocates the impracticable alternative of large direct colonial contributions to the support of the British Navy. In heading a deputation upon this subject to the Prime Minister Sir Michael Hicks-Beach spoke as follows on 10 Dec. 1904:

"It is my deliberate conviction, looking at the enormous efforts now being made in all parts of the world by great powers in increasing their naval strength, that without recourse to a system of borrowing for current expenditure, which would be deeply injurious to the credit of this country, and which would deprive us of the resources necessary for carrying on any great war — without such recourse *it would be impossible for taxpayers of the United Kingdom to continue to bear alone the vast and ever increasing burdens of the naval defense of the Empire.*"

It is often said that a tariff which protects shuts out the goods and produces no revenue; and that a tariff to produce revenue must let in the goods and cannot protect. This is a purely verbal difficulty. Every well-adjusted tariff is partly a protective and partly a revenue-producing instrument. It serves both ends in sufficient measure while serving neither exclusively. Free Traders point to the fact that Great Britain still possesses half the mercantile shipping tonnage of the world, as though in that fact rested naval security and a decisive argument against change. England's advantage in the carrying trade is no larger than it was a generation ago in the iron trade. Americans and Germans were only beginning to compete in iron then, and both have beaten English iron; they are only beginning to compete in shipping now. But sea-power has become a highly specialized form of force, far less intimately connected than in Nelson's days with the mercantile marine, and depending more generally upon the whole financial and technical resources of the nation behind it. Great Britain has half the merchant shipping of the world. In that respect, she has reached the maximum, and the percentage is beginning to show a slight but unmistakable tendency to recede. Under protection her chief commercial competitors have developed a financial and taxable capacity which enables Germany and the United States for the first time to challenge British naval supremacy in earnest. It is perfectly conceivable that England might retain her present proportion of the world's mercantile tonnage and might nevertheless lose her naval supremacy through the eventual ability of some power to bear a far larger naval budget than England as an island could afford.

The United States could dispense in a crisis with the whole of its foreign trade. Germany beaten at sea would still produce the great bulk of her food supplies upon her own territory. France, with her wonderfully compact economy, is practically self-contained. But England is more dependent upon exterior forces for her means of existence — her agricultural imports and her raw material; the food for her people and the food for her machines — than any other society history has known. Great Britain, in other words, cannot continue to be a great power upon an insular basis and the failure to unite her Empire would be followed by the decay of her present national status. The fate of Holland is her danger. The application of the spirit of the Philadelphia Convention to the circumstances of her vast and heterogeneous dominion — that is her hope.

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